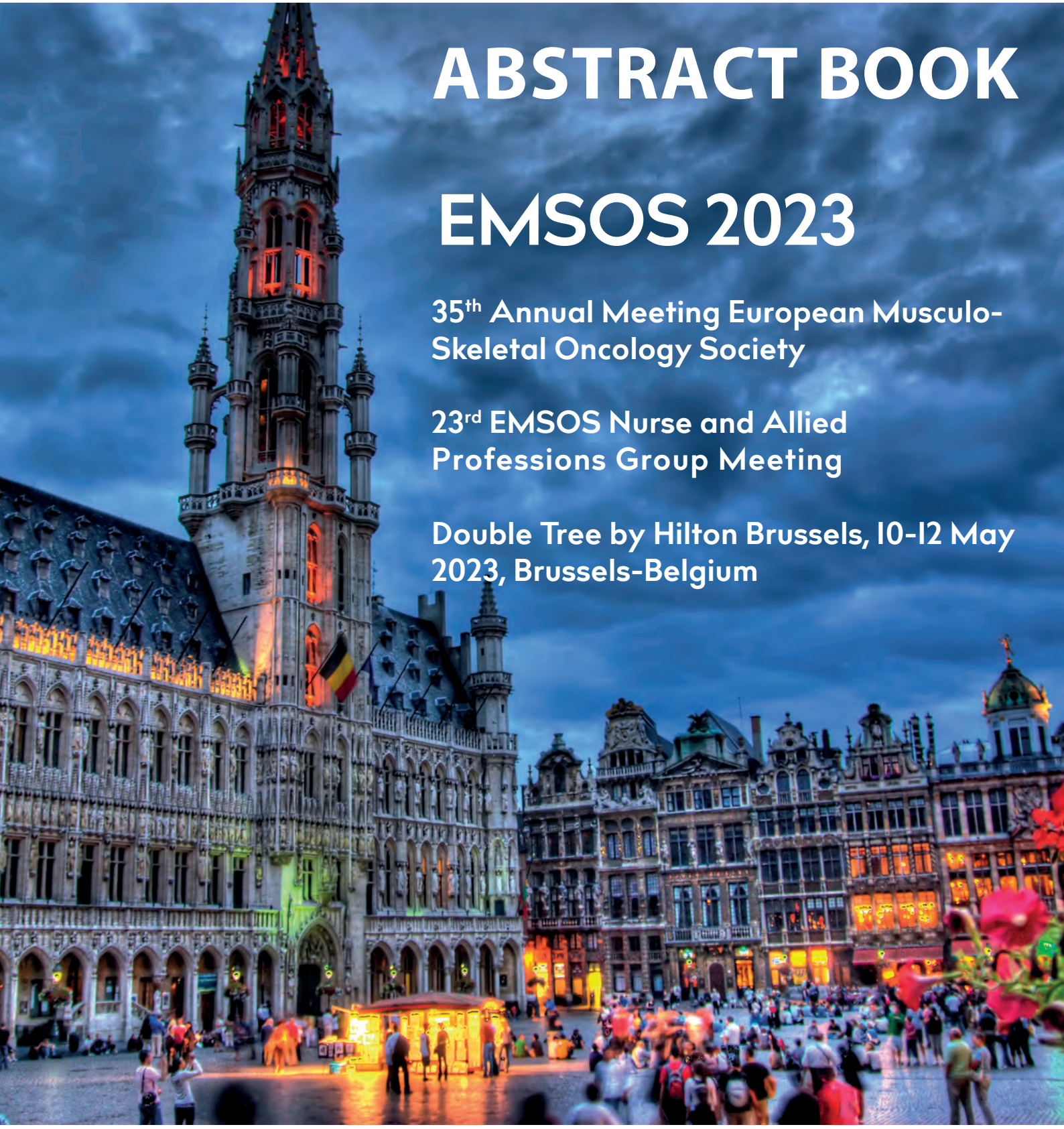

ABSTRACT BOOK

EMSOS 2023

35th Annual Meeting European Musculo-Skeletal Oncology Society

23rd EMSOS Nurse and Allied Professions Group Meeting

Double Tree by Hilton Brussels, 10-12 May 2023, Brussels-Belgium

EMSOS

35th ANNUAL MEETING

BRUSSELS I 2023

35th Annual Meeting European Musculo-Skeletal Oncology Society

23rd EMSOS Nurse and Allied Professions Group Meeting

Brussels, 10-12 May 202

EMSOS 35th ANNUAL MEETING BRUSSELS | 2023

Welcome

Dear participants,

We cordially welcome you in Brussels !

EMSOS 2023 is a joint effort of all Belgian University Hospitals. All professions are also represented in our organising committee, as well as the Belgian patient advocacy group Cum Cura.

We are fully aware that much has changed and continues to change over the past decade, both in society and in our profession: patients' expectations have changed, their role has shifted from more passive 'informed consent' to active 'true shared decision making' during their disease course. Patients are evolving towards full partners in both treatment and in research, seeking peer support in patient advocacy groups. Parallel to this evolution, the expectations of our younger generation collaborators have also changed, sometimes leading to mutual incomprehension and sputtering collaboration between age groups and profession groups.

In this EMSOS edition, we anticipate these trends and have explicitly chosen not to make a separate allied professionals day but to stimulate interdisciplinary interaction by introducing special transdisciplinary sessions aimed at all stakeholders, including patient advocacy groups, nurse practitioners, physical therapists, dietitians, social workers, physicians, researchers, industry and regulatory bodies.

These transdisciplinary sessions revolve around a common theme '**How far do we go?**'. As patients and caretakers we are repeatedly confronted with this question, and answering it requires true transdisciplinary discussion. We also pose the question: **'How can we go further?'** in collaborating with each other in order to find answers to the long-standing questions that remain unresolved due to the rareness of the disease and the notorious tumor diversity between and within individual patients.

We very much look forward to meeting you both as fellow professionals with a shared passion for helping our patients and their loved ones, and especially as friends.

Enjoy the meeting.

On behalf of the organising committee,

Ramses Forsyth and Gwen Sys

EMSOS 2023 Organising Committee

Ramses Forsyth	Department of Anatomo-pathology & Experimental Pathology, Universitair Ziekenhuis Brussel (UZ Brussel), AI Supported Modelling in Clinical Sciences, Vrije Universiteit Brussel (VUB), Brussels
Gwen Sys	Cancer Research Institute Ghent (CRIG), Ghent University, Department of Orthopaedics and Traumatology and Cancer Center, Ghent University Hospital, Ghent
Thomas Schubert	Neuromusculoskeletal Lab (NMSK), IREC, UCLouvain and Department of Orthopaedic and Trauma Surgery, Cliniques Universitaires Saint-Luc, Brussels
Annelies Van Beeck	Department of Orthopaedic Surgery and Traumatology, University Hospital Antwerp, Edegem
Hazem Wafa	Department of Orthopedic Oncology, University Hospitals Leuven, Leuven
Bilal Kapanji	Department of Orthopaedic and Traumatologic Surgery, Hôpital Universitaire de Bruxelles, Brussels
Johan De Munter	Cancer Center, Ghent University Hospital, Ghent and European Oncology Nursing Society, Brussels
Catharina Dhooge	Department of Pediatric Hemato-Oncology and Hematopoietic Stem Cell Transplantation and Department of Pediatric Pulmonology and Infectious Diseases, Ghent University Hospital, Ghent
Christine Gennigens	Department of Medical Oncology, CHU de Liège, Liège
Felix Shumelinsky	Department of Surgery, Institut Jules Bordet-Université Libre de Bruxelles, Brussels
Friedl Sinnaeve	Department of Onco-Orthopaedic surgery, University Hospitals Leuven, Leuven
Lina Vissenaeken	Cum Cura vzw
Gabrielle Van Ramshorst	Department of Gastrointestinal Surgery, University Hospital Ghent, Ghent

EMSOS Board

President	Pietro Ruggieri, Padova, Italy
Past President	Ramses Forsyth, Brussels, Belgium
Secretary	Andreas Leithner, Graz, Austria
Vice-president	Joanna Szkandera, Graz, Austria
Board members	Thomas Baad-Hansen, Aarhus, Denmark
	Peter Bekkering, Utrecht, The Netherlands
	Davide Donati, Bologna, Italy
	Rick Haas, Leiden, The Netherlands
	Jendrik Hardes, Essen, Germany
	Daniel Kotrych, Szczecin, Poland
	Emanuela Palmerini, Bologna, Italy
	Rob Pollock, London, United Kingdom
	Beatrice Seddon, London, United Kingdom

Abstracts

008 Malignant melanoma of the foot: The tip of an iceberg – a creeping danger that lurks beneath the surface. Healing by secondary intention - a valid treatment modality

Eyrique G.[1], Surendra S.[2], Serene S.[2]
[1]Orthopedic Oncology unit, Orthopedic Department. Hospital Kuala Lumpur, Malaysia; [2]Orthopedic and Traumatology Department. Hospital Keningau, Sabah, Malaysia

Malignant melanoma (MM) is a lethal skin carcinoma. This is a case report of a patient with MM of the left plantar foot, who sought treatment at our centre. At presentation, the patient presented with a history of what resembled a skin tag on his left plantar foot, which later grew into a 3cm X 4cm hyper granulation tissue at the sole of his feet in 4 months, which made the patient feel uncomfortable upon ambulation. He did not have any constitutional symptoms. But little did we know that the hyper granulation was just the tip of the iceberg of a vicious malignant melanoma lurking underneath with metastasis.

Upon the suspicions after examining the patient, a biopsy was scheduled to obtain histopathological examination (HPE) report of the hyper granulation tissue, which was reported as a Malignant Melanoma (MM). Magnetic resonance imaging (MRI), computed tomography of the thorax, abdomen, pelvis (CT TAP) and positron-emission tomography (PET) were requested to stage and guide the treatment modalities, which includes surgery and chemotherapy, where oncologist and alongside Musculoskeletal tumour surgeon were consulted. A wide surgical excision was performed and wound was left to heal via secondary intention. Decision of "non-skin coverage post excision" are guided through some criterias.

The aim of this report is to create awareness of early suspicious and detection of MM and treatment, which could lead to a better prognosis and the acceptance of post excision allowance for wound to heal with secondary intention healing. Many of times, immediate closure of an excised wound had been the common practice, but with guidance of some criteria, patient might benefit from wound left to close with secondary intention - evading flaps and graft failure complications.

009 Dermatofibrosarcoma Protuberans with fibrosarcomatous transformation: A case report & an overview

Eyrique G.[1], Riham H.[2], Arrazeen H.[2]
[1]Orthopedic Oncology unit, Orthopedic Department. Hospital Kuala Lumpur, Malaysia; [2]Orthopedic and Traumatology Department. Hospital Keningau, Sabah, Malaysia

Dermatofibrosarcoma protuberans (DFSP) is a rare soft tissue sarcoma of the skin characterised by plaque like tumor derived from mesenchymal cell. Fibrosarcomatous transformation of DFSP (FS-DFSP) is an even rarer variant of which it is clinically indistinguishable from other DFSP variant - diagnosed by histopathological characteristics. As it is known to be more aggressive with higher risk of distant metastases, treatment should be carefully planned followed by strict post-op follow ups.

This is a case of a 57 years old man with a slow growing large tumor on his forearm following a minor trauma 10 years ago, presented to our institution for further management due sudden rapid enlargement and discomfort. The result of the lesion sent for histopathological examination is diagnosed as FS-DFSP without distant metastases (from a full body CT scan). On 3rd month of follow up, neither recurrence nor symptoms of distant metastases has been observed.

In conclusion DFSP needs a histopathological examination to distinguish its variant. This is important as FS-DFSP has higher risk of recurrence and metastasis. There are options of technique to ensure complete surgical resection of tumor. In cases of metastases and unresectable tumor, radiotherapy and pharmacological treatment is to be considered. In our case, there is no signs of recurrent or distant metastases. However, long -term follow up is strictly recommended. After surgical excision - wound was left to heal by secondary intention, Wound healing by secondary intention is a valid treatment decision when well guided with strict criterias. Not every excised wound needs coverage - as skin graft failure complications can be avoided.

010 Tumor grade assessment by artificial intelligence based on MRI images in soft tissue sarcoma

Segura F.P.[1,2], Segura F.V.[1,2], Segura F.M.[1,2]
[1]Universidad Nacional de Córdoba, Cordoba, Argentina; [2] Segura, Centro Privado de Ortopedia y Traumatología, Argentina

Background : In patients suffering from soft tissue sarcomas (STS), decision-making regarding the optimal treatment of the tumor depends on the size and location of the STS, and on the histopathology evaluation that assesses the aggressiveness of the tumor. To establish the histological type and grade, biopsy is essential to make an accurate diagnosis. We seek to non-invasively classify SPB into low grade (G1) and high grade (G2/G3). Through the analyses of MRI images and using deep learning techniques, it is possible to propose an alternative way of determining the degree of aggressiveness of the sarcoma. Deep learning is a subset of artificial intelligence in which computer algorithms are trained to make classifications and predictions based on patterns provided by data. Deep learning has shown a remarkable progress in medical image analyses. In our experience, the best model achieved a precision of 92.1 % and a recall of 91.8 %, allowing an accurate diagnosis of the degree of tumor aggressiveness prior to biopsy.

Objectives : Assessing the aggressiveness of a soft tissue sarcoma by using auto machine learning based on MRI images.

Methods : Two independent cohorts were retrospectively used. First cohort were data from the Cancer Image Archive. This data contains images of FDG-PET/CT and MRI of 51 patients with histologically proven soft tissue sarcoma (STS) collected between November 2004 and November 2011. Second cohort were images from Segura, Private Center of Orthopedics patients. This data contains images of FDG-PET/CT and MRI of 22 patients with soft tissue sarcomas (STS) histologically proven between November 2016 and November 2020. Landing.ai software was used for images classification. We use 10 images from high grade and low grade sarcomas for training, 5 images of high grade and low grade sarcomas for testing and 5 images of high grade and 5 images of low grade for validation. We also used 10 images with no tumor.

Results : Precision of the model was 92.1 % and the recall was 91.8 %, which shows that it is a reliable model to apply before biopsy and also allows to have a pre-histologic expert opinion.

Conclusion(s) : We present a novel approach to determine tumor aggressiveness by using automatized deep learning techniques. By using AutoML model we achieved a precision of 92.1% and recall of 91.8 %, based on MRI images in axial slices over the largest diameter of the lesion on T1 and T2 sequences.

011 Did the COVID-19 pandemic negatively affect outcomes for patients with extremity soft tissue sarcomas?

Griffin A.M.[1], Tsoi, K.M.[1,2], Ferguson P.C.[1,2], Wunder J.S. [2]
[1]Musculoskeletal Oncology Unit, Division of Orthopaedic Surgery, Mount Sinai Hospital, [2]Department of Surgery, University of Toronto, Toronto, Canada

Background: The COVID-19 pandemic has had a major impact on the ability of global health care systems to deliver timely and appropriate care. The goal of this study was to determine the impact of the COVID-19 pandemic on outcomes for patients with extremity soft tissue sarcoma treated at a tertiary care centre.

Methods: Patients treated surgically for an extremity STS from January 2017-May 2022 were identified from our prospectively collected database and divided into pre-COVID (Jan 2017-Feb 2020) and during COVID (March 2020-May 2022) groups. Patient demographics, tumour characteristics, surgical procedures, and outcomes were compared between the 2 groups. Categorical variables were compared with Chi-square test, means with t-test and local recurrence-free survival with Kaplan-Meier method.

Results: A total of 700 patients were identified: 426 pre-COVID and 274 during COVID. There was no difference in gender (female 181 (42.5%), 109 (40%, p=0.5); presentation with metastases (30 (7%), 19 (6.9%), p=0.7); prior 'whoops' surgery (74 (17.4%), 45 (16.4%), p=0.7); need for vascular (20 (4%), 11 (4%), p=0.7), nerve (14 (2.9%), 7 (2.6%), p=0.6) or bone (32 (6.7%), 20 (7.9%), p=0.9) resection; positive margins (81 (19%), 38 (14%), p=0.2); or tumour size (mean 9.3 cm, median 7.9 cm, range 0.5-42 cm; mean 9.8 cm, median 7.7, range 1-35.4 cm, p=0.19) between patients treated before or during the pandemic, respectively.

There was a difference in the use of VAC for wound closure- 79 (18.5%) pre-COVID and 89 (32.5%) during COVID (p<0.001). There was also a difference in wound complications: 24.5% pre-COVID compared to 17.9% during COVID (p=0.045). For patients treated with preoperative radiotherapy (224 pre-COVID, 139 during), the time from radiation completion to surgery was not different between the two time periods: pre-COVID a mean of 50 days, (median 49, range 18-149); while during COVID a mean of 50 days (median 45.5, range 13-169). Estimated 2-year local recurrence-free survival was 95.3% pre-COVID compared to 91.7% during COVID (log rank 5.6, p=0.018).

Conclusion: Surprisingly, patients with extremity STS did not present with larger tumours or a higher percentage with metastatic disease during the pandemic. VAC usage increased during the pandemic and a small decrease in local recurrence-free survival was seen. Follow-up for the COVID cohort is currently too short for a comparison of metastasis-free or overall survival between the 2 groups.

018 Outcome of reoperation for local recurrence following preoperative Denosumab administration and curettage for giant cell tumour of bone with difficult joint preservation

Tsukamoto S.[1], Hindiskere S.[2], Honoki K.[1], Mavrogenis A.[3], Tanaka Y.[1], Chinder P.[2], Donati D.[4], Errani C.[4]
[1]Department of Orthopaedic Surgery, Nara Medical University, Nara, Japan; [2]Department of Musculoskeletal Oncology, HCG Hospital, Bangalore, India; [3]First Department of Orthopaedics, National and Kapodistrian University of Athens, School of Medicine, Athens, Greece; [4]Department of Orthopaedic Oncology, IRCCS Istituto Ortopedico Rizzoli, Bologna, Italy

Purpose: Denosumab enables joint-sparing surgery (curettage) and surgical downstaging in patients with giant cell tumour of bone (GCTB), where joint preservation is not possible. However, denosumab treatment causes osteosclerosis of the lesion, making it difficult to curet the lesion, leaving the tumour behind, and increasing the local recurrence rate. We performed a three-centre retrospective study to investigate the postoperative local re-recurrence rate, joint preservation status, and functional outcomes of locally recurrent lesions after preoperative denosumab treatment and curettage in patients with difficult joint preservation.

Methods: We included 38 of 142 patients with primary GCTB of the extremities who underwent preoperative denosumab and curettage between 2009 and 2021 with local recurrence. Preoperative denosumab was indicated in patients with minimal residual periarticular and subchondral bones, large extraosseous lesions (Campanacci stage 3), and pathological fractures that made joint preservation difficult.

Results: Local re-recurrence occurred in 6 (15.8%) of the 38 patients. In 29 patients who underwent re-curettage, local re-recurrence occurred in six patients (20.7%); however, in nine patients who underwent en bloc resection, no local re-recurrence was observed. The joint preservation rate was 63.2% (24 of 38 patients), with a median Musculoskeletal Tumor Society score of 28 (interquartile range: 26.8–29.0). The median follow-up period after surgery for local recurrence was 63.5 months (interquartile range: 42.5–82.4).

Conclusion: Since the local re-recurrence rate after re-curettage for local recurrence was low, and the joint preservation rate and affected limb function were good, preoperative denosumab administration may be considered in patients who require downstaging to maintain good limb function (joint preservation).

020 Characterizing organelles in myxofibrosarcoma cells using label-free optical diffraction tomography

Choi E.[1], Lee MJ. , Park YK, Hugonnet H.[2]
[1] Department of Orthopaedic Surgery, Chungnam Nat'l University, Daejeon, Korea; [2] Laboratory of Biomedical Optics, Department of Physics, Korea Advanced Institutes of Science and Technology (KAIST)

Background and objectives: Label-free optical diffraction tomography (ODT), an imaging technology that does not require fluorescent labeling or other staining, can overcome the limitations of conventional cell imaging technologies. Conventional microscope techniques are phototoxic and invasive, which limit their ability to be used to precisely determine the characteristic property of each organelles of cells. ODT is one of the non-invasive quantitative phase imaging (QPI) technologies that is now widely used in biology and medicine. However, there was no study on imaging sarcoma cells using ODT. In this study, we used ODT to characterize the cellular organelles of myxofibrosarcoma based on their refractive index and volume of organelles.

Methods: Myxofibrosarcoma cells were derived from excised tumor of patients and cultured. ODT measurement of single cells was performed with a commercial ODT microscope (HT-2H; Tomocube). Using raw ODT images, the refractive index(RI) mapping image was reconstructed by dividing the corresponding RI ranges of the nucleolus, cytoplasm, vesicles, and plasma membrane. The RI iso-surface of the cytoplasm, nucleolus, and vesicle of the cell was rendered using TomoStudio software (2.6.25; Tomocube).

Results: Representative label-free ODT image of living myxofibrosarcoma cell is presented in Fig 1. Serial section(4□□) images of myxofibrosarcoma cell is presented in Fig 2. The cell membrane, cytoplasm, and nucleolus could be identified morphologically. Mean(± standard deviation) molecular density of the nucleus, cytoplasm, vesicles and plasma membrane were 0.0763 ± 0.0039g/ml, 0.0349 ± 0.0018g/ml, 0.1495 ± 0.0038g/ml and 0.0210g/ml, respectively.

*Conclusion:*Our findings demonstrate that ODT can be used to image myxofibrosarcoma cells and quantify the nucleoli and vesicular structures based on RI and volume.

022 Utility of pedicled functional latissimus flaps for reconstruction of the upper extremity following resection of soft-tissue sarcomas

Houdek MT.[1], Arguello A.[1], Sullivan M.[1], Moran SL.[1,2]
[1]Department of Orthopedic Surgery Mayo Clinic, Rochester, MN, USA;
[2]Division of Plastic and Reconstructive Surgery, Mayo Clinic, Rochester MN, USA

Background: Resection of soft-tissue sarcomas of the upper extremity can impart substantial functional implications. There are limited options for functional reconstruction of the shoulder, biceps and triceps. In the lower extremity, free functional latissimus flaps have been utilized to restore function of the hamstrings and quadriceps, however there is limited data on the use of latissimus flaps for functional reconstruction in the upper extremity.

Methods: We reviewed 10 (7 male:3 female; mean age 63 years) patients undergoing resection of a soft-tissue sarcoma involving the triceps (n=4), biceps (Figure 1, n=4) and deltoid (Figure 2, n=2) reconstructed with a pedicled functional latissimus flap. All patients were treated with radiotherapy either neoadjuvant (n=8, total dose 50 Gy) or neoadjuvant and intraoperative (n=2, total dose 62 Gy).

All resections were performed in a rolling lateral position, with harvest of the latissimus performed in a standard fashion following tumor extirpation, however instead of dividing the thoracodorsal nerve, it is protected throughout the case. The resting tension of the latissimus was marked with sutures placed at 5 cm increments prior to flap elevation. The mean tumor size and volume at the time of resection were 12 cm and 612 cm3

Postoperatively patients were kept in an abduction sling or functional brace depending on tumor location for 6 weeks. Patients then began neuromuscular retraining of the latissimus. Mean follow-up was 5 years.

Results: Four patients had a recipient site complication all secondary to the wound. One patient had a donor site seroma. Complications resulted in 3 repeat surgeries, all irrigations and debridement of the wound. There were no flap losses. One patient sustained a radiation associated humerus fracture 5 years postoperative treated non-operatively due to progressive metastatic disease. At most recent follow-up, the mean elbow and shoulder range of motion were 105 and 150 degrees. The mean Musculoskeletal Tumor Society Score was 88%. The mean muscle strength was 4/5.

Four patients developed metastatic disease and three patients died of disease. The 5-year disease specific survival and metastatic free survival were 75% and 70%.

Conclusion: Although early complications are high, pedicled functional latissimus flaps allow for wound coverage, potential space obliteration and restoration of function in the upper extremity following resection of large soft tissue sarcomas.

027 The outcome of 3-D printing techniques and custom made joint sparing implants as a reconstructive modality for juxtaarticular bone sarcoma : A review of 50 patients in single institute

Shehadeh A.
Department of Surgery, King Hussein Cancer Center, Amman, Jordan

Introduction: The outcome of endoprosthetic reconstruction after joint sparing resection is not well described in literature.

Objectives: To investigate the outcome of using customized Joint Sparing Endoprosthesis (JSE) after juxta articular resection of bone tumors.

Materials and Methods: Fifty patients received JSE and 60 joints were spared. age 4-55 year, (median 13 Year), 43 patients received surgery for primary reconstruction and 7 patients for revision of failed bone allograft or modular implant , anatomical location was 42 joints spared in the lower limbs and 18 in the upper limbs.

Flat surface HA coated custom JSE was used to spare 28 joints, and short stemmed custom JSE was used to spare 32 joints. The length of remaining bone epiphysis for JSE anchorage from the knee and ankle joints, was 25-75 mm, median=45mm.

Results: Operative time 2.5 - 4 hr.(Avg. 3 hr.) The bone resection surface fitted the prosthesis surface with < 2mm difference. Histological examination of all resected specimens show clear bone resection margins, 2 patients had positive soft tissue margins.

At mean follow up period of 4 years(6 mo-8yrs), 6 patients developed local and systemic recurrences, three of them had pathological fracture at time of diagnosis and 4 poor response to chemotherapy(P=0.016), all recurrences occurred in the soft tissue. Implant survival at 5 year was 89% , MSTS score was 97%(90-100%).

Conclusion: This is the biggest series in literature for joint sparing surgery in which custom JSE was used .In our series, both implants designs that we used; survived well at 5 year follow up (89%), no increased incidence of local recurrence in comparison to joint sacrificing techniques . No increased need for revision surgery in comparison with joint sacrificing approach. the early results of using custom made JSE is encouraging and functional outcome is outstanding.

028 Management of perioprosthetic infection in limb salvage surgery, what I have learnt?

Shehadeh A.
Department of Surgery, King Hussein Cancer Center, Amman, Jordan

Purpose: To introduce our comprehensive approach in the management of periprosthetic infection, and using the off- antibiotic challenge for 6 weeks, before re implantation of the new endoprosthesis.

Materials and Methods: From 2006-2022, we performed limb salvage surgery with endoprosthetic reconstruction in 226 patients. Fourteen patients (7%) developed periprosthetic infection (PPI), 10 of them was early infection (within 3 months of the surgery) and 4 patients were late infection (after 3 months from surgery). Seven patients (PT= 4, DF=2 and acetabular=1) implants were treated by early debridement and removal of the whole endoprosthesis, and IV antibiotics for 6-8 weeks, then the use of off-antibiotic challenge to re implant a new endoprosthesis. Seven patients (PF=3, TF=2, PT=1 and DF=1) implants, were treated with open debridement, and IV antibiotics for 6 - 8 weeks with retaining the whole prosthesis or the stem, and re implantation immediately after completion of 6 weeks of IV antibiotics.

Results: Six patients in the first group cured from the infection, 5 were re implanted successfully 12- 14 weeks after removal of their implants and success of the off antibiotic challenge, 2 of them were reconstructed using arthrodesis custom made implant, due to limited soft tissue coverage remaining after repeated debridement, 1 patient with pelvic implant remained with no re implantation.

One patient the infection persisted, and antibiotic treatment was extended for 10 weeks, and he ended up with amputation.

In the second group, 3 patients get persistent infection even after the delayed removal of their implants, which mandated amputation, 2 patients recovered completely, and 3 patients ended up with chronic sinus, controlled by chronic use of suppressive antibiotics. In total 4 patients (28%) in both groups ended up with amputation.

Conclusion: The use of off-antibiotics challenge can decrease the possibility of replantation failure. All implant components should be taken out even the well-fixed stems. Delay in debridement and metal removal will result in chronic infection and sinus formation. Endoprosthetic arthrodesis can be used as a salvage procedure to preserve the limb when the soft tissue coverage and muscle remaining is limited.

029 The use of cryotherapy as adjuvant for treatment of aggressive bone tumors, does it really work?

Shehadeh A.
Department of Surgery, King Hussein Cancer Center, Amman, Jordan

Purpose: To study the effect and complications of using Cryotherapy ablation in low grade bone sarcoma and benign aggressive bone tumors.

Material and Methods: From 2006-2022, we operated on 96 patients with locally aggressive bone tumors, Male (n=81), Female (n=15) age 2-55 year, mean = 16. ABC n=38, GCT n=23, Chondroblastoma n=10, Fibrous Dysplasia n=6, Chondrosarcoma n=6, Osteoblastoma and CMF each n=3, others n=6.

We used the liquid nitrogen pouring technique (open system) in 66 patients, and Argon gas Cryoprobe (closed system) in 30 patients, after thorough curettage and high speed burring of the lesion walls. Then filling the cavity with bone graft material with or without internal fixation device depending on the anatomical location and size of the lesion. Ten patients with GCT received Denosumab as neoadjuvant before surgery.

Results: At follow up period 2-10 years, avg.= 5 yr., in the open system group 9 (14%) patients developed local recurrence, all of them were GCT who received Denosumab as neoadjuvant treatment. Four (6%) patients developed superficial skin infection and necrosis, 4 (6%) patients developed deep infection all 8 patients needed surgical debridement and hospitalization, one patient with persistent deep infection ended up with amputation. Four patients developed bone nonunion that mandated subsequent grafting.

In the closed system group, 2 (6%) of patients developed local recurrence, one of them GCT who received denosumab as neoadjuvant, none of the patients developed skin necrosis, infection or nonunion. Local recurrence in all cohort who did not receive neoadjuvant denosumab was 1%., recurrence rate in patients who received denosumab was 100%.

Conclusion: This is retrospective study with no control group, showing decreased local recurrence rate in aggressive bone tumors when use cryotherapy adjuvant (11%) in comparison with historical control, the outcome can be better if denosumab was avoided as neoadjuvant (local recurrence in patients with vs without denosumab was 1% , 11% respectively).

There is a tendency for increased complications mainly skin necrosis and infection when using the open liquid nitrogen pouring techniques in comparisons to the closed cryoprobe Argon gas system.

030 Outcomes of limb salvage surgery with mega-prosthesis: Experience from national cancer center

Bilal M., Rafi I.
Surgical Oncology Department, Shaukat Khanum Memorial Cancer Hospital & Research Center, Lahore, Pakistan

Objective: To determine the early outcomes of limb salvage surgery with mega prosthesis in developing countries with low educational status

Methods: This retrospective study was conducted at Shaukat Khanum Memorial Cancer Hospital and Research Centre (SKMCH&RC) from 1st January 2017 till 31st December 2022. Data like demographics, histopathology, functional and survival outcomes were retrieved from the Hospital Information System. Musculoskeletal Tumor Society (MSTS) score was used to evaluate he functional outcomes after the surgery. For survival analyses, Kaplan-Meier curve was applied. Prosthesis joint infection, amputation rate, metastasis, mortality rate, and recurrence were also recorded.

Results: This study included 72 patients who underwent limb salvage surgery with endoprosthesis reconstruction at SKMCH&RCThe mean age at the time of diagnosis was (21.5±15.8) yearsPatients with distal femoral replacement had the highest MSTSscores (88.45±9.70) while those with proximal humerus replacementhas the lowest MSTS scores (51.8±11.2). There was a strongassociation between site of tumor and MSTS (F=3.30, P=0.017We also found a correlation between surgical site infection andMSTS scores (r=0.484, P=0.001). Patients with recurrence alsohad significantly lower MSTS scores (P<0.05). The cumulativesurvival rate at the end of two-year follow-up was (79.4±12.1)% in proximal femur tumor patients, (92.0±4.2)% in distal femur tumorpatients, and (63.0±2.3)% in proximal humerus tumor patients Besides, patients with Ewing sarcoma had the highest survival rate 91.5±6.0)% while patients with chondrosarcoma had the lowest survival rate (80.8±13.9)%.

Conclusions:
Limb salvage surgery with mega-prosthesis can be performed with satisfactory functional and survival outcomes, butfurther studies are needed to compare it with other limb salvage methods. This study can be used as a reference for future studies.

031 Comparison of limb salvage with mega prosthesis *vs* auto graft reconstruction after cryotherapy in adolescent patients with limb sarcomas

Bilal M., Ilyas Rafi I., Shoaib A.
Surgical Oncology Department, Shaukat Khanum Memorial Cancer Hospital & Research Center, Lahore, Pakistan

Objective: Use of Mega prosthesis implants in skeletally mature Sarcoma patients remains gold standard. However, in adolescent patient's reconstruction using Liquid nitrogen auto grafts is a viable option. We looked into the short-term outcomes of adolescent patients who underwent reconstruction with Mega prosthesis and compared them with liquid nitrogen treated reconstruction.

Methodology: 35 adolescent patients with predicted LLD between <3 cm, who underwent limb salvage with Mega prosthesis or Liquid nitrogen treated auto graft were observed with minimum over 12 months. We retrospectively reviewed both groups and compared chemotherapy breaks, re-operation rate, risk of amputation, duration of hospital stay and LLD at one year.

Results: 15 Patients underwent Frozen Auto graft Reconstruction while 20 patients had Mega prosthesis Replacement. Nine (59.9%) patients in Auto graft Reconstruction group had unplanned chemotherapy breaks vs two (10%) in Mega prosthesis group. Four (26%) in Auto graft Reconstruction group developed deep infection requiring multiple surgeries while there was one (5%) case of deep infection in Mega prosthesis group. Three (20%) patients in Auto graft reconstruction group required amputation while only one (05%) patient in mega prosthesis group had amputation. Average Hospital stay was significantly less in the Mega prosthesis patients ($P < 0.05$). Average LLD was less in Auto graft reconstruction group but it was not statistically significant when compared to Mega prosthesis patients.

Conclusion: In adolescent patient Mega prosthesis provides better outcomes when compared to Auto graft reconstruction, which had much higher complication rate leading to chemotherapy breaks with potential effect on long-term prognosis.

032 The outcome of extremity soft tissue sarcomas in terms of resection margins: A study from a cancer dedicated center

Shafiq M., Rafi I., Shoaib A., Sajid A., Usman Mushtaq
Department of surgical oncology,Shaukat khanum memorial cancer hospital and research center, Lahore, Pakistan

Introduction: Extremity soft-tissue sarcomas are uncommon malignancies of mesenchymal tissue, it accounts for <1 % of cancers and has a high recurrence rate with positive resection margins and unplanned excision. This study aims to determine the influence of unplanned excision and resection margins on local recurrence, metastasis, and overall survival in soft tissue sarcoma of the extremities.

Methods: A retrospective review was conducted from January 2005 to December 2015 on all the patients with soft tissue sarcoma of the extremities. Age, sex, histopathology, site, tumor grade, biopsy type, recurrence, metastasis, and end outcome were analyzed. Kaplan-Meir curves were used for Survival analysis, and log-rank or the Cox proportional-hazards regression model was used for Significance analysis. The data were entered into SPSS version 20, and Statistical significance was set at a p-value ≤0.05.

Results: One hundred forty-five patients with soft tissue sarcoma of extremities were managed with a mean follow-up of 76.3+/-6.7 months. Undifferentiated pleomorphic sarcoma 47 (32.4%) was the most common pathology found in this cohort, followed by Synovial sarcoma 34 (23.4%) and Liposarcoma 19 (13.1%). The most common site of occurrence was lower extremity 102 (70.3%). All the patients had residual disease after unplanned excisions; 107 underwent R0 resection, while 38 underwent R1 resection. Five-year overall survival was 70.2 & 71.1 % for R1 & R0 resections, respectively, and 71.3% for excisional and 74.2% for incisional biopsy. The tumor grade significantly influences overall survival, while other variables were not found to affect Recurrence-free survival and metastasis-free survival.

Conclusion: The data indicates that the high-grade tumor has a negative influence on overall survival, while resection margins width and unplanned excision have no significant effect on local recurrence, Metastasis free survival, and overall survival; however, before excision, adequate planning and awareness among general surgeons is necessary to improve the surgical morbidity and financial burden over the health care facilities.

035 Factors affecting recurrence in chondroblastoma : Retrospective analysis of 48 cases

Karaca O.[1], Özyıldıran M. [1], Bekar H. [1], Başarır K. [2], Yıldız Y. [1]
[1]Department of Orthopedics and Traumatology, Ankara University, Ankara, Turkey; [2]Private orthopedic surgeon, Ankara, Turkey

Background and objectives: Chondroblastoma is an infrequent benign cartilaginous bone tumor. The gold standard surgical treatment is intralesional curettage with or without local adjuvant therapy. High-speed burring, electric cauterization and intralesional phenol application are the main adjuvant treatments. The purpose of this study was to retrospectively review a 36-year experience with chondroblastoma at our institution and investigate the factors affecting the recurrence rates.

*Methods:*We retrospectively analyzed the records of 48 consecutive patients with chondroblastoma who were diagnosed and treated in our institution between April 1986 and October 2020, with a mean follow-up of 46.7 months.

Results: 29 male (60.4%) and 19 female (39.5%) patients with a mean age of 18.5 were included in the study.
All patients underwent intralesional curettage. The resulting cavity was filled with bone grafting in 40 cases (83.3%). Bone cement was applied in 4 cases (8.3%). Arthrodesis was performed in 4 patients (8.3%). Adjuvant therapy with electric cauterization or burring was used in 25 cases (52.1%). The overall local recurrence rate was 16.7% (8 cases). The subgroup analysis showed that the recurrence rate was 4.0% (1 case) for adjuvant therapy group and 30.4% (7 cases) for the other group. The recurrence rate was higher in patient without adjuvant therapy (p=0.018). The recurrence rate was higher (75.0%) in the patients over 30 years of age (p=0.012).

Conclusions: Intralesional curettage and filling the defect with bone graft was effective for local control in most cases. Electric cauterization or high speed burring as local adjuvant therapy leads to low recurrence rates.

036 Brown tumors : Retrospective analysis of 26 cases

Karaca O. [1], Özyıldıran M. [1], Dursun Savran M. [1], Başarır K. [2], Yıldız Y. [1]
[1]Department of Orthopedics and Traumatology, Ankara University, Ankara, Turkey; [2]Private orthopedic surgeon, Ankara, Turkey

Background and objectives: Brown tumors are reactive osteolytic lesions caused by primary or secondary hyperparathyroidism. The purpose of this study was to retrospectively review a 34-year experience with brown tumors in our institution.

Methods: We retrospectively analyzed the records of 26 consecutive patients with brown tumor who were diagnosed and treated in our institution between May 1988 and October 2020, with a mean follow-up of 36.1 months.

Results: 17 male (65.4%) and 9 female (34.6%) patients with a mean age of 41.6 were included in the study. Localized bone pain was present in 13 cases (50.0%) as the first presenting symptom. 3 patients (11.5%) presented with diffuse bone pain. 7 patients (26.9%) were diagnosed with brown tumor while being investigated for pathological fractures. The other 3 patients (11.5%) were diagnosed while being evaluated for hypercalcemia symptoms. 7 patients (26.9%) had solitary lesions, while 19 patients (73.1%) had multiple lesions.

Orthopedic surgery was performed in 21 of 26 patients, the other 5 cases were followed up conservatively. Intralesional curettage was performed in 19 cases (82.6%). The resulting cavity was filled with bone cement in 11 cases (47.8%). Bone grafting was applied in 8 cases (34.8%). No recurrence was observed in patients who underwent orthopedic surgery. It was observed that the lesions of 5 patients who were followed conservatively had regressed after parathyroidectomy.

Conclusions: The diagnosis of brown tumor begins with clinical suspicion. Endocrinology and general surgery consultation is important before surgery. Treatment of brown tumors requires a multidisciplinary approach.

037 Examining patient perspectives on sarcoma surveillance: The sarcoma surveillance survey

Tepper SC.[1], Holten AK.[2], Jeffe DB.[3], England PH.[2], Hong ZL.[2], Pérez M. [3], Ghert M.[5], Hirbe AC.[4,6], Cipriano CA.[7]
[1]Midwest Orthopaedics at Rush University Medical Center, Chicago, Illinois, USA; [2]Department of Orthopedic Surgery, [3]Department of Medicine, [4]Division of Oncology Washington University, St. Louis, Missouri, USA; [5]McMaster University and Hamilton Health Sciences, Department of Surgery, Hamilton, Ontario, Canada; [6]Siteman Cancer Center, Barnes Jewish Hospital, and Washington University School of Medicine, St. Louis, Missouri, USA: [7]Department of Orthopedic Surgery, University of Pennsylvania, Philadelphia, Pennsylvania, USA

Background and Objectives: The optimal frequency and modality of sarcoma surveillance imaging are uncertain, and current practices vary substantially. While efforts to develop evidence-based guidelines are ongoing, patient perspectives regarding surveillance imaging have not been reported. The primary goal of this study was to pilot the novel Sarcoma Surveillance Survey to assess patient concerns regarding sarcoma surveillance.

Methods: In this single-center, cross-sectional study, patients receiving surveillance imaging after surgical sarcoma treatment were administered the 10-item Sarcoma Surveillance Survey, the validated Appraisal Scale, measuring positive and negative emotional reactions to imaging, and the Patient-Reported Outcomes Measurement Information System (PROMIS) Anxiety Short Form 8a as a measure of anxiety. Correlations between the Sarcoma Surveillance Survey items and the Appraisal scales and Anxiety 8a scores were analyzed, as were differences in Sarcoma Surveillance Survey responses between different patient demographic groups.

Results: Patients expressed highest levels of concern about cost and radiation exposure associated with surveillance, and most (87.6%) did not express a preference for more or less frequent imaging. Younger patients and those living further away from the imaging center were more concerned about cost of surveillance. Female patients had higher levels of concern compared to males regarding radiation, IV contrast, and overall levels of concern about surveillance. Higher levels of anxiety were correlated with preference for more frequent imaging (r_s=0.274, p=0.027) and higher overall level of concern about surveillance (r_s=0.259, p=0.037). Higher negative appraisal scores were also correlated with higher overall concerns (r_s= 0.323; p=0.012).

Conclusions: In the absence of definitive, evidence-based protocols for surveillance after sarcoma treatment, individual physicians often determine the frequency and modality of imaging. The Sarcoma Surveillance Survey may be a useful tool for eliciting patient concerns about surveillance imaging and, administered in conjunction with a measure of anxiety, can help identify patients who may be struggling with emotional distress over the course of surveillance. Identifying patients with greater anxiety and concerns regarding surveillance imaging may create opportunities for improved surveillance practices as well as counseling and survivorship interventions.

039 Chronic recurrent multifocal osteomyelitis: A multidisciplinary experience of 22 pediatric cases with a mean follow-up of 27 months

Okay E.[1], Ulu K.[2], Demir F.[3], Sari T.[1], Toksoz Yildirim AN.[4], Baysal B.[5], Zenginkinet T.[4], Reddy K.[6], Sozeri B.[2], Ozkan K.[1]
[1] Istanbul Goztepe Prof.Dr.Suleyman Yalcin City Hospital, Department of Orthopaedics, Istanbul, Turkey; [2] University of Health Sciences, Ümraniye Education and Research Hospital, Department of Pediatric Rheumatology, Istanbul, Turkey; [3] Acıbadem Healthcare Group, Department of Pediatric Rheumatology, Istanbul, Turkey; [4] Istanbul Goztepe Prof.Dr.Suleyman Yalcin City Hospital, Department of Pathology, Istanbul, Turkey; [5] Istanbul Goztepe Prof.Dr.Suleyman Yalcin City Hospital, Department of Radiology, Istanbul, Turkey; [6] University of Cincinnati Medical Center, Department of Orthopedic Surgery, Cincinnati, OH, United States

Background: Chronic recurrent multifocal osteomyelitis (CRMO) is not a well known disorder among nonpediatricians. The aim of this study is to retrospectively evaluate the clinical outcomes of twenty-two CRMO patients presenting to two referral centres.

Methods: This retrospective study included twenty-two children (12 males, 10 females; mean age 13 years; range 7-17 years). The diagnosis was based on clinical, radiological, and pathological findings. Data were retrieved from hospital charts.

Results: The mean delay in diagnosis was 26 months (range, 0-96 months). The mean follow-up after diagnosis was 27.4 months (range, 6-47 months). Symptoms included pain, limping, local swelling, morning stiffness, and fever. 18 patients had multifocal and 4 patients had unifocal disease. Bone lesions were detected with whole-body or local MRI (Magnetic Resonance Imaging). The mean number of bone lesions was 2.5 (range, 1-8). Ten cases underwent biopsy to exclude malignancy and infection. Prior to diagnosis, cast immobilization or curettage was erroneously performed in four patients. One patient suffered from vertebral compression fracture. There is no growth disturbance or deformity in any patient.

Conclusion: This study demonstrated that early recognition of the disease can be improved by using Bristol criteria which should be evaluated by a multidisciplinary team rather than one single specialist. In this way, the reliability of these criteria is improved and the treatment could be given earlier with decreased delay in diagnosis. This multidisciplinary approach is also important for decision for biopsy, timely aggressive medical treatment, and follow-up of the disease to minimise possible complications.

044 Outcomes of abductor repair using mesh augmentation in oncologic proximal femur replacement

Broida SE., Owen AR, Salmons HI., Rose PS., Houdek MT.
Department of Orthopedic Surgery, Mayo Clinic, Rochester, Minnesota, USA

Introduction: A primary challenge with proximal femoral replacement (PFR) is reconstruction of the abductor mechanism. A novel technique involving the use of polypropylene mesh allows for circumferential soft tissue reattachment to the peritrochanteric region of the megaprosthesis without preservation of the greater trochanter (Figure 1). The aim of this study was to investigate functional outcomes of patients treated with mesh augmentation of abductors during PFR.

Methods: A retrospective review was conducted for patients who underwent replacement of the proximal femur with mesh augmentation between 2018-2022 at a single institution. Twenty patients (10 females, 10 males) were followed for a minimum of 6 months or until death. Mean age at surgery was 63 years (range 24-85). Indication for surgery included metastatic disease (n=10), primary sarcoma (n=6), and failure of prophylactic stabilization (n=4). Five patients had a history of radiotherapy to the proximal thigh (mean 4200cGy) and six patients received adjuvant radiation following PFR (mean 2700cGy). Mean follow-up was 15 months (range 6-28).

Results: Post-operatively, 100% of patients were ambulatory. Gait aid requirement at most recent follow-up consisted of walkers in 3 patients (15%), single arm crutch or cane in 10 patients (50%), and independent ambulation in 7 patients (35%). At final follow-up, 36% of patients were able to walk with a non-Trendelenburg gait. Mean total MSTS score was 20 (range 8-29). There were no post-operative infections or wound issues. Three patients experienced local recurrence, one of which underwent hip disarticulation. There were no other re-operations. Three patients died of disease at a mean 13 months from surgery (range 7-22).

Conclusion: Abductor reconstruction after PFR is a difficult problem. Mesh augmentation of PFRs allows for adequate soft tissue tensioning and muscular attachment to the body of the implant. Over 85% of patients undergoing this novel technique were ambulatory without gait aids or with a single-arm assistive device after 3 months post-op and roughly one-third of patients may achieve a non-Trendelenburg gait pattern. There were no complications related to the mesh in this short-term series. In summary, mesh augmentation of PFRs should be considered during reconstruction for oncologic indications.

045 Total humerus reconstruction for oncologic resection and complex arthroplasty

Kruckeberg B., Lee D., Broida S., Barlow J., Morrey M., Sanchez-Sotelo J., Houdek M.
Department of Orthopedic Surgery, Mayo Clinic, Rochester, MN USA

Introduction: Total humerus reconstruction is an option for following oncologic resection, as well as for salvage procedures in the setting of infection and revision arthroplasty. In these challenging scenarios, the massive bone loss often requires an endoprosthesis or allograft prosthetic composite (APC) for limb salvage. Because of the rarity of total humerus reconstruction, there's limited literature regarding functional outcomes, complications and survivorship following endoprosthetic and APC total humerus reconstructions.

Method: We reviewed 17 (13 females, 4 males) patients undergoing total humerus reconstruction for oncologic resection and revision arthroplasty from 1987 to 2021. The mean patient age and body mass index (BMI) were 54±19 years and 27±6 kg/m2. The reconstructions included APC (n=12, 71%) and endoprosthesis (n=4, 24%). The most common indication was revision total shoulder and total elbow arthroplasty (n=9, 53%), primary bone and soft tissue tumors (n=5, 29%), and metastatic disease (n=3, 18%). The mean follow-up was 4.5 years (median 2.8; range 0.8-15.1 years) for the 9 patients who were alive at the time of the study and 0.9 years (median 0.7; range 0-2.5 years) for the 9 patients who had died.

Results: Two- and 5-year overall survival following total humerus reconstruction was 59% and 47%, respectively. Mean postoperative elbow flexion and extension were 50±15° and 106±36°, respectively, while mean postoperative shoulder elevation was 58±29° . Mean postoperative Mayo Elbow Performance Score (MEPS) and Musculoskeletal Tumor Society Score (MSTS) were 62±17 and 48±13%. Mean post-operative ASES (American Shoulder and Elbow) scores was 52±12 and Simple Shoulder Test score 2.1±1.2. Postoperative complications occurred in 11 (61%) patients, of which radial nerve palsy (n=3, 17%) and shoulder instability (n=3, 17%) were most common. Four patients underwent reoperation, 3 of which were a result of a complication and 1 for local oncologic recurrence, and 2 revision surgeries.

Conclusion: Total humerus reconstruction provides an option for limb salvage following oncologic resection and complex revision upper extremity arthroplasty. Both APC and endoprosthesis reconstruction resulted in a functional limb but have functional limitations and high complication rates. Despite the complications, there were few reoperations and only 2 revision surgeries.

047 Trabectedin for the treatment of non-L-sarcomas: A single-center experience

Duarte Mendes A.[1], Vasques AC.[2], Albuquerque J.[3], Esperança Martins M.[4,5], Pacheco T.[4,5,6], Paiva R.[4], Costa L.[4,5,6], Fernandes I.[4,5,6]
[1]Hospital Prof. Dr. Fernando Fonseca, EPE, Portugal; [2]Centro Hospitalar Lisboa Ocidental, Portugal; [3]Hospital da Luz Lisboa, Portugal [4]Centro Hospitalar Universitário Lisboa Norte, Portugal; [5]Instituto de Medicina Molecular – Luis Costa Lab; [6]Faculdade de Medicina da Universidade de Lisboa – Clínica Universitária de Oncologia; Lisbon, Portugal

Background: Soft-tissue sarcomas are rare, and almost half of the patients with intermediate-grade or high-grade tumors develop metastatic disease. The clinical benefit of trabectedin for treating these tumors, mainly leiomyosarcoma and liposarcoma (commonly referred to as L-sarcomas), has been widely described. However, available data on non-L-sarcomas is limited. The present study aims to evaluate the effectiveness and safety of trabectedin in a cohort of patients with non-L-sarcomas in the real-world setting.

Methods: This observational, retrospective, and single-center study included 12 patients with non-L-sarcoma who received trabectedin at our institution between December 2015 and June 2021. The data was collected from the patient's medical files and analysed with IBM SPSS Statistics 28.

Results: The most frequent histologic subtype was synovial sarcoma (n = 5, 41.6%). The other subtypes included malignant peripheral nerve sheath tumor (n = 1, 8.3%), angiosarcoma (n = 1, 8.3%), mesenchymal chondrosarcoma (n = 1, 8.3%), extraskeletal myxoid chondrosarcoma (n = 1, 8.3%), solitary fibrous tumor (n = 1, 8.3%) and myogenic sarcoma (n = 1, 8.3%). Only four patients (33.3%) were metastatic at diagnosis, and the main metastatic site was the lung. Most patients received trabectedin as a subsequent treatment for advanced disease, but two patients (16.6%) received it as the first-line treatment. The mean number of cycles with trabectedin was 7.8 (range 3-17). One patient achieved partial response (8.3%), and two patients showed stable disease (16.6%). Overall, progression-free survival was 4.6 months (95% CI 3.1-6.1). The overall survival was 9.6 months (95% CI 6.2-13.1). Grade 3 adverse events were observed in 3 patients (25%), mostly hematological, and one patient (8.3%) reported grade 4 febrile neutropenia that required hospitalization.

Conclusion: The findings of our real-world data support that trabectedin confers clinically meaningful activity in patients with non-L-sarcoma, with a manageable safety profile.

048 Incidence, risk factors, and clinical outcomes of periprosthetic infection after endoprosthetic reconstruction for metastases to the proximal femur

Kim S., Kim H., Han I.
Department of Orthopaedic Surgery, Seoul National University Hospital, Seoul, Korea

Background: Patients undergoing endoprosthetic reconstruction for bone metastases may be at increased risk of periprosthetic infection because of their cancerous state and its treatment. However, no study exists regarding the incidence and risk factors of periprosthetic infection in patients who undergo surgery for metastases to the femur. The aims of this study were to investigate the rate of periprosthetic infection, identify possible risk factors, and assess the appropriate treatment modality.

Methods: 140 patients who underwent endoprosthetic reconstruction for proximal femoral metastasis with a mean follow-up of 17 months were reviewed. Endoprosthetic reconstruction was performed with femoral reconstruction with modular megaprosthesis (n =79), femoral reconstruction with conventional prosthesis (n=45), and combined femoral and acetabular reconstruction (n=12). Lung cancer (n=31), breast cancer (n=23) and hepatocellular carcinoma (HCC) (n=23) were the most common primaries.

Results: Periprosthetic infection developed in 12 patients (8.21%) at a mean of 7.3 months (range, 1 – 27). Combined femoral and acetabular reconstruction showed the highest infection rate (17%), followed by femoral reconstruction with modular megaprosthesis (9%), and femoral reconstruction with conventional prosthesis (4%). Among the 3 common subtypes, HCC showed the highest infection rate (17%). Infection was controlled in 50% (6 of 12 patients). One-stage revision successfully treated the infection in 43% (3 of 7) whereas two-stage revision was successful in 33% (1 of 3). Debridement without endoprosthesis removal was unsuccessful (0 of 3).

Conclusion: The incidence of periprosthetic infection was considerable in patients undergoing endoprosthetic reconstruction for proximal femoral metastases. Periprosthetic infection rate was higher when the surgery was more extensive. Hepatocellular carcinoma as primary showed the highest incidence of periprosthetic infection.

050 Long term survival of massive bone allografts

Manon J.[1,2], Toulemonde M. [3], Evrard R. [1,2], Docquier P.-L. [1-3], Schubert T. [1,2,3], Cornu O.[1,2,3]
[1] Pôle de Neuro-Musculo-Squelettique (NMSK), IREC, UCLouvain, Brussels, Belgium; [2] Centre de Thérapie Cellulaire et Tissulaire Locomoteur (UTTCAL), Cliniques Universitaires Saint-Luc UCL, Brussels, Belgium; [3] Orthopaedic and Trauma Department, Cliniques Universitaires Saint-Luc UCL, Brussels, Belgium

Introduction: Massive bone allografts (MBA) have been used in author's institution as a means of reconstruction after bone tumor, post-traumatic bone loss, prosthetic loosening and chronic bone infection inducing significant segmental defect. Debates is ongoing relative to the long-term effectiveness of massive allograft reconstruction compared to structural metallic implantable devices. This study aims to observe MBA long term survival and complication pattern.

Method and Materials: This retrospective study included all MBA implanted between 1970 and 2009. The targeted complications were infection, fracture, pseudarthrosis and resorption, and failure was defined by the graft removal. Statistical analyses were performed using Excel and SPSS software.

Results: 246 MBA (124 femurs, 44 humeri, 36 tibias, 25 pelvises, 10 radii, 4 ulna, 2 fibula and 1 clavicle) with an average length of 15.6 cm were implanted in 200 patients (mean age 43 y.o., 53% men, 47% women). Surgical indications were tumor resections (48%), prosthesis revisions (26%), allograft revisions (16%) and traumatic injuries (10%). The median survival of MBA was 27.25 years. The occurrence of one or more complications significantly worsened the survival curve ($p<0.001$). 113 MBA safely evolved, while 133 developed one or more complications. The most common one was pseudarthrosis (30.1%), followed by fracture (24.4%), infection (14.6%) and resorption (7.7%). Non-union ($p=0.019$), fracture ($p<0.001$) and resorption ($p=0.003$) were more often observed in a younger population. Fractures more occurred on longer MBA ($p=0.013$). Significantly more infections were observed in men ($p=0.014$), and in cases of prior infection ($p<0.001$). Resorption was more seen in oncologic indications ($p=0.010$). A total of 87 MBA (35%) ultimately failed. Apart from resorption, the presence of one of the other 3 complications strongly influenced the failure but also the survival curves of the MBA.

Conclusion: Despite a high rate of early complications, a majority of MBA are long lasting nearly three decades later. Prevention of early mechanical and septic complications and improving MBA remodeling by tissue engineered techniques to prevent late stress fractures are likely to further enhance long-term MBA outcomes.

051 Avoiding length discrepancy after massive resection of young children using lengthening nail as primary synthesis of the reconstruction

Campanacci L., Staals E., BianchiG., Donati D.
Orthopaedic Oncology Unit, IRCCS Istituto Ortopedico RIZZOLI, Bologna, Italy

Background and Objectives: In skeletally immature patients, resection of a bone sarcoma in a lower limb create a length discrepancy which will be more serious in patients operated on at a younger age.

Lengthening at the end of growth is possible with external fixator or lengthening nail, but it depends on the previous type and site of reconstruction.

In pediatric patients, when resection sacrifices the physis of the proximal tibia, reconstruction with hemi-articular (resurfacing) composite prosthesis is a good option, because it respects the distal femur, and avoids significant length discrepancy at the end of growth.

Methods: In selected cases of very young children, expecting major LLD, we performed reconstruction of massive tibial resection with hemi-articular composite prosthesis or intercalary massive allograft fixed not with a long plate but with an extendable PRECICE2 nail.

After few years, when a LLD is present, the nail can be "awakened" and used for lengthening. We report 4 cases treated with this technique, aged 6 to 11 years (av. 9 years old).

Results: Out of the 4 cases treated with this technique, in one case lengthening of 4 cm was performed 5 years after reconstruction, by tibial and fibular osteotomy and external magnet on the expandable nail. The other patients are still growing and delayed lengthening will be performed when needed.

Conclusion: In selected cases of young children, primary reconstruction using a lengthening nail may be a possible solution to avoid future limb length discrepancy with minor further surgery.

052 Impact of topography and added TiN-coating on adult human dermal fibroblast viability and proliferation after seeding on titanium surface in vitro

Wahrenburg M. [1], Streitbürger A. [1], Dudda M. [2], Hardes J. [1], Hauschild G. [1]
[1] Department of Orthopedic Oncology, Essen University Hospital, Germany; [2] Clinic of Trauma, Hand and Reconstructive Surgery, Essen University Hospital, Germany

Background: Complications of transcutaneous osseointegrated prosthetic systems (TOPS) focus on the metal-cutaneous interface at the stoma. Besides pain due to scare tissue as well as undefined neuropathic disorders, there is high evidence that the stoma presents the main risk causing hypergranulation and ascending infection. To restore the cutaneuous barrier function in this functional area, soft-tissue on- or in-growth providing a vital and mechanically stable bio-artificial conjunction is considered a promising approach. In this study we assessed viability and proliferation of adult human dermal fibroblasts (HDFa) on modifications of a standard prosthetic titanium surface.

Methods: Un-coated (TiAl6V4) as well as a titanium-nitrite (TiN) coated additive manufactured porous three-dimensional surface structures (EPORE®) were seeded with HDFa and compared to plain TiAl6V4 and polystyrene surfaces as control. Cell viability and proliferation were assessed at 24 hours and 7 days after seeding with a fluorescence-based live-dead assay. Adhesion and cell morphology were analyzed by scanning electron microscopy at the respective measurements.

Results: Both surface specifications revealed a homogenous cell distribution with flat and spread cell morphology forming filopodia at both measurements. Proliferation and trend to confluence was seen on un-coated EPORE® surfaces with ongoing incubation but appeared substantially lower on the TiN-coated EPORE® specification. While maintaining consistent viability, compared to the control surfaces both EPORE® specifications did not reach the proliferation and confluence level provided by these.

Conclusion: The EPORE® topography allows for fibroblast adhesion and viability in both standard TiAl6V4 and – to a minor degree - TiN-coated specifications as a proof of principle.

056 Comparison of reconstructive techniques for metastatic disease in the proximal humerus

Sullivan M., Arguello A., Barlow J., Morrey M., Rose P., Sanchez-Sotelo J., Houdek M.
Department of Orthopedic Surgery, Mayo Clinic, Rochester, MN, USA

Background & Objectives: The proximal humerus is a common location for metastatic disease, and endoprosthetic composites (EPC) are often utilized for limb salvage reconstruction with either hemiarthroplasty (HA) or reverse arthroplasty (RA) constructs. RA constructs have improved functional outcomes in patients with osseous lesions, but no studies have compared techniques in metastatic disease alone. The aim of this study is to compare functional outcomes and complications between HA and RA constructs in patients undergoing endoprosthetic reconstruction for proximal humerus metastases.

Methods: A total of 49 (51% male) patients undergoing reconstruction of the proximal humerus for metastatic disease were retrospectively reviewed, including 31 HA and 18 RA constructs. The majority (88%) presented with pathologic fracture, and most common diagnoses included renal cell carcinoma (47%), multiple myeloma (14%), and breast carcinoma (10%). Average follow up was 2.6±3.5 years.

Results: Patients with RA reconstructions had significantly better post-operative forward elevation (73° vs. 37°, p=0.0005) and significantly higher Simple Shoulder Test scores (3.6 vs. 2.5, p=0.048). HA patients experienced significantly more complications (n=18, 55% vs n=2, 9%, p=0.0014), with instability being the most common (n=14, 45% vs. n=2, 9%, p=0.0079). Two HA patients experienced a periprosthetic fracture about the distal implant. No patients underwent revision surgery.

Conclusion: Patients with metastatic disease of the proximal humerus had improved functional outcomes and fewer complications after undergoing reconstruction with a reverse EPC compared to a hemiarthroplasty EPC. Preference for reverse EPC should be given in patients undergoing this operation.

057 Safety of trabectedin in soft tissue sarcomas : A single centre study

Vasques A.[1], Albuquerque J.[2], Mendes A.[3], Martins M.[4,5,6], Pacheco T.[4,5,6], Paiva R.[4], Costa L.[4,5,6], Fernandes I.[4,5,6]
[1]Centro Hospitalar Lisboa Ocidental, Portugal; [2]Hospital da Luz Lisboa, Portugal; [3]Hospital Fernando da Fonseca, Portugal; [4]Centro Hospitalar Lisboa Norte, Portugal;
[5]Instituto de Medicina Molecular – Luis Costa Lab; [6]Faculdade de Medicina da Universidade de Lisboa – Clínica Universitária de Oncologia, Lisbon, Portugal

Background & Objectives : Trabectedin is an antineoplastic alkaloid drug that acts by causing DNA breaks and preventing tumour growth. It is approved for the treatment of advanced or unresectable soft tissue sarcomas, and it is generally well tolerated. Our goal is to describe our experience regarding the safety of the use trabectedin in soft tissue sarcomas (STS).

Methods: This is an observational retrospective unicentric study of patients with soft tissue sarcomas that were treated with trabectedin between 2010 and 2021. The data was collected from the patients' medical files and analysed with Microsoft Excel V2210.

Results: A total of 69 patients were included in this study with the diagnosis of leiomyosarcoma in 38 patients, liposarcoma in 19 patients and other sarcomas in 12 patients. The median age at diagnosis was 52.5 years and the majority were females (n=44). Regarding stage, 25 patients were in stage III at diagnosis, 21 in stage IV and 12 in early stages. Most patients were treated with trabectedin in 2nd line (n=39), with a median of 7.7 cycles in a median period of 7 months.

Hematologic toxicity was the most common, affecting 62% of patients (n=43) in G1/2 and 17% of patients (n=12) in G3/4, being anaemia and neutropenia the most frequent ones. The gastrointestinal (GI) and hepatic G1/2 toxicity had the same frequency, affecting 51% of patients (n=35) each. Nausea and vomiting were the most common symptoms and only 2 patients had G3/4 toxicity. Regarding hepatic toxicity, the alanine aminotransferase (ALT) was the one who increased more often, 38% (n=26), with toxicity G1/2 in 36% of patients (n=25) and only one with toxicity G3, reaching the maximum value of 247 U/L. There were 2 patients that discontinued treatment after 2 cycles because of G3 cardiac toxicity, which manifested as heart failure with reduced ejection fraction.

Conclusions: In our findings, the major adverse events of trabectedin were haematologic, GI and liver toxicity. Serious adverse events were rare and transient, therefore trabectedin seems a relatively well tolerated drug. However cardiac toxicity is not negligible in our sample. Despite the confounding factor that these patients may have previously received doxorubicin, more studies are needed to evaluate the necessity of cardiac evaluation before and during the use of trabectedin.

060 Surgical treatment of malignant bone tumors of the upper limb in children. A surgical challenge

Salom M., Baixauli F.[2], Aroca JE.[3], Pérez-Garcia A.[4], Thione A.[4]
[1]Pediatric, [2]Tumor Unit, [3] Upper limb Unit, Orthopedic Surgery, [4]Plastic Surgery
Hospital Universitario y Politécnico La Fe, Valencia, Spain

Background and Objectives: The upper limb is not the most frequent location for a malignant tumor in children. When it happens, surgical treatment, and especially reconstruction, is always challenging and surgical techniques are not as well described in the literature as when located in the lower limb. Moreover, the information is scarce in relation to children. The purpose of this abstract is to present three different reconstruction techniques in three malignant bone tumors in children located in the upper limb.

Methods: Case 1. 13-year-old boy diagnosed with a left proximal radius osteosarcoma. After neoadjuvant chemotherapy, he was surgically treated by tumor excision and reconstruction with an allograft and a 10-hole plate. A tunnel was made at the level of the bicipital tuberosity to anchor the biceps brachii tendon.

Case 2. 12-year-old girl diagnosed with a left proximal humeral osteosarcoma. After neoadjuvant chemotherapy, she was surgically treated by tumor excision, at the level of the physis proximally, preserving the humeral head with its muscular insertions. Reconstruction was performed with a vascularized fibula graft and osteosynthesis with a Philos plate. The pectoralis major and the distal deltoid insertion was reattached to the fibula graft and a latissimus dorsi and teres major transfer (L'Episcopo) was performed in order to improve external rotation.

Case 3. 13-year-old girl diagnosed with a left proximal humeral osteosarcoma, with the humeral head, proximal deltoid and axillary nerve affected. After neoadjuvant chemotherapy, she was surgically treated by tumor excision with humeral head removal and a glenohumeral arthrodesis performed with a vascularized fibular graft and osteosynthesis with a Philos plate. The locking screws of the plate allowed us an angular stability with an excellent anchorage on the glenoid, avoiding the use of two plates.

Results: Clear surgical margins were obtained in all specimens. The median follow-up was 3 years (1-5.7). No patient experienced local recurrence. One patient (case 1) developed lung metastasis 5 years after surgery and was treated with surgical excision; he is alive without disease. Another patient (case 2) presented with lung metastases that were partially surgically excised and she is alive with disease. The other patient (Case 3) is alive without disease. The Musculoskeletal Tumor Society (MSTS) score was: case 1, 22/30, Case 2, 28/30 and case 3 16/30.
The radial allograft suffered a fracture at the level of the tunnel made for the brachial biceps anchorage after 3 years of evolution, but without affecting the clinical result. No complications were observed when a vascularized fibula graft was used.

Conclusions: Biological reconstruction with a vascularized fibula provided better results than when allograft was used.
When planning reconstruction techniques for malignant bone tumors of the upper limb in children only non-standardized techniques are described, and the treatment should be individualized.

061 Tumor microenvironment reprogramming during immuno-chemotherapy in osteosarcoma

Chen H.[1,2], Wang J.[1,2]
[1] Department of Musculoskeletal Oncology, Sun Yat-Sen University Cancer Center, Guangzhou, China; [2] State Key Laboratory of Oncology in Southern China, Collaborative Innovation Center of Cancer Medicine, Guangzhou, China

The cellular characteristics of TME are recognized to be critical factors in tumor development and metastasis. The diversity of TME components and the high heterogeneity of osteosarcoma cells greatly affect tumor cell survival and response to chemotherapy and immune checkpoint blockade (ICB). We defined unique features at the single-cell resolution by employing Single cell RNA sequencing (scRNA-seq) and T cell receptor (TCR) approach to describe the complexity of the subcloned transcriptional state in both immuno-chemotherapy-naïve and treated advanced OS patients.

We utilized single-cell RNA sequencing (scRNA-seq) in combination with TCR repertoire sequencing on viable cells derived from untreated tumors, ICB-chemotherapy-exposed tumors and adjacent tissues. We used the Seurat package to cluster tumor and immune cells and analyze gene expression. We performed pathway enrichment analysis using the clusterProfiler package. The CellphoneDB package was employed for the analysis of cellular interactions.

The main cell types in the osteosarcoma microenvironment were osteosarcoma cells, myeloid cells, lymphocytes, fibroblasts, pericytes, endothelial cells, and osteoclasts. Stem-like osteosarcoma cells were the major cell clusters that developed drug resistance in osteosarcoma. Immunomodulatory genes CD40, CD47 and MIF affected the therapeutic effect of neoadjuvant therapy for osteosarcoma. We defined a therapeutic index (TI) to evaluate the impact of various immune cell clusters on the effect of neoadjuvant therapy and found that the main cell populations positively correlated with the TI were type 1 macrophage (M1) and pre-exhausted CD8+ T cells. Chondroblastic osteosarcoma lacks M1 and pre-exhausted CD8+ T cells. Analysis results from CellphoneDB showed that samples with poor response to neoadjuvant therapy had more inhibitory interactions on effector CD8+ T cells.

Compared with osteoblastic osteosarcoma, chondroblastic osteosarcoma lacked immune activating factors and has a poor prognosis. The combined use of immunomodulatory drugs such as MIF inhibitors might improve the prognosis of chondroblastic osteosarcoma. Residual tumor stem-like cells expressed immune suppressive factors to achieve immune escape after combined therapy. Pre-exhausted CD8+ T cells were the main tumor killer generated by combination therapy. The combined use of immunomodulatory drugs provides prospects for future neoadjuvant therapy research.

062 Novel navigation-guided surgical technique for treatment of pathologic bone lesions

Batash R.[1,2], Kollender Y.[1,2], Bilenko G.[1,2], Lubovsky O.[1,2], Debbi R.[1,2], Rosinsky P.[1,2]
[1]Orthopedic Division, Barzilai Medical Center, Ashkelon, Israel; [2] faculty of medicine, Ben Gurion University of the Negev, Israel

Background: Benign bone lesions including, osteoid osteoma, osteoblastoma, chondroblastma, and aspetic avascular necrosis are frequently treated with fluoroscopy- or CT-guided procedures, such as radiofrequency, cryoablation, and decompression. Recurrence rate following these procedures may be as high as 8%, partially due to imprecision in lesion targeting. Furthermore, radiation exposure is high both for the patient and the treating physicians.

Material and methods: Between 2019-2023 10 patients underwent navigation-guided surgery using an O-arm and a Medtronic Navigation System for treatment of benign bone lesions and avascular necrosis of the femoral head. All patients underwent pre- and post-operative imaging and patient files were reviewed for intra-operative and post-operative complications. Surgical variables included radiation exposure (mGy), surgery time, narcotic consumption, and blood loss.

Results : Six male and four female patients with mean age of 27(range 16-43) underwent navigation-guided surgery. Five patients were treated for osteoid ostoema, one for osteoblastoma, one for chondroblastoma, and three patients underwent core decompression for femoral head avascular necrosis. At latest follow-up no recurrence was observed.

Conclusion: We present a novel treatment modality using a navigation system and cannulated device for treatment of various pathological bone lesions. From our experience the technique enables the surgeon to be precise and perform a minimal invasive surgery. Furthermore, the procedure aids in decreasing radiation exposure to the patient and surgical staff, compared to conventional surgery using CT-guided methods.

066 Trabectedin in second or later lines – experience of a Portuguese Center

Albuquerque J. [1], Vasques AC. [2], Duarte Mendes A. [3], Esperança Martins M. [4,5], Pacheco T. [4,5,6], Paiva R. [4], Costa L. [4,5,6], Fernandes I. [4,5,6]
[1]Hospital da Luz Lisboa, Oncology Department, Portugal ; [2]Centro Hospitalar Lisboa Ocidental (CHLO), Oncology Department, Portugal; [3]Hospital Fernando da Fonseca, Oncology Department, Portugal; [4]Centro Hospitalar Lisboa Norte, Oncology Department, Portugal ; [5]Instituto de Medicina Molecular – Luís Costa Lab; [6]Faculdade de Medicina da Universidade de Lisboa – Clínica Universitária de Oncologia, Lisbon, Portugal

Background And Objectives: Trabectedin is a treatment option in 2nd or later lines in metastatic sarcomas, showed an improvement in disease control and acceptable toxicity-profile compared to dacarbazine. Efficacy differences between histological subtypes remains unclear. Our goal is to evaluate progression free survival (PFS) and OS in overall-population and in Liposarcomas and Leiomyosarcomas subgroups treated with Trabectedin.

Methods: A retrospective observational study was conducted in patients with metastatic/recurrent sarcoma treated with trabectedin in ≥2nd line, between January/2009-June/2022 in a Portuguese institution.

Results: A total of 60 patients were treated with trabectedin, median age 61-years (25-81), 38 (63%) were female and 38 (63%) had localized/locally-advanced disease at diagnosis. Of 19 pts (32%) with distance metastases, 12 (63%) had lung metastases, 8 (42%) of them with ≥5 lesions. Leiomyosarcoma was diagnosed in 34 patients (57%), liposarcoma in 16 (26%) and non-L-histology in 10 (17%). Fifty-six patients (96%) had received doxorubicin before, with a median number of chemotherapy-lines of 1 (1-5). Clinical-response was observed in 16 patients (26%). After a median follow-up of 66-months (18-116), the median PFS was 5-months (CI95 4-7) and median OS was 15-months (11-19) in overall-population. No statistical survival difference was found between leio- and liposarcoma (median PFS 5 vs 6-months (Log Rank 1,07; p=0,30); median OS 8 vs 22-months, respectively (Log Rank 2,46; p=0,11)).

Conclusions: The real-word-outcomes reported were consistent with published data. Besides no statistical survival difference was found between histological subtypes, a 14-months difference favor leiomyosarcomas OS was noted. Prospective studies with larger sample size are needed to clarify this survival difference.

068 Bone marrow concentrate in the treatment of aneurysmal bone cyst: A single-institution experience

D'Arienzo A., Cosseddu F., Shytaj S., Ipponi E., Campo F.R., Capanna R., Andreani L.
Department of Orthopedics and Trauma Surgery, Azienda Ospedaliero Universitaria Pisana, Cisanello, Pisa, Italy

Background & Objectives : A recent option for the treatment of bone cystic lesions and in particular of aneurysmal bone cysts (ABC) is represented by the use of mesenchymal stem cells (MSC). Obtained from aspirated and centrifuged bone marrow concentrate and applied locally by percutaneous infiltration under radiographic control, they are used with the aim to stimulate local healing and encourage the colonization of newly formed bone inside the cystic cavity. We carried out a retrospective evaluation of the results obtained using this methodology in our institution, in order to identify the actual benefits of this procedure.

Methods : The study group consisted of 46 cases (31 males and 15 females) with an average follow-up of 33 months, treated between January 2013 and June 2019. Forty-two patients underwent percutaneous treatment as the first approach; four patients underwent curettage as their first treatment. Autologous bone marrow concentrate (BMC) was also associated in each case. Healing status was assessed, viewing plain radiographs within 45 days and 2 months after the procedure, according to the modified Neer classification. The procedure was repeated 2 months in those cases who did not show sufficient signs of lesion healing.

Results : 36 patients recovered with a single procedure (including 4 who underwent curettage), 7 underwent two infiltration procedures, 2 underwent received three infiltrations while one patient underwent a complete resection. At their final follow-up, thirty-six patients had a type II Neer radiological appearance, nine recovered with a type I appearance and one patient was not evaluated due to total hip arthroplasty consequential to the failure of previous treatment.

Conclusions : In our series, with the intralesional administration of BMC, we have obtained complete healing of more than 50% of our cases after only one treatment. Furthermore, we did not report any complications, including superficial or deep infections, fractures or other adverse reactions, neither at the donor site nor at the application site. This confirms the safety of the procedure we used. In conclusion, we can state that the local use of the BMC should be encouraged as it has a very low complication rate and has an indisputable osteogenic and healing potential for bone defects.

070 Cytogenetic characterization of retroperitoneal dedifferentiated liposarcoma: correlation with metabolic and lipidomic profiles and response to treatment

Magalhãe M.[1,5], Rosendo E.[1], Araújo A.[1,5], Vizcaíno JR.[2], Coelho A.[2], Jones R.[3],Thway K.[4]
[1]Department of Oncology, [2]Department of Anatomic Pathology, Centro Hospitalar Universitário do Porto, Porto, Portugal; [3]Department of Oncology, [4]Department of Pathology The Royal Marsden NHS Foundation Trust, London, England; [5]Unit for Multidisciplinary Research in Biomedicine, Instituto de Ciências Biomédicas Abel Salazar, Porto, Portugal

Well-differentiated and dedifferentiated liposarcomas (DDLPS) characteristically have a 12q13-15 amplicon, which results in amplification of Mouse Double Minute 2 homolog (MDM2) and Cyclin-Dependent Kinase 4 (CDK4) genes. The degree of amplification of both these genes has been associated with increased chemoresistance. Two other genes, JUN (1p32) and ASK1(6q23.3) may also have some prognostic implication in survival of DDLPS. Some metabolic and lipidomic alterations have also been associated with increased or decreased resistance to chemotherapy in cancer cell cultures, but those results have never been validated in vivo and no correlation with the degree gene amplification was performed.

We aim to initiate a study in which we will assess the cytogenetic, metabolomic and lipidomic landscape of retroperitoneal DDLPS. All DDLPS will also be evaluated for morphological aspects, and all subjects will be assessed for clinical conditions that may alter metabolism. We will assess degree of gene amplification utilising fluorescent in-situ hybridization, and then correlate the cytogenetic data with metabolomic and lipidomic alterations.

The last step of this study is to find out if a higher copy number of MDM2, CDK4, JUN and ASK1 and the presence or absence of any candidate metabolite and/or lipid influences response to first-line chemotherapy with an anthracycline with or without an alkylating agent.

071 Functional outcomes and quality of life in patients who underwent limb sparing surgery for soft tissue sarcomas

Manrique E.[1], Buendía J. [2], Maroto R.[1] , Escobar D.[3], Cebrián JL.[1]
[1] Orthopaedic Surgery and Traumatology, [2] Plastic Surgery, Musculoesqueletal Sarcomas Department, Hospital Clínico San Carlos, Madrid, Spain; [3] Orthopaedic Surgery and Traumatology, Knee Department, Hospital Infanta Leonor, Madrid, Spain

Objective: The impact of soft tissue sarcoma (STS) surgery on the patient's quality of life and functional capacity after limb sparing surgery needs to be studied in greater depth due to the lack of information in the current literature. establish relationships between the different clinical and demographic characteristics studied and the quality of life and functional capacity of patients operated on for STS in extremities.

Materials and methods: We conducted a cross-sectional observational study where we selected a population of 68 patients operated on STS in the HCSC of Madrid from 2016 to 2021. Three questionnaires were handed out; one for quality of life (QLQ-C30) and two for functionality (TESS and MSTS).

Results: In the statistical analysis we found that a larger tumor axis (≥5 cm) (p=.048) and a larger tumor size determined in Anatomical Pathology (pT3 and pT4) (p=.008) resulted in a higher risk for worse functionality measured by the TESS. In addition, high pT values (pT3 and pT4) resulted in increased risk of scoring lower on the MSTS (p=.012). Also, having a comorbidity (p=.032) and high pT values (p=.001) were associated with a worse quality of life, measured by the QLQ-C30.

Conclusions: The results of this study show that the tumor's major axis, pT values and patient's comorbidities are related to their functional status and quality of life, while other variables such as age, sex or tumor depth are not related to the survey scores.

072 Detrimental effect of COVID-19 pandemic on patients with adult extremity bone sarcoma. Reference center experience

Paweł Teterycz P., Szostakowski B., Rosinska M., Kosela-Paterczyk H., Rutkowski P.
Department of Soft Tissue/Bone Sarcoma and Melanoma, Maria Sklodowska-Curie National Research Institute of Oncology, Warsaw, Poland

Background: The COVID-19 pandemic had a significant impact on the healthcare system globally, including oncology. Which, in turn, led to significant delays in diagnostic and therapeutic procedures. This work aims to evaluate COVID-19 impact on the treatment of bone sarcoma in adult patients based on experience in a single, high-volume institution.

Methods: We have analyzed the early local outcomes (i.e., the possibility of limb-sparing surgery) in all patients with primary bone tumours treated between 2016-01-28 and 2022-11-07 in Polish main sarcoma reference center. Patients treated in the 2016-2019 period were labelled as a (pre-pandemic" group, and patients treated in the 2020-2022 - "pandemic". Mann–Whitney U and Chi-square tests were used in the statistical analysis.

Results: There were 302 eligible patients identified. The group characteristics are presented in table 1. There were no differences in patient-related variables and histological subtypes of tumours between the two groups.

The tumour size did not differ (p = 0.053), when all tumour grades were considered, but high-grade tumours were larger in the "pandemic" group (p = 0.034). This was reflected in the percentage of limb-sparing surgeries which dropped from 83.3% to 68.2% ("pre-pandemic" vs "pandemic", p = 0.004). This difference was even more evident in the case of high-grade tumors - 78% vs. 54%, respectively (p = 0.001).

Conclusion: To our knowledge, this is the first report of the long-lasting detrimental impact of the COVID-19 pandemic on oncologic treatment outcomes in adult patients with primary malignant bone tumors.

077 Functional outcomes after reversed shoulder megaprosthesis following resection of malignant bone tumor in the proximal humerus: A systematic review and meta-analysis

Denissen, JJPM.[1], Koenders N.[1], van Hinte G.[1], Groen F.[2], van der Wees PJ. [3], van der Geest ICM. [4], Dierselhuis EF.[4]
[1] Radboud University Medical Center, Radboud Institute for Health Sciences, Department of Rehabilitation, Nijmegen, The Netherlands; [2]University of Applied Sciences Utrecht, Expertise Center Healthy Urban Living, Research Group Innovation of Human Movement Care, Utrecht, The Netherlands; [3]IQ Healthcare, [4]Department of Orthopaedics Radboud University Medical Center, Radboud Institute for Health Sciences, Nijmegen, The Netherlands

Background: After resection of tumors in the proximal humerus, orthopedic oncologic surgeons are able to restore the shoulder function of patients with a reversed shoulder megaprosthesis. Information about expected postoperative physical functioning is required to guide patient expectations, identify abnormal recovery, and set treatment goals.

Aim: To provide an overview of functional outcomes after reversed shoulder megaprosthesis in patients after proximal humerus resection.

Methods: This systematic review searched studies in MEDLINE, CINAHL and Embase up to March 2022. Data on performance-based and patient-reported functional outcomes were extracted using standardized data-extraction files. A meta-analysis with random effects model was performed to estimate outcomes after two-year follow-up.

Results: The search identified 1,089 studies. Nine studies were included in the qualitative analysis and six in the meta-analysis. Forward flexion ROM after two years was 105 degrees (95% Confidence Interval (CI): 88-122, n=59), abduction ROM 105 degrees (95% CI: 96-115, n=29) and external rotation ROM 26 degrees (95% CI: 1-51, n=48). The mean American Shoulder and Elbow Surgeons-score after two years was 67 points (95% CI: 48-86, n=42), mean Constant-Murley-score 63% (95% CI: 62-64, n=36) and mean Musculoskeletal Tumor Society-score 78 (95% CI: 66-91, n=56).

Conclusion: The meta-analysis shows acceptable functional outcomes two years after reversed shoulder megaprosthesis. However, outcomes may well differ between patients as reflected by the confidence intervals. Further research should focus on modifiable factors associated with impaired functional outcomes.

078 Outcomes following pedestal cup reconstruction of (impending) pathological fractures of the acetabulum due to metastatic bone disease

Macdonald J., Baird C., Jeys L., Parry M., Stevenson J.
Orthopaedic Oncology, Royal Orthopaedic Hospital, Birmingham, UK

Background & Objectives : Periacetabular metastatic bone disease (MBD) are challenging due to bone loss.1 The aim of this study was to evaluate the complications and functional outcome after undergoing peri-acetabular reconstruction using an 'ice-cream cone' pedestal cup endoprostheses for (impending) pathological acetabular fractures.

Methods: Fifty cases from April 2008 to December 2021 were identified. Patients who were alive, with less than six months follow-up were excluded. The acetabular defects were classified using the Metastatic Acetabular Classification (MAC).2 Mobility, pain, surgical complications and survival were assessed.

Results: There were 32 females and 18 males with a median age of 65 years (41-88). Median post-operative follow-up was 16 months (IQR 5.5m - 28.5m). All patients had a MAC of III or IV, 39 had complete and 11 had impending pathological fractures. Observed five-year survival rate was 22%, with a median survival of 16 months (IQR 5.8m-42.5m). Excluding three perioperative deaths, 13 complications occurred in 12 patients; Implant failure in 7 patients (4 aseptic loosening, 2 dislocations, 1 infection). At final follow-up, mobility and pain levels were improved in 85% and 100% respectively.

Conclusion: Reconstruction of (impending) pathological acetabular fractures due to MBD with 'ice-cream cone' endoprostheses reduces pain and improves mobility in patients with significant destruction when other reconstruction options are not appropriate. While the mortality rate is high, it remains reasonable when compared to those with significant MBD.3 Therefore, we would advocate the use of the 'ice-cream cone' for selected patients, balancing the risk of mortality and complications with the observed benefits.

References:

1. Ratasvuori M, Wedin R, Keller J, et al. Insight opinion to surgically treated metastatic bone disease: Scandinavian Sarcoma Group Skeletal Metastasis Registry report of 1195 operated skeletal metastasis. Surg Oncol 2013;22(2):132-138
2. Healey JH, Lenard HB. Pathological pelvic fractures and acetabular reconstruction in metastatic disease. In: Tile M, Helfet D, Kellam J, Vrahas M, editors. Fractures of the Pelvis and Acetabulum - Principles and Methods of Management. 4th ed. Thieme; 2015:835–48.
3. Zacharia, B., Joy, J., Subramaniam, D. et al. Factors Affecting Life Expectancy After Bone Metastasis in Adults — Results of a 5-year Prospective Study. Indian J Surg Oncol 12, 759–769 (2021)

079 A rare case report of paraganglioma in forearm

Kanay E.[1], Okay E.[1], Akbulut SÇ.[1], Yıldırım ANT.[2], Zenginkinet T.[2], Özkan K.[1]
[1] Department of Orthopedics and Traumatology, [2]Department of Pathology, Istanbul Medeniyet University, Prof. Dr Suleyman Yalcin City Hospital, Istanbul, Turkey

Pheochromocytomas are rare tumors and arise from catecholamine secreted chromaffin cells. 80- 85 % of them are originated from adrenal medulla and rest of them are extra-adrenally from ganglia of the autonomic nervous system. They are called paraganglioma or extra -adrenal pheochromocytoma (1). Herein we aimed to report a 37 years old, male patient with a mass lesion in his forearm mimicking sarcoma but turn out to be paraganglioma with preoperative biopsy.

Patient applied to another clinic with a small mass in his forearm 5 year ago, but he didn't have regular follow ups. After 4 years, he applied to our clinic for gradually enlarging mass. His symptoms were numbness in fifth finger, headaches and panic attack episodes beside the lesion. MRI displayed a 38*35*66 mm, heterogenous lesion. Tru-cut biopsy was performed with a possible diagnosis of a sarcoma; however, result came as a paraganglioma. Finally, the mass was excised and in final follow up, no complications or recurrence is detected.

Paragangliomas are extremely rare in appendicular skeleton and there are only a few case reports in the literature. Two of them are in forearm (2,3), one in upper arm (4) and one in thumb (5). We believe that our case is the one of the rarest and unique reports of the literature. It is important that paragangliomas have risk of a malignant degeneration. Symptoms like hypertension, headaches due to catecholamine secretions are important and paraganglioma should be involved on the differential diagnosis of mass lesions in the extremities.

(1)Tevosian SG, Ghayee HK. Pheochromocytomas and Paragangliomas. Endocrinol Metab Clin North Am 2019; 48:727–50.
(2)Wang Y, Zhang G, Chao J. Primary malignant pheochromocytoma in the leftforearm. Chin Med J (Engl). 1996 Apr;109(4):331-3. PMID: 8758300.
(3)Chow LTC, Chan MHM, Wong SKC. Functional Ulnar Nerve Paraganglioma: First Documented Occurrence in the Extremity with Hitherto Undescribed Associated Extensive Glomus Cell Hyperplasia and Tumorlet Formation. Int J Surg Pathol. 2018 Feb;26(1):64-72.
(4 Chong Y, Park M, Ko YH. Extra-adrenal paraganglioma of the median nerve. J Plast Surg Hand Surg. 2014 Dec;48(6):429-31.
(5)Lander ST, Coppola E, Tyler W, Elfar JC. A Peculiar Primary Paraganglioma of the Distal Thumb. J Hand Surg Am. 2016 May;41(5): e91-4.

080 Intraosseous schwannoma of the proximal radius

Kanay E. [1], Okay E. [1], Ozyaman O.[1], Yildirim ANT. [2], Zenginkinet T.[2], Ozkan K. [1]
[1] Department of Orthopedics and Traumatology, [2]Department of Pathology, Istanbul Medeniyet University, Prof. Dr Suleyman Yalcin City Hospital, Istanbul, Turkey

Schwannoma is a benign neoplasm which originates from Schwann cells. Intraosseous schwannoma is a rare subgroup of schwannoma and accounts less than %1 of primary bone tumors (1). It is usually located in the mandibula. Skull, sacrum, vertebral body and long bones may also be affected. In this report we aimed to present a 27 old female which was diagnosed as intraosseous schwannoma after a pathological fracture of proximal radius.

Patient applied to our emergency room with a simple trauma. A pathological fracture of the radial neck was detected on X-rays. Physical examination displayed lack of wrist extension consistent with posterior interosseous nerve palsy. MRI displayed a 24*12 mm cystic lesion at radial neck region. Open biopsy was performed due to close neurovascular structures. Pathological examination revealed benign looking, immunohistochemically S-100 protein positive spindle cells leading to diagnosis of intraosseous schwannoma and the patient was operated. After dissection and release of the posterior interosseous nerve, intralesional curettage and fixation with radius intramedullary nail was performed. Her radial nerve palsy dissolved completely 4 weeks after the operation.

Although many examples of intraosseous schwannoma (especially in the maxillofacial skeleton) exist, there are only few reports in forearm. In the literature review, we found four reports of intraosseous schwannoma at proximal ulna (2,3) and radius (4,5). Only one of them (5) was located at the proximal radius. Our surgical management and fixation method were presented for the treatment of this unique case which was causing posterior interosseous nerve palsy.

(1)Reyniers P, Wafa H, Sinnaeve F, Debeer P, Sciot R. Intraosseous schwannoma of the glenoid: case report and literature review. SICOT J. 2021; 7:2.
(2)Kito M, Yoshimura Y, Isobe K, Aoki K, Momose T, Kato H. Intraosseous neurilemmoma of the proximal ulna. Int J Surg Case Rep. 2014;5(12):914-8.
(3)Lim KX, Wu K. First-ever intraosseous ancient schwannoma of the proximal ulna successfully treated using the cement technique. J Int Med Res. 2021 Feb;49(2):300060520987732.
(4)Giné J, Calmet J, Sirvent JJ, Domènech S. Intraosseous neurilemmoma of the radius: a case report. J Hand Surg Am. 2000 Mar;25(2):365-9.
(5)Bagci P, Dervisoglu S, Hız M, Kanberoglu K. Intraosseous Schwannoma of the Radius. Turk Patoloji Derg. 2010; 26(2):173-176.

081 A peculiar extra-axial chordoma of the proximal humerus

Kanay E. [1], Cepni SK. [2], Saglam N.[2], Unverengil G.[3], Bilgic B.[3], Özkan K. [1]
[1]Department of Orthopedics and Traumatology, [3]Department of Pathology, Istanbul Medeniyet University, Prof. Dr Suleyman Yalcin City Hospital, Istanbul, Turkey; [2]Department of Orthopedics and Traumatology, Umraniye Training and Research Hospital, Istanbul, Turkey

Chordomas are slow growing malignant tumors of notochord and are 1–4% of all malignant bone tumors (1). The extra-axial location is extremely rare and there are only limited numbers of cases in the literature. Herein we report a 60 years old female patient with extra-axial chordoma in proximal humerus.

Patient applied to another hospital with abruptly starting left shoulder pain 3 months ago. After evaluation, patient was diagnosed with pathological, non-displaced fracture of the proximal humerus. MRI revealed a 78*46*43 mm, lytic, expansile, lobulated mass which was expanding from the humeral head to diaphysis. She was referred to a tumor center. However, she didn't have regular follow-ups until her symptoms start to gradually increase. After a biopsy in another hospital which came as a clear cell sarcoma; the patient was referred to our unit and the specimens here consulted to an expert of musculoskeletal pathologist. This time diagnosis came as an extra-axial chordoma. No other tumoral lesion was detected in the FDG- PET scan. Finally, wide resection and prosthetic reconstruction of was performed. The post-operative evaluation did not show any complications.

Extra-axial chordomas are unusual lesions. Evans and al. reported only 3 cases in their chordoma series (2). Literature reviews showed various anatomical locations of extra-axial chordomas (1,3). However, there are only two cases which were located within the supraspinatus muscle and soft tissue of the posterior arm without bony involvement (4,5). To the best our knowledge, our case is the first case of a proximal humerus extra-axial chordoma.

(1)Neumann J, Gersing AS, Barth TF, Boxberg M, Woertler K. Intra-articular extra-axial chordoma of the wrist:a case report with review of the current literature.Skeletal Radiol.2019 Dec;48(12):2015-2020.
(2)Evans S, Khan Z, Jeys L, Grimer R. Extra-axial chordomas.Ann R Coll Surg Engl.2016 May;98(5):324-8.
(3)Lee S, Halpern JL, Liang J. Pediatric Extra-Axial Chordoma:Case Report and Literature Review. Pediatr Dev Pathol. 2021 Nov-Dec;24(6):585-591.
(4)DeComas AM, Penfornis P, Harris MR, Meyer MS, Pochampally RR. Derivation and characterization of an extra-axial chordoma cell line(EACH-1)from a scapular tumor.J Bone Joint Surg Am. 2010 May;92(5):1231-40.
(5)Righi A, Sbaraglia M, Gambarotti M, Cocchi S, Drago G, Casadei R, Picci P, Vanel D, Dei Tos AP. Extra-axial chordoma:a clinicopathologic analysis of six cases. Virchows Arch.2018 Jun;472(6):1015-1020.

082 Comparing clinical efficacy of bio similar to original molecule in short course use of neoadjuvant denosumab in giant cell tumour of bone

Puri A., Pruthi M., Gulia A., Nayak P.
Orthopaedic Oncology, Tata Memorial Centre, Mumbai, India

Methods: Between January 2019 to December 2021, of 27 patients treated with short course neoadjuvant denosumab, 13 received original molecule (OD) while 14 received biosimilar (BD). The protocol followed was drug delivery at 0,7,15 & 28 days with patients getting more doses during initial study period. All patients received minimum 2 doses of 120mg. Mean duration of treatment in both groups was 5 weeks, with mean number of 3 doses in both groups. We compared initial radiographs to the pre-surgery radiographs (usually after 3-4 weeks from last dose). The development of a sclerotic neocortex (peripheral rimming) and varying degrees of matrix osteosclerosis (intralesional ossification) was assessed by 2 blinded reviewers. Rimming was graded as present or absent while matrix ossification was graded as < or > 50%.

Results: 4 patients received 2 doses, 10 received 3 doses while 14 patients received 4 doses. Intralesional ossification was <50% in 46% and >50% in 54% of patients receiving OD while it was <50% in 43% and >50% in 57% of the patients receiving BD. Peripheral rimming was present in 100% of the patients receiving OD while it was in 86% (12 out of 14) patients receiving BD.

Conclusions: The data from the present study suggests similar efficacy of biosimilar drug as compared to original molecule. This has implications for cost effectiveness and improved access without compromising clinical efficacy in neoadjuvant treatment of denosumab in giant cell tumor of bone.

083 Radius neck to humerus trochlea transposition arthroplasty after proximal ulna resection

Puri A., Prajapati A., Singh RP.
Orthopaedic Oncology, Tata Memorial Centre, Mumbai, India

Background: Reconstruction after osteoarticular resection of proximal ulna is challenging and various options are described. We report a cases series of 4 patients of radial neck to humerus trochlea transposition arthroplasty following proximal ulna osteoarticular resection.

Material and methods: Between January 2019 to February 2022, 4 patients of primary bone tumor of ulna underwent radial neck to humerus transposition arthroplasty after proximal ulna resection (type III. Mean age of patients was 28 years (Range 12- 41). Elbow range of motion, forearm rotation, joint stability and functional outcomes using Musculoskeletal Tumor Society score (MSTS) were measured.

Results: All four patients were available at mean follow up of 17 months (Range 11- 25) for assessment and were disease free. Mean flexion of elbow was 107 degrees. Pronation was restricted in all the patients. For 2 patients supination range was from 10-85 degree and for 2 patients, it was 0-85 degree. Three patients had varus-valgus instability. All patients were able to extend their elbow against gravity and to carry out routine daily activity. The mean MSTS Score of the patients was 23.5.

Conclusion: Radial neck to humerus trochlea transposition is an acceptable method of reconstruction of elbow after type III proximal ulna resection and provides a functional elbow.

085 Surgical phocomelia - A limb salvage option for upper limb sarcomas instead of shoulder disarticulation

Puri A., Pruthi M.
Orthopaedic Oncology, Tata Memorial Centre, Mumbai, India

Background: Total humeral reconstruction is challenging in pediatric population due to growth discrepancies and small bone diameter for insertion of prosthetic components.

We present oncological and functional outcomes of surgical phocomelia in 2 young children following resection of total humerus for sarcomas.

Method: Two male patients (3 & 5 years), 1 osteosarcoma and 1 Ewings sarcoma involving the complete humerus, both non-metastatic at presentation underwent surgical phocomelia after receiving neo-adjuvant chemotherapy as per the standard hospital protocols. Resection of total humerus was done in both cases preserving a part of triceps insertion on olecranon. Triceps periosteal sleeve was sutured to glenoid labrum using non-absorbable sutures. After immobilising for 6-8 weeks , shoulder movements were encouraged.

Results: Margins were free in both cases. One patient had post-operative vascular insufficiency which required resection-anastomosis of brachial vessels. There were no neurological deficits. At last follow-up both children use the affected limb for day to day activities and are disease free. Mean musculoskeletal tumour society score was 18 demonstrating acceptable functional outcome.

Conclusion : Surgical phocomelia is an acceptable alternative to shoulder disarticulation following total humeral resections in very young children when prosthetic reconstruction is not feasible.

087 A size-based criteria for flap reconstruction following thigh adductor soft tissue sarcoma resection

Novak R. [1], Nevin JL.[1,6], Rowell PD. [1], Griffin A.[1], Mazin S.[5], Hofer SOP.[2,3], O'Neill AC. [2,3], Tsoi K.[1,3,4], Ferguson PC.[1,3,4], Wunder JS.[1,3,4]
[1]University Musculoskeletal Oncology Unit, Mount Sinai Hospital, University of Toronto, Toronto, Canada; [2]Division of Plastic and Reconstructive Surgery, University Health Network, University of Toronto, Toronto, Canada; [3]Department of Surgical Oncology, University Health Network, Toronto, Canada.; [4]Division of Orthopaedic Surgery, Dept of Surgery, University of Toronto, Toronto, Canada; [5]Department of Software Engineering ORT Braude Academic College, Israel

Background: Resection of soft tissue sarcomas from the adductor compartment is associated with significant complications. Free/pedicled flaps are often used for wound closure, but their effect on healing is unclear. We compared wound complications, oncologic and functional outcomes for patients undergoing flap reconstruction or primary closure following resection of adductor sarcomas.

Methods: 177 patients underwent resection of an adductor sarcoma with primary closure (PrC) or free/pedicled flap reconstruction (FR). Patient, tumor and treatment characteristics were compared, as were wound complications, oncologic and functional outcomes (TESS/MSTS87/MSTS93). To examine the relative benefit of flap reconstruction, number needed to treat (NNT) was calculated.

Results: 143 patients underwent PrC and 34 had FR, 68% of which were pedicled. There were few differences in demographic, tumor or treatment characteristics. No significant difference was found in the rate of wound complications. Length of stay was significantly longer in FR (18 days vs PrC 8 days; $p<0.01$). Oncologic and functional outcomes were similar over 5 years follow-up. Uncomplicated wound healing occurred more often in FR compared to PrC for tumors with >15cm (NNT=8.4) or volumes >800ml (NNT=8.4). Tumors <336ml do not benefit from a flap whereas those >600ml are 1.5 times more likely to heal uneventfully following flap closure.

Conclusions: Although flap use prolonged hospitalization, it decreased wound healing complications for larger tumors, and in all sized tumors demonstrated similar functional and oncologic outcomes to primary closure. Our size-based treatment criteria can help identify patients with large adductor sarcomas who could benefit from flap reconstruction.

088 Topical application of vancomycin powder to prevent infections after massive bone resection and the implant of megaprostheses in orthopedic oncology

Andreani L., Ipponi E., Varchetta G., Ruinato A.D., De Franco S., Campo F.R., D'Arienzo A.
Department of Orthopedics and Trauma Surgery, University of Pisa, Italy

Background & Objectives: Periprosthetic joint infection (PJI) represents a serious burden in orthopedic oncology and in particular for those cases who undergo massive bone resections and the implant of megaprostheses. These interventions are for their nature prone to develop PJIs due to their long surgical times, the width of prostheses' metallic surfaces and often patients' clinical conditions. Through the years, several local expedients, such as the use of silver coated prostheses or the addition of antibiotic loaded cement, have been proposed to minimize the risk of periprosthetic infection. In this study, we report our outcomes using topical vancomycin powder (VP) with the aim to prevent PJIs.

Methods: Fifty oncological cases treated with massive bone resection and the implant of a megaprosthesis were included in our study. Among them, 22 (Group A) received one gram of vancomycin powder on the surface of the implant and another gram on the surface of the muscular fascia. The remaining 28 did not receive such a treatment (Group B). The rest of surgical procedures and the follow-up were the same for the two groups. Patients underwent periodical outpatient visits, X-rays and blood exams' evaluations. Diagnosis of PJIs and adverse reactions to topical vancomycin were recorded.

Results: None of the cases treated with topical vancomycin developed infections, whereas 6 of the 28 cases (21.4%) who did not receive the powder suffered from PJIs. These outcomes suggest that cases treated with VP had a significantly lower risk of postoperative PJI ($p=0.028$). None of our cases developed acute kidney failures or any other complication directly or indirectly attributable to the local administration of VP.

Conclusions: The topical use of vancomycin powder on megaprosthetic surfaces and the overlying fascias, alongside with a correct endovenous antibiotic prophylaxis, can represent a promising approach in order to minimize the risk of periprosthetic infections in orthopedic oncology surgery.

091 Custom–made 3D–printed prosthesis after resection of a voluminous giant cell tumour recurrence in pelvis

Khal AA.[1,2,3], Apostu D.[1,3], Schiau C.[3,4], Bejinariu N.[3], Pesenti S.[2], Jouve JL.[2]
1 Department of Orthopaedics and Traumatology, Iuliu Hatieganu University of Medicine and Pharmacy, Cluj-Napoca, Romania; [2]Department of Paediatric Orthopaedics, AP-HM Timone Enfants, Marseille, France; [3] Regina Maria Private Health Care Network, Cluj-Napoca, Romania; [4] Department of Radiology, Iuliu Hatieganu University of Medicine and Pharmacy, Cluj-Napoca, Romania

Background: Giant-cell tumours are benign aggressive bone lesions that can affect any part of the skeleton. In early stages, curettage is preferred, but in case of local recurrence or voluminous lesions in peri-acetabular region, wide resection and reconstruction are recommended. The purpose of this article is to increase clinicians' awareness of the importance of the follow-up of these patients and to describe a case of a voluminous recurrence of a giant-cell tumour in the pelvis.

Methods: We present a case of a 25-year-old female who underwent internal hemipelvectomy assisted by 3D cutting-guides and reconstruction with a custom-made 3D-printed pelvic prosthesis, hip arthroplasty and ilio-sacral arthrodesis.

Results: No postoperative complications occurred and, at long-term follow-up, patient had a stable and painless hip joint, good bone-implant osteointegration, with an excellent functional outcome.

Conclusion: In spite of all available reconstructive techniques, in well-selected patients with voluminous pelvic resections, custom–made 3D–Printed implants allow patients to have a good mechanical outcome.

092 Distal fibula reconstruction in primary malignant tumours

Khal AA.[1,2], Zucchini R.[3], Giannini C.[3], Sambri A.[4], De Paolis M.[4], Donati DM.[3]
[1] Department of Paediatric Orthopaedics, AP-HM Timone Enfants, Marseille, France;
[2] Regina Maria Private Health Care Network, Cluj-Napoca, Romania; [3] Department of Orthopaedic Oncology, Istituto Ortopedico Rizzoli, Bologna, Italy; [4] IRCCS Azienda Ospedaliera Universitaria di Bologna, Bologna, Italy

Background: Restoration of ankle biomechanics after distal fibula (DF) resection in bone sarcomas can be performed with different techniques. We report the functional and oncological outcomes of a case series;

Methods: Ten patients (5 females and 5 males) with a mean age of 27 years (range 10–71) were retrospectively evaluated. Following the resection, different techniques were used to reconstruct the ankle: tibiotalar arthrodesis, residual lateral malleolus fixed to the tibia, non-vascularized or rotational vascularized fibula transposition and intercalary allograft. All complications were recorded, and the functional outcomes were evaluated;

Results: The mean follow-up time was 54 months (range, 13–116). Six patients were free of disease while four patients died of disease. All patients had a stable ankle and bone union, which was achieved after a mean of 9.4 months (range 3–20). The mean MSTS Score was 26.7 (range 21–30). Chronic ankle pain and peroneal external nerve palsy were observed. Patients underwent additional surgeries for deep infection and for equinus ankle deformity. No local recurrence was observed. Metastasis occurred in four patients after a mean of 14.7 months (range 2–34); (4)

Conclusions: After DF resection, the restoration of ankle biomechanics gives acceptable functional results, but a larger series of patients with long-time follow-up are required to confirm the durability of the reconstruction.

096 Does the use of negative pressure wound therapy in sarcomas affect local recurrence?

Amaya JV.[1], De la Calva C. [1], Angulo M. [1], Ferrás J[1], González P.[2], Baixauli F. [1]
[1]Musculoskeletal Oncology Unit. Department of Orthopedic and Trauma Surgery, La Fe University Polyclinical Hospital, Valencia, Spain; 2 IIS La Fe, Valencia, Spain

Background & Objectives: Soft tissue sarcomas (STS) surgeries are a high-risk procedure concerning wound complications and local recurrence. Previous studies have shown that negative pressure wound therapy (NPWT) can reduce postoperative complications, but the use of this therapy for oncological surgical wounds remains controversial due to concerns that the angiogenic effect may stimulate tumor recurrence. The aim of this study was to investigate how NPWT influence in local recurrence in STS resection.

Methods: Retrospective analysis of 117 operated patients with STS managed at a referral sarcomas unit after resection between 2017 and 2021. There was a minimum follow up of 12 months. Of these, 30 were treated with NPWT, 25 (83.3%) on close surgical incision following resection and 5 (16.7%) after wound complication.

Results: Local recurrences occurred for 13,33% (4/30) of the cases and for 13,79% (12/87) of the controls. With the numbers available, Kaplan-Meier survivorship free from local recurrence did not differ between patients treated with or without the NPWT ($p = 0.9$). The groups were comparable across the remaining variables analyzed (age, gender, histological subtype, surgical margins, location, size), with no statistically significant differences with respect to them.

Conclusion: The findings showed that the application of NPWT in STS resection revealed no difference in local recurrence, and therefore it can be used as an oncologially safe technique.

099 Dedifferentiated liposarcoma of the extremities: Characteristics and outcome

Park JH., Kim SE., Kim HS., Han I.
Department of Orthopedic Surgery, Seoul National University Hospital, Seoul, South Korea

Background: Dedifferentiated liposarcoma (DDLPS) of the extremities is very rare and its features have not been clearly elucidated. In this study, we aimed to investigate the characteristics and the treatment outcomes of DDLPS of the extremities treated at a single institution.

Methods: Twenty-eight patients diagnosed with DDLPS in the extremities from July 2004 to December 2020 were analyzed. Demographic characteristics, histopathologic findings, fatty composition on magnetic resonance imaging (MRI), and treatment methods were collected. Oncologic outcomes and prognostic factors were analyzed.

Results: The median age of the DDLPS patients was 66 years (range, 35-87) and the proportion of men was higher than that of women (2:1). The most common site of involvement was the thigh (n=19). Two patients (7.1%) were identified as having tumors dedifferentiated from well-differentiated liposarcoma. Four patients had concomitant other primary malignancies. Demographic characteristics, histopathologic findings and fatty composition on MRI had no significant effect on oncological outcomes. Four patients (14%) presented with initial metastasis. Of the 24 patients with localized disease at diagnosis, 2 (8%) developed metastases. On univariate analysis, administration of postoperative radiotherapy was associated with local recurrence ($p = 0.014$). Distant metastasis was strongly associated with overall survival ($p = 0.007$), whereas local recurrence was not. The 5-year local recurrence-free survival, metastasis-free survival, and overall survival (OS) were 80.5%, 95.7%, and 87.9%, respectively.

Conclusion : Although DDLPS of the extremities has a spectrum of fatty composition on MRI, fatty component was not associated with oncologic outcome. Distant metastasis was associated with poor OS. The metastatic potential of DDLPS of the extremities may be lower than previously reported.

101 Development and validation of a machine learning model to predict outcomes following radiation in soft tissue sarcoma

Bozzo A.[1], Chatterjee S.[2], Hollingsworth A.[2], Bhatbagar S.[3], Aoude A.[3], Healey J.[1]
[1] Musculoskeletal Oncology, Memorial Sloan Kettering Cancer Center, NYC, USA; [2] AI/ML and NextGen Analytics, Memorial Sloan Kettering Cancer Center, NYC, USA; [3] McGill University, Montreal, Canada

Introduction: Predicting a soft tissue sarcoma (STS) patient's prognosis, risks of local recurrence, distant metastasis and complications from radiation therapy are essential to enable tailored treatment specific for each patient. Current sarcoma nomograms such as those by Callegaro(1) and the previous nomogram from MSKCC(2) rely on just 4-6 clinical variables and do not incorporate image data. The objective of this study is to develop a machine learning model that analyzes clinical variables as well as MRI images of the sarcoma to predict a patient's overall survival, risk of local recurrence, distant metastases, and risk of re-operation.

Methods: Patients with STS who underwent primary resection at MSKCC from 2006-2021 and received neo-adjuvant RT were included. T1 and T2 sequences were available and segmented for all patients. Radiomics features were extracted with pyradiomics and AutoGluon was used for feature reduction. The performance of machine learning classifiers using just clinical variables, just radiomics features, or the combination of both data sources was compared. Models were evaluated with 5-fold cross validation and characterized using F1 score and C-index.

Results: A total of 113 patients are included. The combination of clinical variables and radiomics features from T1 and T2 sequences was more accurate for predicting the risk of distant metastasis (F1 0.59) compared to clinical variables alone (F1 0.37). The combined model also performed best in predicting survival (F1 0.57 vs 0.39) and re-operation (F1 0.36 vs 0.16). Prediction of local recurrence improved from the previous MSKCC nomogram (C-index 0.774 vs 0.730).

Conclusion: Feature extraction using radiomics and machine learning improves the performance of prediction models compared to clinical variables alone. This is the first machine learning model to predict four important outcomes.

References

1. Callegaro D, Miceli R, Bonvalot S, et al. Development and external validation of two nomograms to predict overall survival and occurrence of distant metastases in adults after surgical resection of localised soft-tissue sarcomas of the extremities: a retrospective analysis. The Lancet Oncology. 2016;17(5):671-680.
2. Cahlon O, Brennan MF, Jia X, Qin L-X, Singer S, Alektiar KM. A postoperative nomogram for local recurrence risk in extremity soft tissue sarcomas after limb-sparing surgery without adjuvant radiation. Annals of surgery. 2012;255(2):343.

103 Patient-reported outcomes following treatment with vimseltinib for tenosynovial giant cell tumor in a phase 2 expansion study

Blay J-Y. [1], Gelderblom H. [2], Rutkowski P. [3], Wagner AJ. [4], van de Sande M. [2], Stacchiotti S. [5], Le Cesne A. [6], Harrow B.[7], Sharma MG.[7], Tap WD.[8]
[1] Centre Léon Bérard, Lyon, France; [2] Leiden University Medical Center, Leiden, Netherlands; [3] Maria Sklodowska-Curie National Research Institute of Oncology, Warszawa, Poland; [4] Dana-Farber Cancer Institute, Boston, MA, USA; [5] Fondazione IRCCS Instituto Nazionale dei Tumori, Milano, Italy; [6] Gustave Roussy, Villejuif, France; [7]Deciphera Pharmaceuticals, LLC, Waltham, MA USA; [8] Memorial Sloan Kettering Cancer Center, New York, NY, USA

Background and Objectives: Tenosynovial giant cell tumor (TGCT) is a rare, locally aggressive neoplasm caused by upregulation of the colony-stimulating factor 1 (CSF1) gene. Vimseltinib is an oral switch-control tyrosine kinase inhibitor specifically designed to selectively and potently inhibit CSF1 receptor (CSF1R) and was well tolerated by patients in a phase 1/2 study. Here, we evaluate patient-reported outcome measures for patients with TGCT treated with the recommended phase 2 dose (RP2D) of vimseltinib (30 mg twice weekly; NCT03069469).

Methods: Patients with TGCT not amenable to surgery were treated in 2 cohorts: A (no prior anti-CSF1/CSF1R therapy except imatinib and/or nilotinib) and B (prior anti-CSF1/CSF1R therapy). Pain was evaluated using the brief pain inventory; swelling and stiffness at the site of the tumor were assessed with symptom-specific questions on the numeric rating scale (scale from 0–10 with 0 being none and 10 being worst imaginable). Results at week 25 are reported.

Results: As of May 6, 2022, 58 patients were enrolled: 46 in A (enrollment complete) and 12 in B (enrollment ongoing). In cohort A, 22/46 (48%) and 24/46 (52%) patients had ≥30% improvement in worst and average pain, respectively. In cohort B, 5/9 (56%) patients had ≥30% improvement in both worst and average pain. At baseline, the average score was 5.1 for both swelling and stiffness in cohort A; swelling decreased by 2.5 points and stiffness decreased by 2.0 points. In cohort B, the average baseline scores for swelling and stiffness were 4.3 and 5.2, respectively; swelling decreased by 2.4 points and stiffness decreased by 2.7 points.

Conclusions: At the RP2D of vimseltinib, patients in both cohorts reported improvement in worst and average pain and joint swelling and stiffness at week 25. Results support continued evaluation of vimseltinib at this dose level in the ongoing phase 3 MOTION trial (NCT05059262).

104 Malignant peripheral nerve sheath tumors: A retrospective analysis of a rare soft tissue sarcoma

Ranchor R., Magalhães M., Rosendo E., Araújo A.
Medical Oncology, Centro Hospitalar Universitário do Porto, Porto, Portugal

Background: Malignant peripheral nerve sheath tumors (MPNST) are rare soft tissue sarcomas (0.001% of all population), with a high recurrence rate and propensity to metastasize.

Methods: Retrospective study on adult patients with MPNST diagnosed at our hospital between 2014 and 2021. Clinicopathological characteristics were obtained from medical records. PFS and OS were analyzed by the Kaplan-Meier method and predictors of mortality by Cox regression.

Results: 12 patients with MPNST were enrolled. 58% (n=7) were men and the median age was 45 years (28-60). 25% (n=3) presented with neurofibromatosis type 1. All patients had a symptomatic presentation (50% swelling, 8% pain and 42% both). Extremity localization was the most common (n=11, 92%), the majority of cases located at thigh (n=6, 55%). At diagnosis 17% (n=2) were at stage I, 66% (n=8) at stage III and 17% (n=2) at stage IV. Initial treatment was surgery for all patients, with R0 resection in 83% (n=10); 50% (n=6) also received adjuvant radiotherapy and the 2 patients at stage IV received chemotherapy following surgery. Median PFS was 7 months and 1-year PFS was 67%. Median OS was 10 months and 1-year OS was 75%. Tumors with a negative S-100 staining had worse mortality rate (58%; vs. 42%; HR=4.23; CI= 1.008-23.090, p=0.001).

*Conclusion*s: 1-year PFS and OS were 67% and 75%, respectively. S-100 negative staining was a predictor of mortality in MPNST. By providing real-word evidence, this study allows to refine the management of MPNST, through an improvement on knowledge of patients' characteristics and prognostic factors.

106 Fake "innocent" small and superficial soft tissue sarcomas

Gómez-Álvarez J. , Lamo-Espinosa J.M., San-Julián M.
Department of Orthopedic Surgery, Clínica Universidad de Navarra, Pamplona, Spain

Background & Objectives: Small (<5 cm) and superficial soft tissue sarcomas (SS-STS) generally have an excellent prognosis when treated with appropriate surgery. This study aims to compare SS-STS patients initially managed with a proper treatment in a sarcoma center versus SS-STS patients initially resected according to non-oncological criteria ("Whoops excision").

Methods: Patients with a SS-STS from Clínica Universidad de Navarra (1990-2020) with a median follow-up of 20 years (6 – 30 years) were identified. The patients initially managed in our sarcoma unit were treated with surgery alone and the patients with Whoops excision were treated with re-resection with or without radiotherapy. Baseline variables, treatment and disease outcomes were recorded. Statistical tests performed included univariate analyses and Kaplan-Meier analysis.

Results: The medical records of 721 patients with an STS were analyzed. 54 patients (7.5%) had small (<5 cm) and superficial soft tissue sarcomas (SS-STS). Twelve patients (22%, group I) were initially managed at our sarcoma unit by isolated resection, without radiotherapy, and 42 patients (78%, Group II) had a whoops excision elsewhere. 38 out of these 42 patients also received radiation. The local recurrence rates in groups I and II were 8% and 31%, respectively ($p<0.05$). We found 100% overall survival in group I after 20 years of follow-up. On the other hand, group II patients had an overall survival of 62% at 20 years' follow-up ($p<0.01$) (5 patients had an amputation and 16 patients died of the disease). The 4 patients with a Whoops excision treated with isolated re-resection had no recurrence and are alive with no evidence of disease, after a mean follow-up of 16 years

Conclusion: Whoops excision in SS-STS was associated with a 38% decreased overall survival at long-term follow-up (20 years). This long follow-up indicates that the tumors were less aggressive at the beginning as they were small and superficial. Therefore, in addition to the histological grade and size-depth, there is another prognostic factor, namely inadequate initial resection. Further studies are needed to determine the benefit of adjuvant radiotherapy in patients with a SS-STS and a Whoops excision. To refer these patients to sarcoma centers is crucial even for these "fake innocent" sarcomas.

107 Characteristics and outcomes of osteosarcomas treated in a Portuguese referral center

Ranchor R., Magalhães M., Rosendo E., Araújo A.
Medical Oncology Department, Centro Hospitalar Universitário do Porto, Porto, Portugal

Background: Osteosarcoma is the most common primary malignant bone tumor, however a relatively rare neoplasm. It is an aggressive tumor with a high potential of dissemination. In the last decades the introduction of adjuvant chemotherapy increased dramatically the survival of these patients.

Methods: Retrospective study on adult patients with osteosarcoma diagnosed at our hospital between 2014 and 2021. Clinicopathological characteristics were obtained from medical records. PFS and OS were analyzed by the Kaplan-Meier method.

Results: 21 patients with osteosarcoma were enrolled. 57% (n=12) were men and the median age was 31 years (18-70). All patients had a symptomatic presentation (10% swelling, 33% pain, 47% both and 10% pathologic fracture). Appendicular localization was the most common (n=20, 95%), the majority of cases located at thigh (n=11, 52%). 81% (n=17) of cases were intramedullary osteosarcomas (conventional). At diagnosis 14% (n=3) were at stage I, 57% (n=12) at stage II, 24% (n=5) at stage III and 5% (n=1) at stage IV. Initial treatment was surgery for 29% (n=6) of patients; 52% (n=11) performed perioperative chemotherapy plus surgery and 14% (n=3) surgery plus adjuvant chemotherapy. The patient at stage IV received chemotherapy. Recurrence and mortality rates were, 43% (n=9) and 24% (n=5), respectively. Median PFS was 11 months and 2-year PFS was 85%. Median OS was 31 months and 2-year OS was 91%.

Conclusions: As expected intramedullary osteosarcomas with appendicular localization were the most common. 2-year PFS and OS were 85% and 91%, respectively, results non-inferior than data described in literature.

109 RNF4~RGMb~BMP6 axis required for osteogenic differentiation and cancer cell survival

Novak R., Ahmad Y.A., Timaner M., Bitman-Lotan E., Rosenfeldt M., Nikomarov D., Diefenbacher M.E., Shaked Y., Orian A.
Department Orthopedics, Rambam Health Campus Center, Haifa, Israel

Background - Molecular understanding of osteogenic differentiation (OD) of human bone marrow-derived mesenchymal stem cells (hBMSCs) is important for regenerative medicine and has direct implications for cancer.

Methods and Results - We report that the RNF4 ubiquitin ligase is essential for OD of hBMSCs and that RNF4-deficient hBMSCs remain as stalled progenitors. Remarkably, incubation of RNF4-deficient hBMSCs in conditioned media of differentiating hBMSCs restored OD. Transcriptional analysis of RNF4-dependent gene signatures identified two secreted factors that act downstream of RNF4 promoting OD: (1) BMP6 and (2) the BMP6 co-receptor, RGMb (Dragon). Indeed, knockdown of either RGMb or BMP6 in hBMSCs halted OD, while only the combined co-addition of purified RGMb and BMP6 proteins to RNF4-deficient hBMSCs fully restored OD. Moreover, we found that the RNF4-RGMb-BMP6 axis is essential for survival and tumorigenicity of osteosarcoma and therapy-resistant melanoma cells. Importantly, patient-derived sarcomas such as osteosarcoma, Ewing sarcoma, liposarcomas, and leiomyosarcomas exhibit high levels of RNF4 and BMP6, which are associated with reduced patient survival.

Conclusions - Overall, we discovered that the RNF4~BMP6~RGMb axis is required for both OD and tumorigenesis.

This work was published in: https://www.nature.com/articles/s41419-022-05262-1

110 Does intrawound vancomycin powder alter in vivo osseointegration in a murine model of joint arthroplasty?

Hamad CD.[1], Kendal JK.[1], Hart CM.[1], Mamouei Z.[1], Peterson NV.[1], Sobti R.[2], Pearce JW.[2], Bernthal NM.[1]
[1] Department of Orthopaedic Surgery, University of California, Los Angeles, Santa Monica, CA, USA; [2] University of California, Los Angeles, Los Angeles, CA, USA

Background & Objectives: Intrawound vancomycin powder is commonly used to prevent the development of superficial and deep wound infections in orthopaedic oncology. Investigators have demonstrated in vitro that vancomycin is cytotoxic to host cells required for healing such as osteoblasts, fibroblasts, myocytes, and endothelial cells. This data has generated concerns that the potential benefit of mitigating infection using vancomycin powder may not be worth the risk of perturbing biologic stability of orthopedic implants. There is a paucity of in vivo studies investigating the impact of vancomycin on osseointegration. The concern of impaired osseointegration is particularly relevant in the orthopaedic oncology population who may have diminished wound healing due to systemic illness and the use of chemotherapy. This study aims to determine if intrawound vancomycin powder decreases osseointegration of titanium implants in a murine model of joint arthroplasty.

Methods: A 6 x 0.8mm titanium pin was implanted retrograde into the distal femur of 10-week-old C57BL/6 mice. Mice were randomized to receive 4mg of intrawound vancomycin prior to wound closure (1g equivalent in humans). Animals were sacrificed at 2 and 4 weeks, and femurs were disarticulated, removed, and cleaned of all soft tissue. There were 5 mice in each group at each time point (N=20). Femurs were embedded in a resin block with the distal aspect exposed for “push-in” testing. An Instron hydraulic press was calibrated and used to quantify the force necessary to “push-in” the titanium implant, effectively disrupting the bone-implant interface. Peak values were recorded for each implant from generated force curves.

Results: Despite a small reduction in “push-in” force in the vancomycin treated group, there was no statistical difference at 2 weeks for control (21.4N) and vancomycin (16.9N) treated animals (p=0.6). At 4 weeks, there was no difference in average “push-in” forces in control (36.4N) and vancomycin (36.2N) groups (p=0.9).

Conclusion: Investigators have demonstrated that vancomycin causes toxicity in vitro at concentrations used for intrawound application. In this murine model of titanium osseointegration, intra-wound vancomycin powder did not have a significant effect on osseointegration at 2 or 4 weeks post-operatively, as assessed by push-in force required for disruption of the bone-implant interface.

111 In search of the ideal implant: Measuring osseointegration of titanium implants with antimicrobial surface treatments

Hamad CD.[1], Mamouei Z.[1], Kendal JK.[1], Peterson NV.[1], Hart CM.[1], Pearce JW.[2], Sobti R.[2], Bernthal NM. [1]
[1] Department of Orthopaedic Surgery, University of California, Los Angeles, Santa Monica, CA, USA; [2] University of California, Los Angeles (UCLA), Los Angeles, CA, USA

Background & Objectives: Periprosthetic infection and aseptic loosening are important and common modes of endoprosthetic failure in orthopaedic oncology. Advances in implant engineering include implant coatings aimed at promoting osseointegration and preventing infection. In this study, we investigate osseointegration of two implant coatings: Bactiguard and an iodine eluting coating (Zimmer Biomet, Warsaw, IN). Bactiguard is an FDA approved coating currently used on urinary catheters to prevent infection. It consists of three noble metals: silver, gold, and palladium that generate a pico-current dispersion force that prevents microbial adhesion.

Methods: A 6 x 0.8mm titanium pin was implanted retrograde into the distal femur of 10-week-old C57BL/6 mice. Mice were randomized to receive three implants: uncoated titanium, Bactiguard®, and eluting iodine. Animals were sacrificed at 2 and 4 weeks, and femurs were disarticulated, and soft tissue was removed. There were 5 mice in each group at each time point (N=30). Femurs were embedded in a resin block with the distal aspect exposed for “push-in” testing. An Instron hydraulic press was calibrated and used to quantify the force necessary to “push-in” the titanium implant, disrupting the bone-implant interface.

Results: Push-in forces for titanium, Bactiguard, and iodine eluting implants were 40.8N, 47N, and 58N, respectively at 2 weeks. Push-in forces for titanium, Bactiguard, and iodine eluting implants were 70.5N, 63.2N, and 76.8N, respectively at 4 weeks. At 2 weeks, iodine has the highest push-in force and improves osseointegration compared to uncoated titanium ($p=0.02$). There was no significant difference between Bactiguard and uncoated titanium at 2 weeks ($p=0.7$). Iodine and Bactiguard did not significantly affect osseointegration of implants compared to uncoated titanium at 4 weeks ($p=0.7$ and $p=0.56$, respectively).

Conclusion: To decrease the incidence of implant failure, it is necessary to identify an implant coating with intrinsic antimicrobial activity and the ability to promote osseointegration. In this murine model of knee arthroplasty, an iodine eluting coating improved osseointegration at 2 weeks, but Bactiguard did not have a significant effect on osseointegration at either 2 or 4 weeks, as assessed by “push-in” force required to disrupt the bone-implant interface.

113 Augmented reality as a navigation tool in orthopaedic oncology surgery

Paolucci A., Fiore M., Bortoli M., Pace A., Zunarelli R., Montanari A., Zucchini R., Sambri A., De Paolis M.
Orthopedic and Traumatology Unit, IRCCS Azienda Ospedaliero-Universitaria di Bologna, Bologna, Italy

Background & Objectives: Image-based 3D-technologies such as Augmented Reality (AR) are transforming orthopaedic oncology surgical practice. AR overlays virtual information on a real space, improving objects visual comprehension and exploration. Our study aims to evaluate the efficacy of combined 3D-printed cutting-guides and AR on 5 cases of primary bone cancer surgery to assess the futuristic role of AR.

Methods: 3D-anatomic models were obtained by standard 2D-imaging, segmented using D2PTMsoftware (3DSystems). 3D-models were used to plan resection and create 3D-printed cutting-guides, then inserted into an AR visor for intra-operative superimposition of the virtual imaging on patient's anatomy. Intra-operatively, the accuracy of the overlay between AR reconstructions and 3D-planned cutting-planes was quantified measuring reciprocal dimensional deviation. Post-operatively, CT-scan was performed and compared with pre-operative planning to verify their conformity. Results were compared with a similar cohort of 10 patients who underwent 3D cutting-guided resection without AR. Histological margin assessment was conducted in both groups.
Results
In all 5 cases overlaying between 3D printed cutting guides and AR reconstruction was precise, with a medium deviation of 2 ± 0.4 mm. Pre-operative and post-operative imaging comparison showed correspondence between the planned and obtained resection. Histologically, wide surgical margins were obtained in both groups.

Conclusions: AR represents an added value to 3D-planned surgery in orthopaedic oncology, potentially increasing the safety of surgical acts and empowering the consciousness of surgeons decisions. Moreover, AR could be a valid, user-friendly tool to exploit to accelerate learning curves. However, more studies are needed to assume that AR could be a futuristic independent intra-operative navigation instrument.

114 Preliminary results from EMSOS study on megaprosthesis PJI treated with a staged approach

Sambri A.[1], Fiore M.[1], Smolle MA.[2], Neri E.[3], Bergovec M.[2], Cevolani L.[4], Vyrva O.[5], Oliveira V.[6], Donati DM.[4], Leithner A.[2], Campanacci DA. [3], De Paolis M.[1]
[1] Orthopedic and Traumatology Unit, IRCCS Azienda Ospedaliero-Universitaria di Bologna, Bologna, Italy; [2] Medical University of Graz, Graz, Austria; [3] Azienda Ospedaliera Universitaria Careggi, Firenze, Italy; [4] IRCCS Istituto Ortopedico Rizzoli, Bologna, Italy; [5] Centro Hospitalar Universitário do Porto, Oporto, Portugal; [6] Sytenko Institute of Spine and Joint Pathology, Kharkiv, Ukraine

Introduction: The infection rate is high for endoprosthetic reconstruction (EPR), patients with bone sarcomas are at increased risk for infection, because of the use of neoadjuvant chemotherapy, extensive soft tissue resection, and prolonged operative time.

Treatment options are similar to that for prosthetic infection (PJI) involving a standard joint arthroplasty and include debridement and implant retention, primary exchange arthroplasty, or 2-stage revision arthroplasty. Moreover, patients affected by PJI have an increased risk of amputation, in particular in case of infection recurrence.

We aimed to identify predicting factors for the outcome of PJI treated with a staged approach and to compare different reconstructions and different sites.

Methods: All EMSOS members have been invited to send their data on EPR PJI. Early PJI and patients with a follow-up <12 months were excluded. Re-infection rate was recorded.

Results: So far 85 cases were included from 6 different referral centers. Mean patient age was 45.3 years (range 16-85). Most represented site of EPR were distal femur (37 cases), proximal tibia (27 cases) and proximal femur 13 cases. Most of EPR were produced by Implantcast.
Infections were most commonly mono¬microbial from gram-positive pathogens (methicillin resistant S. aureus in 26% and methicillin sensible S.Aureus in 18%). In 13% of the cases an Enterobacteriaceae was isolated. No pathogen was isolated in 21% of the cases, despite PJI was clinically confirmed.

Recurrence of infection was observed in 12.3%of the cases after a median of 11 months.

Conclusions : This study is ongoing and further data is welcome for a complete analysis. From these preliminary results we confirm that PJI of an EPR has a higher prevalence of high virulence bacteria such as S aureus and Enterobacteriaceae and of methi¬cillin-resisitant bacteria compared with series involving standard PJI.

Two stage approach is the gold standard to treat chronic PJI, but in case of EPR success rate is inferior than for standard prosthesis.

115 Extreme solutions for the reconstruction of massive bone defects

Rondinella C. [1], Fiore M. [1], Bruschi A. [2], Filippini M. [1], Morante L. [1], Montanari A. [1], De Cristofaro R. [1], Sambri A. [1], De Paolis M. [1]
[1] Orthopedic and Traumatology Unit, IRCCS Azienda Ospedaliero-Universitaria di Bologna, Bologna, Italy; [2] IRCCS Istituto Ortopedico Rizzoli, Bologna, Italy

Introduction: Extreme large bone defects represent a challenge for the orthopaedic surgeon when a reconstruction is needed. In these cases, standard megaprostheses are not viable options due to the lack of bone stock where to anchor the stem. Therefore, other techniques like biological or customized reconstruction have been suggested. However, very few studies compare functional results and complications of these options. Thus, this is a narrative review of the literature providing a comprehensive overview on salvage options in case of extreme bone stock defects, focusing on functional outcomes and complications.

Methods: Due to the lack of literature considering extreme large bone defects reconstructions and the rarity of the conditions leading to them, a narrative review was performed. Different articles concerning reconstruction techniques in bone stock defects were reviewed. Functional outcomes and complication rates were compared.

Results: Despite being technically demanding, allograft-prosthetic composite (APC) biological reconstruction deemed to be the most used technique in reconstruction of extreme bone defects. It provides suitable functional results despite high complication rate. As well, reconstructions with short stems and customized fixation systems appeared to be a viable option, but cost and manufacturing time, limit their application. On the other side, very few data are available on compression systems. Differently, a total bone reconstruction should be reserved for cases with no residual bone.

Conclusions: Reconstruction of an extreme bone defect is extremely challenging. Few techniques are available and APC deemed to be the most used, yielding viable functional results despite high complication rates.

116 A planned multidisciplinary surgical approach to treat primary pelvic malignancies

Sambri A. [1], Fiore M. [1], Filippini M. [1], Bortoli M. [1], De Cristofaro R. [1], Bianchi G. [2], De Iaco P. [3], Cipriani R. [4], Brunocilla E. [5], Donati DM. [2], Gargiulo M. [6], Poggioli G. [7], De Paolis M. [1]

[1] Orthopedic and Traumatology Unit, IRCCS Azienda Ospedaliero-Universitaria di Bologna, Bologna, Italy; [2] IRCCS Istituto Ortopedico Rizzoli, Bologna, Italy; [3] Gynecologic Oncology Unit, [4] Plastic Surgery Unit, [5] Division of Urology, [6] Vascular Surgery Unit, [7] General Surgery Unit, IRCCS Azienda Ospedaliero-Universitaria di Bologna, Bologna, Italy

Introduction: The pelvic anatomy poses great challenges to orthopedic surgeons. Sarcomas are often large in size and typically enclosed in the narrow confines of the pelvis with the close proximity of vital structures. The aim of this study is to report a systematic planned multidisciplinary surgical approach to treat pelvic sarcomas.

Methods: Seventeen patients affected by bone and soft tissue sarcomas of the pelvis, treated using a planned multidisciplinary surgical approach, combining the expertise of orthopedic oncology and other surgeons (colleagues from urology, vascular surgery, abdominal surgery, gynecology and plastic surgery), were included. Seven patients were treated with hindquarter amputation; 10 patients underwent excision of the tumor. Reconstruction of bone defects was conducted in six patients with a custom-made 3D-printed pelvic prosthesis.

Results: Thirteen patients experienced at least one complication.

Conclusions: Well-organized multidisciplinary collaborations between each subspecialty are the cornerstone for the management of patients affected by pelvic sarcomas, which should be conducted in specialized centers. A multidisciplinary surgical approach is of paramount importance in order to obtain the best successful surgical results and adequate margins for achieving acceptable outcomes.

117 Wait-and-scan of atypical cartilaginous tumours in the long bones

Scholte CHJ. [1], Dorleijn DMJ. [2], Krijvenaar DT. [1], van de Sande MAJ. [1], van Langevelde K. [3]
[1] Department of Orthopedics, Leiden University Medical Center, he Netherlands; [2] Department of Orthopedics, University Hospital Ghent, Ghent, Belgium;
[3]Department of Radiology, Leiden University Medical Center, The Netherlands

Due to its indolent behaviour, the treatment of atypical cartilaginous tumours (ACT) in the long bones is shifting towards active surveillance through wait-and-scan. However, a broad variation remains between institutions in the treatment of these lesions, because of lack of evidence. In this retrospective cohort study performed in a tertiary referral center, we studied the natural behavior of ACT lesions by active surveillance with MRI. The aim of this study was to see whether active surveillance is safe regarding malignant degeneration. In total, 117 patients were evaluated with MRI assessing growth, cortical destruction, endosteal scalloping, periosteal reaction, relation to the cortex, and perilesional bone marrow edema. Patients received up to six follow-up scans with MRI. At the time of the first follow-up MRI, 6% of the lesions showed growth, 87% of the lesions remained stable and 7% decreased in size. During the third follow-up, with a mean follow-up time of 5 +/- 1,9 SD years, 24 patients were scanned of which 13% of the lesions grew and 13% of the lesions decreased in size. After 8 +/- 3,1 SD years, at the sixth follow-up MRI, 100% of the lesions remained stable. The same results were observed at the fourth and fifth follow-up MRI. None of the cases showed malignant degeneration. In conclusion, although some lesions grew (average 1 +/- 0,8 mm) we did not find any sign of malignant degeneration and thereby conclude from this data that active surveillance with MRI is safe for ACT in the long bones in the short and middle long-term follow-up.

119 Aneurysmal bone cyst of the pelvis and sacrum: A single-center study of 17 patients

Deventer N., Budny T., Gosheger G., de Vaal M., Rachbauer A., Schwarze J., Deventer N.
Department of Orthopedics and Tumororthopedics, University Hospital Muenster, University Hospital Muenster, Muenster, Germany

Background: The aneurysmal bone cyst (ABC) is a benign, but locally aggressive cystic lesion of the bone. It usually occurs in the metaphysis of long bones of adolescents and young adults but can also affect the pelvis.

Methods: This single-center study is a retrospective review of 17 patients with primary ABCs of the pelvis. It examines the importance of polidocanol instillations as minimally invasive treatment option for ABCs of the pelvis compared to intralesional curettage or marginal resection.

Results: 17 patients with the diagnosis of a primary ABC of the pelvis were included in the study. Six patients were male (35%) and eleven patients female (65%); the mean age was 18 (9-49) years. The mean follow-up time was 50 months (12-136 months). The most common location of manifestation was the pubis (6; 35%), followed by the ilium (6; 35%), the sacrum (3; 18%) and the ischium (2; 12%). Eight patients were treated by intralesional curettage with the use of adjuvants, one patient by marginal resection, seven by sequential instillation of polidocanol and one patient by simple observation. Five patients received an additional transarterial embolization. After intralesional curettage local recurrence was detected in 4/8 cases (50%). After instillation therapy six patients (86%) had a stable disease without recurrence, only one patient (14%) had a persistent disease with need of additional treatment and was therefore converted to intralesional curettage without local recurrence in the follow-up.

Conclusions: Sequential instillations of polidocanol are a promising, minimally invasive treatment method for ABCs of the pelvis and can be well combined with transarterial embolization.

120 Risk profile of malignant conversion in pelvic osteochondromas. An analysis of cartilage cap thickness

Laitinen MK. [1], Morris GV. [2], Kurisunkal V.[2], Stevenson JD.[2], Parry MC.[2], Jeys LM. [2]
[1] Department of Orthopaedics and Traumatology, Helsinki University Hospital, Helsinki, Finland; [2] Royall Orthopaedic Hospital, Birmingham, UK

Osteochondromas represent the most common bone tumour. Osteochondromas may be solitary, or inherited multiple (HME). The rate of malignant transformation is unknown, but rates of 1% in solitary osteochondromas and in 3%–5% of patients with HME are reported. Continued lesion growth after skeletal maturity and a cartilage cap greater than 1.5 cm in thickness have been reported to indicate malignant transformation. Pelvic location is known to have high conversion rates to malignancy.

135 patients with resection histology of a pedunculated cartilage lesion in the pelvis were studied. Benign osteochondroma in 66 (49%) or peripheral chondrosarcoma in 69 (51%).

Males were predominant (n=90 ,67%) and the majority of the tumours arose in the ilium (n=86, 64%). A significant number of patients had HME (n=25, 19%) with a similar distribution of benign:malignant to sporadic presentation (benign in 11 (44%), malignant in 14 (56%).

The median cartilage cap was 6 mm in benign and 80 mm in malignant tumours ($p<0.001$). The median size of the tumour was 6 cm in benign and 12 cm in malignant tumours ($p<0.001$). In all benign tumours, the cartilage cap was less than 4 cm. In one malignant CS the cartilage cap was 3 cm and in all other malignant CS the cartilage cap was more than 4 cm.

The role of pre-operative biopsy is again brought into question in this study. Most of the benign tumours did not have biopsy 41/66 (62%) but all the biopsies of benign osteochondromas showed no evidence of malignancy. 7/69 (10%) of the malignant tumours did not have preoperative biopsy. Of those malignant tumours biopsied, 13/62 (21%) the biopsy result was benign or unable to show malignant cells and in 22/62 (35%) the grade in biopsy was lower than in resection specimen.

Preoperative biopsy was unable to reliably predict the final histologic grade or malignancy, being accurate in <50% of cases. A small cartilage cap (<3cm) is characteristic of benign osteochondroma. The risk of malignant transformation of chondroid tissue increases after cartilage cap reaches 3 cm. The authors, therefore, would recommend excision for pelvic osteochondromas preferably before cartilage cap is 3 cm. As per previous studies from the authors, we feel the role of pre-operative biopsy is negligible (as radiological measurement of the cartilage cap more accurately predicts malignancy) and we recommend to aim for clear margins (>1 mm: Tsuda, Corr, 2019) without preoperative biopsy in all cases where cartilage cap exceeds 3 cm in MR imaging.

122 Preoperative arterial embolization of musculoskeletal tumors: A tertiary center experience

Kedra A. [1], Barat M. [1,2], Biau D. [2,3], Belbachir A. [4], Dautry R. [1,2], Lucas A. [1,2], Aissaoui M. [1,2], Feydy A. [2,5], Soyer P. [1,2], Dohan A. [1,2]
[1] Department of Diagnostic and Interventional Imaging, APHP - Cochin hospital, Paris, France; [2] Université de Paris; [3] Department of Orthopedic Surgery, [4] Department of Anesthesiology, [5] Department of Musculoskeletal Imaging, APHP - Cochin hospital, Paris, France

Background and Objectives: The purpose of this study was to report the effectiveness in term of blood loss and functional outcome of preoperative transcatheter arterial embolization (TAE) of musculoskeletal tumors.

Methods: Patients who underwent preoperative TAE of hypervascular musculoskeletal tumors between January 2018 and December 2021 were retrospectively included. Patient's characteristics, TAE procedure details, degree of post TAE devascularization, surgical outcomes in terms of red blood cell transfusion and functional results were collected. The degree of devascularization was compared between patients who had perioperative transfusion and those who had not using Chi² test.

Results: Thirty-one patients were included. The 31 PAE procedures led to complete (58%) or near-complete (42%) devascularization of the tumors. Twenty-two patients (71%) did not require blood transfusions during surgery and nine (29%) required transfusion with a median number of red blood cell packs of 3 (q1, 2; q3, 4; range: 1-4). There was no association between the degree of devascularization at the end of TAE and the need of perioperative transfusion (OR=1.7; 95% CI: 0.26-12.8; p=0.70). Median follow-up time was 22 months (q1, 5; q3, 30; range: 3-40.7 months). Eight patients (27%) had complete improvement of the initial musculoskeletal symptoms at the end of the follow-up, 15 (50%) partial satisfying improvement, 4 (13%) partial unsatisfying improvement and 3 (10%) no improvement.

Conclusion : Our study suggests that preoperative TAE of hypervascular musculoskeletal tumors allows bloodless surgery of hypervascular musculoskeletal tumors in 71% of patients and only transfusion needs for the remaining 29%.

124 Epidemiology of musculoskeletal tumors in adult patients at a referral unit

Angulo M. [1], De la Calva C. [1], Amaya JV. [1], Ferrás J. [1], González P. [2], Baixauli F. [1]
[1]Musculoskeletal Oncology Unit. Department of Orthopedic and Trauma Surgery, La Fe University Polyclinical Hospital, Valencia, Spain; [2]Data Manager, IIS La Fe, Valencia, Spain

Background: Sarcomas are a heterogeneous group of rare malignant tumors that require a major clinical suspicion for diagnosis and treatment. The aim of this study was to analyzed the epidemiological characteristics of the patients presented in musculoskeletal tumors committee of a tertiary hospital.

Methods: This retrospective analysis included adult patients managed at a referral sarcomas unit from 2009 to 2021, including data such as a clinical and anatomopathological diagnosis, age, gender and location.

Results: A total of 1756 patients were analyzed, of whom 268 (15,26%) had a non-pathologic diagnosis, 19 (1,28%) were carcinomas and 146 (9,81%) were metastasis. A total of 1488 (84,74%) patients were diagnosed with musculoskeletal tumors, of whom 442 (33,54%) were bone sarcomas and 876 (66,46%) were soft tissue sarcomas. An osteochondroma is the most common type of benign bone tumor (44, 24,04%), the intermediate malignancy was the giant cell tumor (40, 78,43%) and osteosarcoma is the most frequent malignant bone tumor (59, 28,78%). In this latter case, the most common location was the femur in 23 patients (39,66%). A lipoma is the most common type of benign soft tissue tumor (139, 55,60%), the intermediate malignancy was the atypical lipomatous tumor (87, 51,79%) and undifferentiated pleomorphic is the most frequent malignant soft tissue tumor (90, 19,74%). In this latter case, the most common location was the thigh in 28 patients (31,46%).

Conclusions: Epidemiological data of musculoskeletal tumors are important for optimizing the tracking criteria to referral sarcomas units, in order to improve their diagnosis and treatment.

126 The importance of diagnosis in low-grade central osteosarcoma

Aiba H.[1,2], Adrian KA. [3,4], Righi A.[5], Gambarotti M. [5], Colangeli M.[1], Donati DM. [1], Manfrini M.[1], Errani C. [1]
[1]Third Orthopedic and Traumatologic Clinic Prevalently Oncologic, IRCCS Istituto Ortopedico Rizzoli, Bologna, Italy; [2] Department of Orthopaedic Surgery, Nagoya City University, Nagoya, Japan; [3] Department of Paediatric Orthopaedics, AP-HM Timone Enfants, Marseille, France; [4] Department of Orthopedics and Traumatology, Iuliu Hatieganu University of Medicine and Pharmacy, Cluj-Napoca, Romania; [5]Department of Pathology, IRCCS Istituto Ortopedico Rizzoli, Bologna, Italy

Background & Objectives : Low-grade central osteosarcoma (LGCOS) is a rare entity of osteosarcomas. The precise diagnosis of LGCOS is challenging due to misleading radiological features and the overlap of pathological characteristics with benign tumors. The aim of this study was to describe the features of LGCOS with highlighting the diagnosis, treatments and outcomes.

Methods: We retrospectively analysed the medical records of 49 patients with LGCOS (Broders grade 1-2) from 1985 to 2017. For the confirmation of diagnosis, the immunohistochemical assay or fluorescence in-situ hybridization of MDM2 were performed in 29 patients (59.2%).

Results: Median age at diagnosis was 26 years. LGCOS mostly affected long bones in the extremities (83.7%). A diagnosis of LGCOS was made primarily for 40 patients (81.6%) and all these patients underwent resection; the margin status was wide (n= 38, 95.0%) or marginal (n=2, 5.0%). Nine patients (18.4%) were diagnosed as benign and treated with curettage (intralesional margin) elsewhere prior to referral. Local-recurrence occurred in 2 patients with marginal margin (5%) in the group of 40 patients treated with resection and in all 9 patients treated with curettage ($p<0.001$). Five patients had distant metastasis during follow-up and the 5-year overall survivals were 92.8% in the patients who underwent resection and 76.2% in the patients who underwent curettage ($p=0.268$).

Conclusions: The diagnosis of LGCOS is challenging; however it can be properly diagnosed based on complementary works of histology and radiology. LGCOS might be controllable by surgery alone if wide margins are achieved.

127 Nailing of long bone metastases: Indications and results of carbon fiber nails

Pala E., Trovarelli G., Pagliarini E., Cerchiaro MC., Ruggieri P.
Department of Orthopedics and Orthopedic oncology, University of Padova, Padova, Italy

Background & Objectives: Intramedullary nailing allows stabilization in long bone metastases with early functional recovery, although with possible local progression of the disease. Aim of the study is to analyze the results of intramedullary nailing for bone metastases, comparing carbon fiber and titanium nails.

Methods: Sixty-six nails were implanted between 2015 and 2022: 36 cases (54.5%) titanium nails and 30 cases (45.4%) carbon nails; 28 males and 36 females, mean age at surgery of 70,8 years. Sites included 42 femur, 20 humerus and 4 tibia.

Results: At a mean time of 8,58 months, 18 patients were alive with disease (AWD) while 45 died (DWD). Singns of consolidation occurred in 25 cases (38%), at a mean time of 5.5 months with no difference between carbon and titanium nails ($p = 0.8$). The average duration of surgery was 102 minutes with no difference in surgical time between carbon and titanium nails in the femur ($p = 0.1$) while shorter surgical time was found for humeral carbon nails ($p = 0.01$). The average duration of radioscopy was 130 seconds with no difference between carbon and titanium nails. Major complications occured in 2 carbon fiber nails: in both cases breakage of the nail was treated with proximal femur resection and reconstruction with modular prosthesis.

Conclusion (s): Intramedullary nailing is indicated in patients with multiple metastases and bad prognosis. In the current study the use of carbon fiber nails shows good functional results, low complication rate and no increase in surgical time or radioscopic exposure.

128 IDH1 R132 mutations are related to poor prognosis in patients with chondrosarcoma

Trovarelli G., Sbaraglia M., Angelini A., Pala E., Dei Tos AP., Ruggieri P.
Department of Orthopedics and Orthopedic oncology, University of Padova, Padova, Italy

Background & Objectives: Chondrosarcoma (CS) is resistant to chemotherapy and radiotherapy. Thus, surgery is the only available curative option. However, despite oncologically adequate surgical treatment, the incidence of local recurrence and metastases remains increased in high-grade CS. Isocitrate dehydrogenase (IDH) mutations are involved in different cancer and were also found in CSs. However, their impact on the survival of patients with CS is still controversial. Our study aimed to correlate IDH mutational status with the oncological outcomes of patients with CS.

Methods: We prospectively collected patients with CS from 2017 to 2020. Data were recorded regarding sex, age, diagnosis, grade, surgery, local recurrence, metastasis, and last follow-up. Five 10-µm paraffin-embedded sections were used to extract the DNA. The EasyPGX-ready IDH1-2 kit was used to assess the mutational status of IDH1 (codons 105 and 132) and IDH2 (codons 140 and 172) genes. IDH mutations were analyzed and associated with clinical outcomes.

Results: IDH mutations were analyzed in 23 patients: 10 males, mean age 56 years. Six patients were Wild-Type, while 17 had IDH mutations (12 IDH1 R132, 3 IDH1 G105, 2 IDH2 R172). No patient was lost to follow-up; the mean follow-up was 3 years (range, 2-5 years). Patients with IDH1 R132 mutations had significantly lower overall survival (p = 0.007), recurrence-free survival (p = 0,0111), and metastasis-free survival (p = 0.001) than those Wild-Type or with other mutations.

Conclusion (s): IDH1 R132 mutations negatively influenced the prognosis of patients with bone CS. These preliminary results must be confirmed in a more extensive series.

129 A systematic literature review on multicentric giant cell tumour and presentation of 3 cases at long term follow-up

Trovarelli G., Pala E., Angelini A., Ruggieri P.
Department of Orthopedics and Orthopedic oncology, University of Padova, Padova, Italy

Background & Objectives: Giant Cell Tumour (GCT) of bone accounts for 4% to 5% of primary bone tumours and typically presents as a solitary lesion. Multicentric GCT has been rarely reported, presenting multiple synchronous or metachronous lesions in different bones. Due to its rarity, it is not easy to understand its biological behaviour and correct management. We performed a literature review on multicentric GCT to define: patient features, treatment guidelines and the biological behaviour of the disease.

Methods: The search terms used in combination were "multicentric", "giant cell tumour", and "bone". Exclusion criteria were: lacking data or only abstract availability; papers not reporting data on multicentric GCT; papers on multicentric GCT associated with other diseases. We also reported the results of 3 cases of multicentric GCT treated at our hospital.

Results: Fifty-two papers reporting on 104 patients were analysed; we present three cases. Multicentric GCT affected young people at a mean age of 22, manifesting commonly metachronous tumours: the mean interval between the first and subsequent lesions was 7 years.

Synchronous lesions were observed in one-third of patients. Surgery was curettage in 63% of cases; resections or amputations were less frequent. Systemic treatments were used in 10% of patients. Local recurrence and distant metastases were common.

Conclusion (s): Multicentric GCT is rare, biologically aggressive, and its course is unpredictable.

Patients with GCT should be followed for a long time, suggesting a prompt referral in case of any suspicious new symptoms (mainly pain). Denosumab can have a crucial role in the treatment.

130 Do unresectable giant cell tumours of bone treated with denosumab progress after discontinuation of treatment?

De la Calva C. [1], Angulo M. [1], González P. [2], Peiró A. [3], Cebrián JL[4], Valero-Cifuentes G. [5], Pablos O. [6], Chaves I. [7], Pérez I. [8]
[1]Musculoskeletal Oncology Unit. Department of Orthopedic and Trauma Surgery, La Fe University Polyclinical Hospital, Valencia, Spain; [2] Data Manager, IIS La Fe, Valencia, Spain; [3] Hospital de la Santa Creu y Sant Pau, Barcelona, Spain; [4] Hospital Clínico San Carlos, Madrid, Spain; [5] Hospital Clínico Universitario Virgen de la Arrixaca, Murcia, Spain; [6] Hospital de Bellvitge, Barcelona, Spain; [7] Hospital Nuestra Señora de Candelaria, Santa Cruz de Tenerife, Spain; [8] Hospital Ramón y Cajal, Madrid, Spain

Denosumab is a treatment option for unresectable giant cell tumour of bone (GCTB). However, there are no standardized protocols regarding length of administration, with just a few studies having been published on patients that have reached the end treatment.

We present a retrospective multi-centre study carried out in seven hospitals in Spain on the use of denosumab as single treatment for unresectable GCTB. Of a group of 31 patients diagnosed and treated at multidisciplinary sarcoma and musculoskeletal tumour units between 2009 and 2019, 17 finished their treatment and were recruited for the study.

Disease remained stable in 82.4% of patients (n=14), with a median recurrence-free survival of 19.5 months (0 – 116 months) after being treated for a median time of 29 months (5 – 88 months). Three patients experienced local progression, with a median recurrence time of 15 months (5 – 25 months) following treatment for 42 months (13 – 45 months). Forty-seven percent of patients discontinued denosumab to commence an off-therapy rest period due to tumoral control.

The findings of the present study suggest that discontinuation of denosumab in patients with unresectable GCTB is not necessarily associated with progression of the disease. Further studies are necessary to determine the length of administration of denosumab required to minimize the risk of recurrence.

*This research was carried out by the DENO study group: de la Calva C., Angulo M., González P., Gracia I., Peiró A., Machado P., Cebrián J.L., García R., Valcárcel A., Puertas P., Valero-Cifuentes G., Pablos O., Maireles M., Fontalva M.L., Chaves I., Orce A., Coll L., Pérez I., Sanz M.C., González F.

131 The difference between spinal compression events of primary spinal Ewing sarcoma and metastatic spinal Ewing sarcoma

Aiba H. [1,2], Kojima Y. [1], Shimoi T. [1], Sudo K. [1], Yazaki S. [1], Imai T. [1], Yoshida A. [3], Iwata S. [4], Kobayashi E. [4], Kawai A. [4], Arakawa A. [5], Ogawa C. [5], Kimura H. [2], Suzuki N. [2], Yonemori K. [1]
[1]Department of Medical Oncology, National Cancer Center Hospital; [2]Department of Orthopaedic Surgery, Nagoya City University; [3]Department of Diagnostic Pathology, National Cancer Center Hospital; [4]Department of Musculoskeletal Oncology and Rehabilitation, National Cancer Center Hospital; [5]Department of Pediatric Oncology, National Cancer Center Hospital, Japan

Background & Objectives: Malignant spinal cord compression (MSCC) is one of the serious events in the management of tumors. The events might be caused by primary Ewing sarcoma (EWS) or metastatic EWS arose in spinal columns. In this study, we aimed to analyze the clinical feature of MSCC with focusing on the neurological status.

Methods: We reviewed 146 patients with EWS treated in our hospital between 2005 and 2019. MSCCs occured in 12 patients with primary spinal EWS and 10 metastatic spinal EWS. We anallyzed the changes of the neurological status via the Frankel grading system.

Results : At the occurrence of MSCCs, the neurological status of the patients with primary spinal EWS was categorized as Frankel A (1, 8.3%), B (1, 8.3%), C (6, 50.0%), D (2, 16.7%), E (3, 16.7%). As for the treatment of MSCCs, emergent surgical treatment followed by 1st line chemotherapy + adjuvant radiotherapy (5 patients), emergent surgical treatment followed by 1st line chemotherapy (2 patients), 1st line chemotherapy and radiotherapy (2 patients), 2nd line chemotherapy (2 patients) and radiotherapy (1 patient) were performed. Except for 1 patient who died within 3 months after MSCC, 6 in 7 patients (85.7%) with Frankel A-C recovered to Frankel D 3 months after MSCCs, but 2 patients had eventually deteriorated neurological status due to the re-progression of the tumor, which developed into Frankel A.

In constrast, at the occurrence of the MSCCs, the neurological status of the patients with metastatic spinal EWS was categorized as Frankel A (2, 20.0%), C (2, 20.0%), D (2, 20.0%), and E (4, 40.0%). As for the treatment of MSCCs, emergent surgical treatment followed by 2nd line chemotherapy (1 patient), radiotherapy (4 patients), 2nd line chemotherapy + radiotherapy (2 patients) and 2nd line chemotherapy (3 patients). Only 1 patient, who underwent emergent surgery, recovered from Frankel C to Frankel D and 1 patient with Frankel D had progressed to Frankel A despite radiotherapy and chemotherapy. Five patients died within 3 months after MSCCs.

Conclusions: This study indicated that the neurological status after MSCCs were different between primary and metastatic lesion.This is because, due to pre-treatment status, the most of patients with metastatic spinal EWS were not target for surgery and had resistance to chemotherapeutic agents or radiotherapy. Closer monitoring for MSCC is important expecially for EWS in advanced stage.

133 Lipoma arborescens: A review of 406 cases focused on epidemiology, differential diagnosis and treatment

Angelini A., Mosele N., Cerchiaro MC., Trovarelli G., Pala E., Ruggieri P.
Department of Orthopedics and Orthopedic oncology, University of Padova, Padova, Italy

Background & Objectives: Lipoma arborescens, also known as villous lipomatous proliferation of synovial membrane, diffuse lipoma of the joint, or diffuse synovial lipoma, is a rare idiopathic disease of unknown etiology. It is characterized by intra-articular villous proliferation of the synovial membrane. To date, there is not a gold standard treatment going from a conservative treatment in some cases to surgery (arthroscopic, open or combined approaches). Aims of this study were to analyse the possible differential diagnosis of intra-articular lesions in order to avoid misdiagnosis from the literature and to evaluate all the possible treatments for each site.

Methods: We analysed 406 cases of lipoma arborescens from 1952 up to date focusing on the localization, treatment strategies and outcome. Of the 406 analysed patients, only 17 were growing patients, whereas the vast majority were adults, with cases reaching up to over 80 years-old. Most of the cases were localized in the knee with a clear predilection for suprapatellar area. Some multiarticular cases have also been reported with sporadic cases localized in two or three different joints in the same patient. Hip, shoulder, elbow and ankle localization are rarer than knee but still present in literature. MRI is the gold standard for diagnosis demonstrating lobulated frond-like masses with signal intensity resembling fat on all sequences, and decreased signal intensity following fat suppression. Surgical treatment has been the main choice since the first reported cases. Treatment consists of arthroscopic excision or open sinoviectomy. New treatments include radiosinoviectomy with Yttrium 90.

Results: We found 310 cases of knee primary localization with 41 cases of bilateral knee localization. Hip localization has been reported in 9 cases, 3 of them with bilateral incolvement. Twenty shoulder localization both intra-articular and in the subacromial or subdeltoid bursa have been reported. Timely excision of the lesion is crucial to avoid later complication such as early onset osteoarthritis. Sinoviectomy was the gold standard treatment, (open in 72, arthroscopic excision in 54) and intrarticular radiosinoviectomy with Yttrium90 in 4 cases administered with good results. Relapse of the lesion after the removal was extremely rare and only sporadic cases have been reported.

Conclusion (s): Lipoma arborescens is a rare disease about 400 cases reported in literature, diagnosis is always made with MRI. Timely excision is crucial and it can be performed with an arthroscopic approach when the size of the lesion allows it into an open access. Outcome were satisfactory in all cases and recurrences were extremely rare regardless the site of the lesions.

134 Vertebra plana: A clinical and imaging overview among possible differential diagnoses

Angelini A., Mosele N Gnassi A., Baracco R., Grazia Rodà M, Cerchiaro M., Ruggieri P.
Dept. of Orthopedics and Orthopedic oncology, University of Padova, Italy

Background & Objectives: Vertebra plana (VP) is a rare radiologic condition characterized by a uniform loss of height of a vertebral body. VP is common in spinal involvement of Langerhans cell histiocytosis (LCH) and represent a pathognomonic finding of this disease; but may be caused by osteoporotic fractures, metabolic disease, or other tumors. Purpose of this study was to review all possible differential diagnoses that may present with a VP as described in the current literature.

Methods: We performed a literature review in compliance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses guidelines, analyzing 602 articles (1946-2022). Patient demographics, clinical presentation, imaging characteristics and diagnoses were investigated and data were compared to the experience of a specialized center in musculoskeletal oncology and spine surgery. VP is not a pathognomonic feature of Langerhans cell histiocytosis, but other oncologic and non-oncologic conditions should be considered.

Results: LCH was the most common etiology and in 300 patients analyzed (46% pediatric age), only 26% had a VP. The most affected segment was the cervical segment. Benign lesions include cases of VP in giant cell tumor (2.7% of all cases), osteoblastoma (2), myofibromatosis (1), hemangioma (1) and aneurysmal cyst (1). Haematological diseases include lymphoma (<5 cases), acute lymphoblastic leukemia (2 cases) and myeloma. Ewing's sarcoma (10 cases) and osteolytic metastases from carcinoma are the most common differential diagnoses. Among the non-oncological causes, Nocardia infections (3), tuberculosis (2.4% of cases), “Chronic Recurrent Multifocal Osteomyelitis” (4), Osteogenesis imperfecta and Kummel's disease were reported. Metabolic diseases and osteoporosis can clinically manifest with VP, in fragility fractures.

Conclusion (s): The diagnosis and treatment of VP require a multidisciplinary evaluation of radiological imaging, histological and clinical / surgical aspects to identify the underlying etiology. We are proposing a univocal definition of VP as a severe (reduction > 70% of anterior vertebra height compared to adjacent cephalic level vertebra) compression-induced vertebral collapse, with somatic flattening and local kyphosis angle > 15°. Despite LCH is the most frequent cause, numerous other differential diagnoses need to be considered and the list, based on our literature review, can be recalled with the mnemonic HEIGHT OF HOMO.

138 Controversies in the management of patients with soft tissue sarcoma: The top recommendations of the Conference on State of Science in Sarcoma (CSSS) 2022

Andreou D. [1], Rothermundt C. [2], Gelderblom H. [3], Haas R. [4], Kunz WG. [5], Leithner A. [1], Lindner LH. [6], Liegl-Atzwanger B. [7], Szkandera J. [8], Hofer S. [9], on behalf of CSSS panelists

[1] Department of Orthopaedics and Trauma, Medical University of Graz, Graz, Austria; [2] Department of Medical Oncology and Haematology, Cantonal Hospital St. Gallen, St. Gallen, Switzerland; [3] Department of Medical Oncology, Leiden University Medical Center, Leiden, the Netherlands; [4] Department of Radiotherapy, The Netherlands Cancer Institute, Amsterdam and the Leiden University Medical Center, Leiden, the Netherlands; [5] Department of Radiology, University Hospital, LMU Munich, Munich, Germany; [6] Department of Medicine III, University Hospital, LMU Munich, Munich, Germany; [7] Diagnostic and Research Institute of Pathology, Medical University Graz, Graz, Austria; [8] Division of Oncology, Department of Internal Medicine, Medical University of Graz, Graz, Austria; [9] Department of Neurology, University Hospital Zurich, Zurich, Switzerland

Background & Objectives: International guidelines on soft tissue sarcoma (STS) cover primarily aspects, for which good quality evidence exists. Consensus expert recommendations are therefore needed to complement these guidelines.
Methods: We organized a consensus meeting of 62 European sarcoma specialists, using a modified Delphi process to identify and evaluate 220 controversial questions in STS management. A recommendation agreed upon by >=75% panellists was defined as a "consensus", while the term "strong consensus' was used in case of >=95% agreement among the panellists of all disciplines. The process was designed to allow the identification of areas without consensus, where additional data collection or future research was deemed necessary.
Results: There was consensus in 30 topics, such as recommending a core-needle rather than incisional biopsy for histological diagnosis and preoperative rather than postoperative chemotherapy in patients with extremity or trunk wall STS, applying both local and systemic treatments in patients with metachronous oligometastatic disease, and recommending against reimbursement of STS surgery outside reference centers. There was strong consensus in additional 16 topics, such as the need to validate the diagnosis of mesenchymal tumours with unusual morphology, biological behaviour, or with detectable molecular aberration by reference pathologists, basing surgical strategies on both tumor characteristics and surgical morbidity/function preservation and recommending randomized discontinuation trials in palliative patients achieving stable-disease. On the other hand, no consensus was achieved on how high-risk STS should be defined, when next-generation-sequencing should be performed in the palliative setting, the goals of surgical treatment in patients with progressive disease under preoperative treatment, the extend of resection following preoperative radiotherapy or chemotherapy for localised STS, the time point of peri-operative radiotherapy (pre- versus postoperative) or the optimal time interval between preoperative radiotherapy and subsequent surgery.
Conclusions: Several consensus recommendations could be identified. For a variety of sarcoma management aspects, future research questions could be formulated, whereas for some topics, it appears unlikely that there will ever be sufficient data or a consensus.

139 Advantages and risks of wound drains in tumor spine surgery: A multicenter surveillance study

Walter SG. [1], Knoell P. [1], Zarghooni K. [2]
[1]University Hospital Cologne, Department of Orthopedic Surgery, Cologne, Germany; [2]Helios Clinic Hildesheim, Department of Orthopedic Surgery and Traumatology, Hildesheim, Germany

Background: There is an ongoing debate whether a surgical drain is beneficial to prevent local accumulation of hematoma and to reduce the rate of wound infections, and neurological deficits.

Methods: Data from the German Spine Society (DWG) registry were filtered for surgically treated spine tumor cases between 2017 and 2021. Cases were categorized into such with (Group I) and without (Group II) placement of a surgical drain. Subgroups were compared for demographic data, type of surgery, experience of the surgeon and postoperative surgical complications.

Results: 10,029 cases were included into final analysis (Group I: 3,007; Group II: 7,022). There was no significant difference between both groups regarding age or gender distribution. Average morbidity of patients was significantly elevated in Group I ($p < 0.05$) and the rates of invasive surgery were significantly increased in this group ($p < 0.001$). Overall complication rates were reported with 12.0% (Group I) and 8.5% (Group II). There were significantly more epidural hematoma ($p < 0.001$) and motor dysfunction ($p = 0.049$) as well as deep wound infections ($p < 0.001$) in Group I.

Conclusion: A surgical drain cannot prevent epidural hematoma.

140 How do transarticular skip metastases in sarcoma patients affect local treatment and outcome? A case series of four patients

Engel NM.,Hardes J., Nottrott M., Röder J., Podleska LE. , Streitbürger A., Guder WK.
University hospital Essen, Essen, Germany

Background & Objectives: Literature reports on transarticular skip metastases in bone sarcoma patients are scarce. Yet, their occurrence affects local treatment decisions and may even have an impact on overall survival. It is the objective of this study to investigate when skip metastases manifest, how they affect local treatment and whether they affect overall survival.

Methods : Four patients with bone sarcoma and histologically confirmed transarticular skip metastases treated between 2018 and 2022 at our sarcoma center were retrospectively analyzed.

Results: The mean patient age at operation was 23 years (range 8-59) and gender evenly distributed. Two cases of osteosarcoma (OS) and Ewing's sarcoma (ES) were treated. The primary and skip metastasis were localized around the knee in two and around the hip and shoulder joint in one case each. Lymphonodular metastasis was suspected (ES) and confirmed (OS) in one case each. Three patients had suspected distant metastases (pulmonal n=2 (ES/OS) and osseous n=1 (ES)). All patients received (neo-)adjuvant chemotherapy (CTx). One patient was treated by above-knee amputation (ES). Two patients received limb-sparing extraarticular resections and one patient a limb-sparing intraarticular resection of both primary and skip. R0 resections were confirmed in all patients. Response to chemotherapy was good and poor in two patients (ES/OS) each. One patient underwent re-resection for a soft tissue local recurrence 12 months postoperatively (OS). One patient (ES) had a distant relapse and achieved complete remission after autologous stem cell transplantation. Three patients are currently alive at a median follow-up of 15 months (2-49; n= 2 NED, n=1 adj. CTx). One patient (OS) died with progression under adj. chemotherapy 3 months postoperatively.

Conclusion: Transarticular skip metastasis seems to be associated with advanced disease in bone sarcoma. Despite larger resection defects, limb-sparing resections were possible in all but one patient with a primary of the proximal tibia and slim prospect of reaching adulthood with a functional leg of equal length. In patients with advanced systemic disease, the impact of transarticular metastases on overall survival is likely small. However, in one patient with localized OS it did not have a negative impact on overall survival. The oncological feasibility of functionally improved intraarticular resections over extraarticular resections will need to be investigated in the future.

141 Musculoskeletal tuberculosis as differential diagnosis of neoplastic lesions: A retrospective analysis of bone and joint tuberculosis in Austria

Vielgut I.[1], Putzl L. [1], Thomüller I. [2], JIgrec J. [3], IBrcic I. [4], Valentin T. [5], Wittig U. [1], Leithner A. [1], Fischerauer S. [1], Scheipl S. [1]
[1]Department of Orthopaedics and Trauma, Medical University of Graz, Graz, Austria; [2] Lung Specialist, Graz, Austria; [3] Division of General Radiology, Department of Radiology,
[4]Diagnostic & Research Institute of Pathology, Diagnostic and Research Center for Molecular BioMedicine, [5]Division of Infectious Diseases, Department of Internal Medicine, Medical University of Graz, Graz, Austria

Background: Several high-income countries recently experience an increase in the incidence of tuberculosis (TB), mainly because of increased migration from disease-endemic regions.(1,2) Therefore, and because neoplastic lesions are frequent differential diagnoses, we aimed to recall musculoskeletal tuberculosis (MTB) to the attention of physicians.(3,4)

Methods: (A) We analysed data obtained from the Austrian national TB registry (1995 – 2019). (B) We performed a retrospective study of all patients with a confirmed diagnosis of MTB who were admitted to the Department of Orthopaedics and Trauma, Medical University of Graz (2005-2019). Data were retrieved from the medical records.

Results: (A) From 1995-2019, there was a significant linear reduction in overall Austrian tuberculosis incidence rates ($p < 0.001$), and Austria recorded a total of 307 MTB patients. (B) Our retrospective case-series included 17 individuals (9 males, 8 females; average follow-up 48.4 months; range, 0-116). Age distribution was biphasic (elderly native Austrians: median 69, range, 63-92; younger patients with a migration background: median 29, range, 18-39). Sites of manifestation were the spine (n = 10), peripheral joints (n = 5), and the soft tissues (n = 2). Patients presented with septic/inflammatory conditions (n = 7), neurological deficits (n = 5), or a suspected neoplastic process (n= 5). Eleven patients underwent surgery (64.7%). Secondary deformities were frequent (n = 9).

Conclusion: MTB should be considered in cases of untypical joint infections or nonspecific bone and soft tissue lesions in younger patients with a migration background or in patients with specific risk factors.(3,4)

(1) Global tuberculosis report 2020. World Health Organization. Licence: CC-BY-NC-SA 3.0 IGO, Geneva¸ ISBN: 978-92-4-001313-1
(2) Agashe VM, Johari AN, Shah M, et al. Diagnosis of Osteoarticular Tuberculosis: Perceptions, Protocols, Practices, and Priorities in the Endemic and Non-Endemic Areas of the World-A WAIOT View. Microorganisms. 2020;8(9):1312. doi: 10.3390/microorganisms8091312.
(3) Putzl L. Differential diagnosis TB: Analysis and evaluation of patients with tuberculosis affecting the bones and soft tissues, a retrospective study. 2022;Diploma Thesis, Medical University of Graz
(4) Vielgut, I., Putzl, L., Thomüller, I. et al. Musculoskeletal tuberculosis revisited: bone and joint tuberculosis in Austria. Arch Orthop Trauma Surg. 2022; https://doi.org/10.1007/s00402-022-04615-x

143 The effect of preoperative embolization in giant cell tumors of the bone localized in the iliosacral region of the pelvis

Müller DA.[1], Selman F.[1], Spirig J.[1], Farshad M.[1], Kobe AR.[2], Kaiser D.[1]
[1]Department of Orthopedics, Balgrist University Hospital, Zürich, Switzerland; [2] Department of Interventional Radiology, University Hospital of Zürich, Zürich, Switzerland

Background: Giant cell tumors of the bone (GCTB) are local aggressive tumors with usually high vascularization. They rarely occur in the posterior pelvis and sacral area (2-8%). However, at the posterior pelvis and at the sacrum no tourniquet can be applied, and cementation is often not possible due to proximity to the lumbosacral nerves. Therefore, the curettage of GCTB in this anatomical region is associated with high blood loss, resulting in a poor visibility of the operating field and higher complication rate. Preoperative embolization of the main tumor vessels is a valid option to reduce intraoperative blood loss. This monocentric case control study evaluates the effect of the preoperative embolization in GCTB localized at the iliosacral region

Methods: 3 patients with GCTB in the sacrum (n=1) or in the posterior ilium (n=2) underwent a total of 4 surgeries from May 2021 to December 2021 in our institution. In all patients a preoperative CT-guided biopsy was performed. One patient developed an early local recurrence in the sacrum, why a second surgery was needed. In all the patients the tumor was carefully removed with a curettage, whereas in one patient the bone cavity was filled with cement.

The first two surgeries in this consecutive series were done without any preoperative treatment (1 sacrum, 1 posterior ilium). In the second two surgeries (1 sacrum, 1 posterior ilium) an embolization of the feeding tumor vessels was successfully accomplished 24h prior to operation. None of the patient received a denosumab treatment.

Results: In the two surgeries without any preoperative embolization the mean intraoperative blood loss was 3250 ml (3000 and 3500 ml). The mean perioperative erythrocyte transfusion volume was 1125 ml (1250 ml and 1000 ml) and the mean surgical time was 114.5 min (131 min and 98 min). For the 2 surgeries with preoperative embolization the mean intraoperative blood loss was 1850 ml (3000 ml and 700 ml), no perioperative erythrocyte transfusion was needed, and the mean surgical time was 68 min (78 min and 58 min). There were no significant differences regarding the tumor volume in the preoperative MRI detected, which excludes a possible significant bias.

Conclusion: Curettage of GCTB in the posterior pelvis and sacrum results in a significantly high blood loss. Although preoperative embolization is not routinely performed for GCTB, in our experience it should be considered at the pelvis because it may reduce blood loss and surgical time.

144 Patient-specific cutting guides for the resection of bone tumors involving the iliosacral joint at the pelvis

Müller DA., Winkler E., Spirig J., Farshad M., Kaiser D.
Department of Orthopedics, Balgrist University Hospital, Zürich, Switzerland

Background: The correct resection of malignant bone tumors affecting the pelvis remains a challenging surgery. If the tumor involves the posterior ilium, the medial part of the resection is usually performed through the iliosacral joint (Ennecking Type 1). However, if the tumor invades the iliosacral joint the osteotomy has to be done more medially through the sacrum. This poses the risk of injuring vascular structures, such as the A. and V. iliaca communis, especially when performing the osteotomy from posterior. This study evaluates if the use of patient-specific guides, limiting the depth of the osteotomy, enable a safe tumor resection.

Methods: 3 patients with a mean age of 33 years (range: 24-50 years) suffered from either an Ewing-sarcoma (n=2) or Chondrosarcoma (n=1) in the posterior pelvis. In all patients, the iliosacral joint was affected necessitating an osteotomy through the sacrum. No distant metastasis were noted on PET/CT-scans in any patient. A virtual 3D model was created fusing the CT scan and the MRI. The resection through the ilium and the sacrum was carefully planned on the computer. According to the preoperative model patient-specific cutting guides were produced. The cutting guide has been designed to block the chisel at the correct height to prevent too deep perforation. To reduce the risk of injuring neurovascular structure anterior to the sacrum, the depth of the osteotomy was also limited by the guide. For stabilization, a lumbopelvic spondylodesis with interposition of either allo- or autograft followed.

Results: In all 3 patients the preoperative planning could be realized without any intraoperative deviations. All tumors were resected with sufficient margin (R0-resection). No vascular or focal neurological injuries were noted, even though the osteotomies were done from posterior without any dissection of the iliac vessels. The bone defects were bridged by an iliosacral spondylodesis and interposition of either bone allo- or autograft in order to restore the posterior pelvic continuity. One patient underwent a revision surgery due to a superficial skin necrosis without a deep infection. No hardware failure or secondary dislocation was observed in the follow-up consultations.

Conclusion: Patient-specific cutting guides enable a safe and reliable osteotomy even medial of the iliosacral joint as an anterior perforation through the sacrum is prevented.

145 68Ga-FAPI PET/CT as novel diagnostic tool in sarcoma

Hamacher R. [1,2], Lanzafame H. [2,3], Mavroeidi IA. [1,2], Pabst KM. [2,3], Bauer S.[1,2], Podleska LE. [2,4], Herrmann K. [2,3], Siveke JT.[2,5], Fendler WP. [2,3]
[1] Department of Medical Oncology, West German Cancer Center, University Hospital Essen, Essen, Germany; [2] German Cancer Consortium (DKTK), Partner site University Hospital Essen, Essen, Germany; [3] Department of Nuclear Medicine, West German Cancer Center, University Hospital Essen, Essen, Germany; [4] Department of Musculoskeletal Oncology, Sarcoma Center, Essen, Germany; [5] Bridge Institute of Experimental Tumor Therapy, West German Cancer Center, University Hospital Essen, Essen, Germany.

Background & Objectives: Radiolabeled fibroblast activation protein (FAP) inhibitors (68Ga-FAPI-46) show high tumor uptake on PET in several tumor entities and therefore represent a promising novel molecular imaging method in oncology besides 18F-FDG PET. This is particularly interesting for sarcomas that demonstrate high expression of FAP on tumor cells and associated fibroblasts.

Methods: Patients with sarcoma undergoing clinical 68Ga-FAPI PET for staging were eligible for enrollment into the 68Ga-FAPI PET observational trial. A group of patients also underwent 18F-FDG PET. Number of detected lesions and tracer uptake (SUVmax) for T, N and M were analyzed. Non-parametrical t-test was employed for semiquantitative analysis. Association between 68Ga-FAPI PET uptake and histopathologic FAP expression was analyzed with Spearman r correlation.

Results: We included 200 sarcoma patients (33 low, 26 intermediate and 141 high grade sarcomas). 68Ga-FAPI vs. 18F-FDG PET detected a total of 1174 (81%) vs. 1023 (71.5%) lesions. On a per-region basis, 68Ga-FAPI vs. 18F-FDG PET demonstrated higher detection efficacy for T (142 (100%) vs 124 (92%)) and M (940 (80%) vs 797 (68%)). SUVmax was significantly higher for 68Ga-FAPI vs. 18F-FDG in T (13.51±10.2 vs. 9.87±7.6, p=0.0001), visceral M (12.06±14.3 vs. 8.68±8.2, p=0.03) and bone M (12.28±15.2 vs 7.30±7.0, p=0.05). 68Ga-FAPI PET showed higher uptake over 18F-FDG in low (p=0.01), intermediate (p=0.005) and high (p=0.003) grade tumors. The association of 68Ga-FAPI uptake and histopathologic FAP expression (n = 89) showed a positive correlation (Spearman r = 0.43; p < 0.0002).

Conclusion: 68Ga-FAPI PET/CT is as novel imaging tool for sarcoma and shows superiority over 18F-FDG PET/CT particularly in low/intermediate grade sarcoma.

146 Patient-reported outcome scores in lower-limb sarcoma patients. Results from the German-wide prospective cohort study (PROSa)

Smolle MA. [1], Eichler M. [2], Hofbauer C. [3], Hohenberger P. [4], Kasper B. [5], Leithner A. [1], Schaser KD. [3], Schmitt J. [3], Schuler MK. [2], Andreou D. [1]
[1]Department of Orthopaedics and Trauma, Medical University of Graz, Austria; [2]Clinic and Polyclinic for Internal Medicine I, University Hospital Carl Gustav Carus, Technical University Dresden, Germany ; [3]National Center for Tumor Diseases Dresden (NCT/UCC), Germany: German Cancer Research Center (DKFZ), Heidelberg; [4]Division of Surgical Oncology & Thoracic Surgery, Mannheim University Medical Center, University of Heidelberg, Germany; [5]Sarcoma Unit, Mannheim Cancer Center, Mannheim University Medical Center, University of Heidelberg, Mannheim, Germany

Background & Objectives: The aim of the present study was to collectively analyse the post-treatment functional outcome of lower-limb sarcoma patients registered in the German-wide prospective cohort study (PROSa).

Methods: From 1309 patients of the PROSa dataset, 303 (54.8% males; mean age: 54.6 ± 15.8 years) with lower limb sarcoma and functional outcome available (Oxford Hip [OHS], Oxford Knee Score [OKS], Toronto Extremity Salvage Score [TESS]) were analysed. PROs were correlated with demographic, tumour- and treatment-related parameters as well as specific EORTC-QLQ-C30 subscales using Pearson correlation coefficients, Wilcoxon-rank-sum and Kruskal-Wallis tests.

Results: 227 patients had soft tissue sarcoma (STS; 74.9%). Mean TESS, OHS and OKS were 71.1 ± 20.6, 39.5 ± 9.8 and 35.5 ± 10.4 points, respectively. TESS ($p=0.023$) and OKS ($p<0.001$) were significantly lower in bone sarcoma (BS) than STS patients, whilst the difference in OHS was non-significant ($p=0.116$). No differences in PROs regarding demographic, tumour- and treatment-related parameters were found. A moderate positive correlation between all PROs and EORTC-QLQ-C30 subscale physical functioning (all rho > 0.5; $p<0.0001$) was found, as was a weak to moderate positive correlation for subscale global health (all rho > 0.42; $p<0.0001$).

Conclusions: Sarcoma patients' OHS and OKS are comparable to those externally reported following total hip (mean, 41.4) or knee arthroplasty (mean, 36.3). BS patients appear to report lower PROs than STS patients. A weak to moderate correlation between PROs and specific quality of life items is present.

147 Surgical outcomes in patients treated with 5-day preoperative radiotherapy for primary soft tissue sarcoma

Kendal JK. [1,5,] Peterson NV. [1,5], Savjani R. [3], Wessel L. [1,5], Deng J. [3,5], Reddy VK. [3,4,5], Crompton JG. [2,4,5], Bernthal NM. [1,4,5], Eilber FC. [2,4,5], Kalbasi A. [3,4,5]
[1] Department of Orthopedic Surgery, UCLA, Santa Monica, CA; [2] Department of Surgery, Division of Surgical Oncology, UCLA, Los Angeles, CA; [3] Department of Radiation Oncology, UCLA, Los Angeles, CA; [4] UCLA Jonsson Comprehensive Cancer Center, Sarcoma Program, Los Angeles, CA; [5] David Geffen School of Medicine at UCLA, Los Angeles, CA, USA

Background: Standard of care treatment for high-risk soft tissues sarcoma (STS) of the extremity/trunk includes radiation therapy (RT) and surgical resection. At our center, initial results of a phase II single arm trial of 5-day preoperative RT overall demonstrated safety and local control comparable to conventional 5-week preoperative RT. However, a more granular assessment of surgical outcomes and complications is warranted. The purpose of this study is to assess surgical outcomes and complications in patients undergoing 5-day preoperative RT (30 Gy) followed by surgical resection for high-risk STS of the extremity/trunk.

Methods: Patients meeting criteria were consented and enrolled in an ongoing IRB-approved prospective phase II trial and received preoperative hypofractionated RT (30 Gy over 5 consecutive daily fractions) followed by surgical resection. Data extracted included demographic variables, tumor variables, and surgical outcome data. Minimum post-operative follow-up was 3 months.

Results: 94 patients were included with mean age of 57 (SD 17.2), and a median follow-up of 23.7 months. The most common diagnosis was undifferentiated pleomorphic sarcoma (39.4%), then myxoid liposarcoma (23.4%), and myxofibrosarcoma (8.5%). The most common location was the lower extremity (60.6%), then upper extremity (18.1%), pelvis/trunk (17.0%), and 'other' (4.3%). Limb salvage rate was 95.7%. Twenty-six (27.7%) patients experienced soft-tissue complications at a median of 43.5 days (IQR 40.3-85.3) from surgery, with wound dehiscence occurring in 18 patients (19.1%). Bony complications included 4 pathologic fractures, and 1 osteonecrosis without fracture. Twenty-eight patients (29.8%) required secondary surgery. There was no association with use of peri-operative chemotherapy and soft tissue complications ($p = 0.42$). Patients requiring local soft tissue advancement for closure had more soft tissue complications (OR 3.03, 95% CI 1.2-8.0, $p = 0.024$). Soft tissue complications were comparable in those having surgery ≤2 weeks vs. > 2 weeks after RT (OR 0.95, 95% CI 0.28-3.74, $p = 0.93$).

Conclusions: Perioperative soft tissue, and bony complications for patients with primary STS undergoing surgical resection following 5-day preoperative RT remain low and comparable to conventional 5-week preoperative RT, with a high rate (96%) of limb salvage. Soft tissue complications were higher among patients requiring local soft tissue advancement for wound closure.

148 Can we identify novel immunotherapies for the non-surgical management of periprosthetic joint infection?

Hamad CD. [1], Kendal JK. [1], Mamouei Z. 1[1], Peterson NV. [1], Hernandez A. [2], Shehata M. [3], Adams J. [1], Yeaman MR. [4], Bernthal NM. [1]
[1] Department of Orthopaedic Surgery, University of California, Los Angeles (UCLA), Los Angeles, CA, USA; [2] UCLA David Geffen School of Medicine, Los Angeles, CA, USA; [3] University of California, Los Angeles (UCLA), Los Angeles, CA, USA; [4] Lundquist Institute for Infection and Immunity at Harbor UCLA Medical Center, Los Angeles, CA, USA

Background & Objectives: Periprosthetic joint infection (PJI) is a devastating complication of endoprosthetic reconstruction. The formation of a local immunosuppressive immune microenvironment (IME) may drive the development of chronic infection in PJI. To identify novel immunotherapies to overcome this paradigm, it is critical to elucidate the cellular mechanisms that promote immunosuppression in PJI. In this study, we endeavor to determine the molecular and cellular changes that occur throughout time in a murine model of PJI.

Methods: An established murine model of S. aureus PJI was utilized. On post-operative days (PODs) 1, 3, 7, 14, 21, and 35, periarticular tissue was homogenized and peri-implant IME cells were isolated by centrifugation for 32-plex cytokine array and flow cytometry analyses, respectively. Flow cytometric analysis was used to quantify innate and adaptive immune populations and co-expression of relevant immunosuppressive surface markers: programmed cell death protein 1 (PD-1), programmed death-ligand 1 (PD-L1), and colony-stimulating factor 1 (CSF-1R).

Results: Cytokines that significantly peaked on PODs 1 or 3 promote the recruitment and activity of neutrophils and macrophages. Cytokines that peaked on PODs 7 or 14 promote T-helper cell polarization (Th1 and Th17). Cytokine responses waned by POD21. On flow cytometry, percent neutrophils and macrophages were lower in infected and sterile animals compared to that of negative controls. T-cells were highest in infected animals on POD1, but decreased below negative control by POD3. PD-L1+CSF-1R+ F4/80+ macrophages and monocytic MDSCs (M-MDSCs) were significantly elevated in PJI samples on POD7 ($p = 0.007$ and $p = 0.0006$, respectively). On POD7, PD-L1+ immune cells were significantly elevated in both sterile control and infected mice compared to non-operative control ($p < 0.001$ and $p < 0.001$, respectively), and were significantly elevated in infected mice compared to sterile control at POD7 ($p = 0.002$).

Conclusions: In a murine model of PJI, the early cytokine response induced acute neutrophil and monocyte recruitment. As inflammation persists, the cytokine milieu promoted Th1 and Th17 cellular immunity, despite a low T-cell number. This native immune response failed to eradicate S. aureus PJI. In this model, chronic S. aureus PJI promoted the recruitment of M-MDSCs and immunosuppressive macrophages. Immunosuppressive polarization may be driven by both pin implantation and PJI.

149 What are the indications and survivorship of tumor endoprosthetic reconstructions for patients with extremity metastatic bone disease?

Kendal JK.[1,2], Hamad C.[1], Abbott AG. [2], Greig D. [1], Peterson NV. [1], Wessel LE. [1], Puloski SKT. [2], Monument MJ. [2], Bernthal NB.v
[1]Department of Orthopaedic Surgery, University of California, Los Angeles, Santa Monica, CA, USA; [2]Section of Orthopaedic Surgery, Department of Surgery, University of Calgary, Calgary, AB, Canada

Background: Surgical resection and endoprosthetic reconstruction (EPR) in metastatic bone disease (MBD) is generally indicated for patients with more favorable survival, oligometastatic disease, or non-reconstructable pathology. As advances for MBD patients progress, an evaluation of indications, survivorship, and complications of EPRs performed for MBD is indicated. The objectives of this study were to study patients undergoing EPR for MBD to review the surgical indications, and implant and patient survivorship.

Methods: A retrospective review of patients undergoing EPR for extremity MBD between 1990 and 2022 at the University of California, Los Angeles, and the University of Calgary was performed. Surgical data included EPR type, indication for EPR, and implant survival. Patient survival was calculated using the Kaplan Meier statistic. Failure modes were categorized by Henderson's classification system. Patients who failed previous surgical fixation were analyzed for tumor type and use of novel therapies, and retrospective pre-operative survival predictions werew assessed using PathFx v3.0.

Results: 115 patients were included with a median age of 50.6, and 59 (51.3%) were female. Median follow-up was 14.9 months (95% CI 9.2-19.3), and median patient survival was 19.4 months (95% CI 13.6-26.1). The 3 most common primaries were renal cell (34/115, 29.6%), breast (26/115, 22.6%), and lung (16/115, 13.9%). Indications included: actualized fracture (58/115, 50.4%), impending fracture (30/115, 26.1%), and failed surgical fixation (27/115, 23.5%). The most common EPR location was proximal femur (43/115, 37.4%), then proximal humerus (41/115, 35.7%) and distal femur (20/115, 17.4%). Henderson type 1 failure (soft tissue failure) was the most common (4/10, 40%), followed by type 5 (tumor progression) (3/10, 30%). Patients undergoing EPR for failed fixation were more likely to have renal cell or lung cancer ($p = 0.006$), and since the introduction of immunotherapies, 7/8 (87.5%) were on active immunotherapy and/or targeted agents.

Conclusions: EPRs were performed most frequently for renal cell carcinoma and in patients with a relatively favourable survival (19.4 months in this cohort). Implant failure was uncommon. EPR was indicated for failed previous fixation in 23.5% of cases, emphasizing the importance of predictive survival modeling. When utilized for the appropriate indication, EPR is a reliable and durable surgical option for patients with MBD.

150 Decreasing bacterial colonization: Non-eluting Bactiguard implant coating decreases burden of implant infection seven days after surgery

Hamad CD. [1], Mamouei Z. [1], Hart C. [1], Peterson NV. [1], Hernandez A. [2], Kendal JK. [1], Kavanaugh A. [1], Billi F. [1], Bernthal NM. [1]
[1]Department of Orthopaedic Surgery, University of California, Los Angeles, Santa Monica, CA, USA; [2] UCLA David Geffen School of Medicine, Los Angeles, CA, USA

Background & Objectives: Periprosthetic infection is a morbid complication of endoprosthetic reconstruction. Currently, prophylactic antibiotics, host-decolonization, and intraoperative field sterility are used to prevent PJI, but breakthrough cases still occur. Implant coatings could provide additional protection against early biofilm formation on implants. Bactiguard (Zimmer Biomet, Warsaw, IN) is an FDA approved coating currently used on urinary catheters to prevent infection. It consists of three noble metals: silver, gold, and palladium that generate a pico-current dispersion force that prevents microbial adhesion. In this study, we will determine if Bactiguard can protect implants from biofilm formation in a murine model of post-arthroplasty infection.

Methods: A 6 x 0.8mm Bactiguard or uncoated titanium pin were implanted retrograde into the distal femur of 10-week-old C57BL/6 mouse and inoculated with 1E3 colony forming units (CFUs) of S. aureus (Xen36) or sterile saline. Bacterial burden was longitudinally measured in vivo by quantifying bacterial bioluminescence using an IVIS Spectrum. Animals were sacrificed on post-operative days (PODs) 7, 21, and 35 to collect implants and harvest tissue for CFU analyses. Additional implants were harvested on PODs 7 and 35 for scanning electron microscopy (SEM) analysis.

Results: There was no difference in in vivo bioluminescence between Bactiguard and uncoated pins. Bactiguard coated pins had significantly lower CFUs compared to that of uncoated pins on POD7 ($p=0.0085$). There were no significant differences in CFUs on PODs 21 ($p=0.44$) and 35 ($p>0.99$). On SEM, there were fewer staphylococci observed on Bactiguard coated implants harvested on POD7 compared to uncoated pins. On POD35, there were no observed differences between groups on SEM.

Conclusions: Bactiguard coating has demonstrated efficacy in reducing infections in urinary and venous catheters. Despite extensive soft-tissue infection seen on in vivo bioluminescence, non-eluting Bactiguard coating provides protection against bacterial colonization of titanium implants on POD7, which is observed on CFUs and SEM. Implant coatings such as Bactiguard could be helpful in conjunction with current multi-modal approaches to help prevent PJI caused by microbial contamination at the time of surgery, especially in immunocompromised oncologic patients who are more susceptible to direct wound contamination at the time of surgery.

151 From *in vitro* to *in vivo*: Do surgical irrigants meaningfully reduce bacterial burden?

Hamad CD. [1], Sheppard W. [1], Mamouei Z. [1], Hernandez A. 2, Lloyd T. [2], Kendal JK. 1, Sobti R. [3], Pearce JW. [3], McPherson E. [1], Bernthal NM. [1]
[1] Department of Orthopaedic Surgery, University of California, Los Angeles (UCLA), Los Angeles, CA, USA; [2] UCLA David Geffen School of Medicine, Los Angeles, CA, USA; [3] University of California, Los Angeles (UCLA), Los Angeles, CA

Background & Objectives: There is no clear consensus regarding the ideal surgical irrigant to be utilized in infected hardware revisions. Most studies influencing decision making rely on clinical data comparing single agents to normal saline. There is a paucity of evidence to dictate surgical decision making and surgeon or institutional preference often determines which irrigant is used. We sought to address this by studying the use of irrigants in vitro and in an established murine model of spinal implant infection.

Methods: Irrigants utilized in all experiments include Dakins full strength (0.5%), povidone iodine (3.5%), hydrogen peroxide (3%), Puracyn (0.024%), and normal saline. Efficacy testing was conducted against S. aureus (Xen36). Irrigants were used in three in vitro assays: a growth curve, planktonic bacterial killing, and killing of established biofilm on implants. A dwell time of 5 minutes was utilized for all killing assays. Colony forming units (CFUs) were counted to quantify efficacy. An established murine model of spinal implant infection was used to investigate the efficacy of irrigants in vivo. There were 3 mice in each group (N=18). Implant and tissue CFUs were counted on post-operative day 7 following a 5-minute irrigant dwell time. Volumes of irrigants were converted for a 25g mouse using a human weight of 75kg.

Results: Dakins, hydrogen peroxide, and povidone iodine are bacteriostatic, whereas, Puracyn did not affect bacterial growth. Dakins and povidone iodine were the only irrigants capable of eliminating or reducing planktonic bacteria compared to negative control. Against biofilm, povidone iodine and hydrogen peroxide eliminated bacteria from implants, whereas, Dakins resulted in a 3 log CFU reduction compared to negative control. In vivo, irrigants did not reduce implant or tissue CFUs after a 5-minute dwell time.

Conclusions: The ideal surgical irrigant has yet to be determined with mixed efficacy results from in vitro and in vivo studies. Our in vitro data demonstrates that irrigants such as povidone iodine and Dakins are bacteriostatic and lead to variable reductions in planktonic or biofilm bacterial CFUs. However, irrigants failed to significantly reduce CFUs in our murine model. We hypothesize that this is due to rapid, non-specific activation of chemical irrigants upon contact with hardware and host tissues. Future studies are necessary to identify the ideal surgical irrigant.

152 Can the use of bacteriophage derived endolysin reliably prevent S. aureus periprosthetic infection in a murine model?

Hamad CD. [1], Mamouei Z. [1], Li Alan. [2], Hernandez A. [2], Kendal JK. [1], Sobti R. [3], Pearce JW. [3], Loessner M. [4], Schmelcher M. [4], Bernthal NM. [1]
[1] Department of Orthopaedic Surgery, University of California, Los Angeles (UCLA), Los Angeles, CA, USA; [2] UCLA David Geffen School of Medicine, Los Angeles, CA, USA; [3] University of California, Los Angeles (UCLA), Los Angeles, CA, USA; [4] Department of Health Sciences and Technology, ETH Zürich, Zürich, CH

Background & Objectives: Oncologic patients are often immunocompromised and more susceptible to periprosthetic infections. Despite implementation of multi-modal preventative strategies, there has been little to no improvement in clinical outcomes and breakthrough infections still occur. Hence, there is a need to develop novel antimicrobials. Bacteriophage derived endolysins are a potential candidate and function by potently digesting the bacterial cell wall. Endolysins have multiple advantages over antibiotics as they function specifically against pathogens and do not disturb host flora, have the ability to kill antibiotic resistant bacteria, and rarely induce bacterial endolysin resistance. We will test the ability of two endolysins, M23 and CHAP, to prevent S. aureus periprosthetic joint infection (PJI) in a murine model of post-arthroplasty infection.

Methods: An established mouse model of PJI was utilized. A 6 x 0.8mm titanium Kirschner wire was implanted retrograde into the distal femur of 10-week-old C57BL/6 mouse and inoculated with 1E3 colony forming units (CFUs) of bioluminescent S. aureus (Xen36) or sterile saline. There were three mice per experimental group. Shortly after surgical closure, mice were administered intraarticular lysin injections (20mg/kg). Mice received subsequent once daily injections for four days. Bacterial burden was longitudinally measured in vivo by quantifying bacterial bioluminescence using an IVIS Spectrum. Animals were sacrificed on post-operative day (POD) 14 to collect implants and harvest tissue for CFU analyses.

Results: As compared to infected control implant and tissue CFUs, M23 was able to significantly prevent infection in all three animals (p=0.194; p=0.005, respectively) while CHAP was able to prevent infection in one of three animals (p=0.677; p=0.818, respectively).

Conclusions: Two S. aureus specific endolysins, M23 and CHAP, with differing biologic activity were tested in a validated murine model of post-arthroplasty infection. While CHAP only prevented the establishment of PJI in one of three animals, M23 successfully prevented infection in all three animals. M23 and similar endolysins could be helpful in conjunction with current multi-modal strategies to help prevent PJI caused by microbial contamination at the time of surgery. This adjunct is particularly important for patients with comorbidities or who are immunocompromised as a result of systemic chemotherapy.

153 Polymicrobial infection with Candida albicans and Staphylococcus aureus increases bacterial biofilm formation in a murine model of periprosthetic joint infection

Hamad CD. [1], Mamouei Z. [1], Hernandez A. [2], Peterson NV. [1], Kendal JK. [1], Pearce JW. [3], Sobti R. [3], McPherson E. [1], Bernthal NM. [1]
[1] Department of Orthopaedic Surgery, University of California, Los Angeles (UCLA), Los Angeles, CA, USA; [2] UCLA David Geffen School of Medicine, Los Angeles, CA, USA; [3] University of California, Los Angeles (UCLA), Los Angeles, CA, USA

Background & Objectives: Polymicrobial periprosthetic joint infections (PJI) are increasing in incidence and portend worse clinical outcomes compared to monomicrobial PJI. Unfortunately, patients undergoing tumor resection and endoprosthetic reconstruction are at increased risk of developing polymicrobial and fungal PJIs due to host immunocompromise. It is unclear how various pathogens interact in polymicrobial infections. To address this gap, we studied the most common bacterial and fungal combination in polymicrobial PJI, S. aureus (SA) and C. albicans (CA), in a murine model of post-arthroplasty infection.

Methods: 1E3 colony forming units (CFUs) of S. aureus (Xen36) and 1E7 CFUs of C. albicans (SC5314) were co-incubated for one hour with 10 x .8mm titanium implants. Implants were subsequently removed and grown in fresh RPMI media. S. aureus implant CFUs were calculated at 1, 3, 6, and 24 hours. A 6 x 0.8mm titanium Kirschner wire is implanted retrograde into the distal femur of 10-week-old C57BL/6 mouse and the distal femur was inoculated with 1E3 CFUs of bioluminescent S. aureus (Xen36), 1E7 CFUs of C. albicans (SC5314), or a combination of the two. There were 15 mice per experimental group. Bacterial burden was longitudinally measured in vivo by quantifying bacterial bioluminescence using an IVIS Spectrum. Animals were sacrificed on post-operative days (PODs) 7, 14, and 35 to collect implants and tissues for CFU quantitation of each organism.

Results: In vitro, S. aureus CFUs were increased by 1.5 logs on co-infected implants at 24hrs compared to S. aureus monomicrobial controls. On longitudinal bacterial bioluminescence, S. aureus burden was significantly higher on co-infected animals on PODs 3-10 compared to S. aureus monomicrobial controls. There was no difference in S. aureus CFUs between co-infected and monomicrobial infected animals on POD7. In vivo, S. aureus biofilm burden was increased on co-infected implants on POD 14 ($p=0.19$), but this increase was not significant until POD35 ($p=0.035$).

Conclusions: C. albicans was observed to promote the formation of S. aureus biofilm on implants both in vitro at 24hrs and in vivo by POD14. However, S. aureus does not appear to have an effect on the growth of C. albicans. Further investigation is required to study the synergistic mechanisms between these bacterial organisms and the impact of polymicrobial infection on host immunity.

154 Reverse total shoulder arthroplasty demonstrates improved functional outcomes over hemiarthroplasty following proximal humerus replacement: Long-term results of 170 cemented endoprosthetic reconstructions for tumors of the upper extremity

Greig D., Trikha R., Kendal J., Wessel L., Hamad C., Peterson NV., Eckardt JJ., Bernthal NM.
Department of Orthopaedic Surgery, University of California, Los Angeles, USA

Background: Indications for the use of reverse total shoulder arthroplasty (rTSA) have been expanding to include use for endoprosthetic reconstruction (EPR) following tumor resection, though data on functional outcomes following rTSA in oncologic patients is limited. The objective of this study was to examine long-term outcomes of cemented stem EPR for tumors of the upper extremity utilizing a large database with up to 30 years of follow-up. Additionally, we sought to compare outcomes of proximal humerus replacement (PHR) using rTSA with conventional hemiarthroplasty.

Patients and Methods: 170 patients who underwent limb salvage surgery with EPR for musculoskeletal tumors of the upper extremity between December 1980 and December 2021 were retrospectively reviewed. The average follow-up time of surviving patients was 8.1 years (range: 0.2 – 31.9 years). All follow-up was performed at a single institution. Demographic, oncologic, procedural, and outcome data was analyzed.

Results: 133 PHR, 21 total humerus replacements, and 16 distal humerus replacements (DHR) in 162 patients were included. Tumors were low grade (IA/IB) or benign in 31 patients, high grade (IIA/IIB) in 62, and metastatic carcinoma or stage III primary sarcoma in 69. Kaplan-Meier survivorship revealed 95.0% disease-specific survival at 25 years for patients with low-grade or benign disease, 53.1% at 30-years for patients with high-grade IIA/IIB disease and 7.7% at 20 years for patients with metastatic disease or stage III primary sarcoma. 30-year implant survival was 82.1% using revision of the stemmed components as the endpoint. PHRs demonstrated 96.7% survival at 25 years; DHRs had the lowest survival at 40.1% at 20 years. 14 implants (8.2%) failed: 3 for aseptic loosening (1.8%), 6 for structural failure (3.5%), 4 for local recurrence (2.4%), and 1 for infection (0.6%). 6 patients who underwent PHR were treated with rTSA. Average shoulder range of motion was greater following rTSA compared with hemiarthroplasty for forward elevation (112.0° vs 36.7°, p=0.009), abduction (128.3° vs 35.7°, p=0.001), and external rotation (30.0° vs 15.5°, p=0.053).

Conclusions: The present study confirms the long-term durability of cemented endoprosthetic reconstructions for musculoskeletal tumors of the upper extremity, particularly for PHR. Tumor progression is the most common cause of failure of upper extremity limb salvage. rTSA has improved functional outcomes over conventional hemiarthroplasty.

155 Slipped capital femoral epiphysis after tumorprosthesis implantation

Nottrott M. [1], Spodeck D. [2], Guder W. [1], Röder J. [1], Polan C. [2], Podleska LE. [1], Streitbürger A. [1], Hardes J. [1], Engel N. [1]
[1] Department of Orthopedic Oncology, University Hospital Essen, Germany; [2] Department of Trauma Surgery, University Hospital Essen, Germany

Background: While the usual etiology of slipped capital femoral epiphysis (SCFE) is idiopathic, there are many other factors that increase the predisposition of slippage. Chemotherapy can be one of them. We report a rare case of acute SCFE after tumor prosthesis implantation.

Methods: A 10- year old girl with osteosarcoma of the right distal femur underwent (neo-)adjuvant chemotherapy, wide tumor resection and reconstruction using a growing tumor prosthesis and a short non-cemented femoral stem. Half a year after implantation, she developed aseptic loosening. Revision surgery was performed using an HA coated cementless femoral stem. Postoperative plain radiographs revealed an acute SCFE that was treated by closed reduction and screw fixation.

Results: Postoperatively, the patient recovered without complications. After 6 weeks of partial weight bearing, she started increasing load incrementally. The use of walking aids was terminated and she returned to school. Half a year after the operation, she was pain free, had full weight bearing and the range of motion in the right hip was not limited. Avascular necrosis was not observed. The left, unaffected hip showed no radiographic signs of slippage.

Conclusion: As the pathogenesis of SCFE is characterized by the disproportion between the load-bearing capacity of the epiphysis and the acting forces on the proximal femur, the most likely cause for acute SCFE in this case was the force necessary to achieve a press fit femoral stem implantation. A long period of partial weight bearing during adjuvant chemotherapy and aseptic stem loosening probably added to the reduction of the femoral epiphysis' load-bearing capacity.

A history of radiation and/or chemotherapy are known to increase the risk of epiphysiolysis of the affected epiphysis and/or other sites, respectively. The forces of implanting a tumor prosthesis, especially with a non-cemented stem, act on the weakened bone and increase the risk of an acute SCFE even more. Therefore, to avoid missing an acute SCFE postoperatively, the adjacent joint should be visible on postoperative plain radiographs. Additionally, special attention should be given to hip pain, appearing over time, even if it is far from the implant site.

The controversy over prophylactic pinning of the uninvolved hip in radio- / chemotherapy-associated SCFE is unresolved. It may be justifiable to fix the contralateral epiphysis if incipient signs of abnormal radiographic findings are detected.

156 The prognostic importance of pathologic fracture in limb salvage surgery for primary bone sarcoma of the extremities

Greig D., Trikha R., Kendal J., Wessel L., Hamad C., Peterson NV., Eckardt JJ., Bernthal NM.
Department of Orthopaedic Surgery, University of California, Los Angeles, USA

Background: Pathologic fracture (PF) has long been regarded as a poor prognostic factor in patients with primary bone sarcoma. The purpose of this study was to determine whether the presence of PF impacts overall survival, the development of metastases, local recurrence, or implant survival in patients who undergo limb salvage surgery with endoprosthetic reconstruction (EPR) for primary bone sarcoma of the extremities.

Methods: 373 patients who underwent limb salvage surgery with cemented EPR for extremity primary bone sarcoma between 1980 and 2019 were retrospectively reviewed. 304 patients had osteosarcoma (OS) and 69 patients had chondrosarcoma (CS). Average follow-up of surviving patients was 13.0 years (range: 0.2 – 37.7yrs). Implant failure was defined as necessitating revision of the stemmed components or amputation.

Results: 17 patients (5.6%) with OS and 7 patients (10.1%) with CS had a PF prior to limb salvage surgery. In the OS cohort, there were no differences in age, sex, disease stage, or percent tumor necrosis in patients with and without a PF. In OS, there were no differences in disease-specific patient survival ($p = 0.80$), metastases (35.2% vs 38.3%; $p=0.80$), or local recurrence (17.6% vs 9.4%; $p=0.27$). In CS, PF patients were older and more likely to have high grade IIA/IIB tumors and dedifferentiated disease. PF patients with CS had worse disease-specific patient survival ($p=0.0004$) and higher rates of metastases (85.7% vs 21.0%; $p<0.001$) and local recurrence (57.1% vs 12.9%; $p=0.003$). For patients with dedifferentiated CS, 100% of patients with a PF developed distant metastases versus 26.3% of patients without a PF ($p<0.001$). Survival to both distant metastases and local recurrence was significantly diminished in CS with a PF ($p<0.001$ for both). There was no significant difference in survival of limb salvage between patients with and without PF (100% vs 89.6% at 25 years; $p=0.55$). Overall implant survival was 26.0% at 30 years and did not differ significantly between patients with and without PF (52.3% vs 24.8%, $p=0.40$).

Conclusions: In OS, the presence of a PF did not significantly influence disease prognosis. In CS, the presence of a PF in patients who undergo limb salvage surgery was a poor prognostic factor, and a larger proportion of patients with PF had dedifferentiated disease. For patients who undergo endoprosthetic reconstruction, implant survival does not appear to be affected by the presence of a PF.

157 Characterization of the inflammatory status of osteosarcoma by in silico RNA-seq analyses

Yoon DJY. [1], Huynh M-A. [1], Peron C. [1], Schwartz J-M. [2], Modrowski D. [1], Odri G-A. [1,3]

[1] Université Paris Cité, Inserm U1132 BIOSCAR, Paris, France; [2] School of Biological Sciences, University of Manchester, Manchester, UK; [3] Service de chirurgie orthopédique et traumatologie, AP-HP, Hôpital Lariboisière, Paris, France

Although it could be associated with an anti-tumor immune response, a systemic inflammation is associated with a worse prognosis in patients with osteosarcoma. At the opposite, the mechanisms of inflammation within the bone tumors are largely unknown. In this work, we investigated the intratumoral inflammation status by analyzing transcriptomic data of osteosarcomas (GSE87686 and TARGET-OS).

Raw counts of RNA-seq analyses were converted into TPM (transcripts per million). The mean of TPM for the genes of the "Hallmark_Inflammatory_Response" signature served to establish a Z-score reflecting the intensity of the inflammatory response. Three groups of tumors were determined: Low, Medium and High. A Kaplan-Meier survival analysis showed that patients in the High inflammation group had a better survival (p=0,049). Gene Set Enrichment Analyses of differentially expressed genes revealed that TNFα signaling (p=0.023) and leukocyte transendothelial migration (p=0.006) were up-regulated in High vs Low group. The top 20 results of enrichment of Biological Process with Gene Ontology included chronic inflammatory, immune cell migration and regulation of immune response (p<0.10). The ESTIMATE software showed greater immune infiltrate in tumors of the High group compared to the Low group (p=0.002). Consistently, the populations of T cells and neutrophils evaluated with the Microenvironment-Cell-Populations-Counter method were increased in the High group (p<0.001). Finally, confronting an osteosarcoma gene signature revealed that MTAP and ADA2 expression were lost in the low inflammation group, suggesting that the inflammation status was linked to genetic alterations of osteosarcomas.

In conclusion, our results highlight the TNFα/NFκB pathway, T cells and neutrophils as major mediators of the well-balanced inflammatory process in tumors, which is directly related to a greater immune infiltrate and to better outcome for the patients. The inflammation status seems to depend on intrinsic characteristics of the tumor cells i.e. the genetic alterations that drive tumor progression.

158 Clinical outcomes of 468 soft tissue sarcoma patients at Cochin Hospital from 2012 to 2019 : A monocentric experience

Yoon DJY. [1], Abou Al Ezz M. [2], Kreps S. [3], Boudou-Rouquette P. [2], Larousserie F. [2], Feydy A. [2], Dumaine V. [2], Cladiere-Nassif V. [2], Anract P. [2], Biau D. [2]
[1] Université Paris Cité, Inserm U1132 BIOSCAR, 75010 Paris, France; [2] Hôpital Cochin, Paris, France; [3] Hôpital Européen Georges Pompidou, Paris, France

We describe here 468 limb and trunk soft tissue sarcomas (STS) operated at Cochin Hospital, AP-HP, from 2012 to 2019, to share our single-center experience. We collected patient and sarcoma characteristics, performed treatments as well as patient outcomes regarding the survival, local recurrence or metastasis, and revision surgery.

The median age of the patients was 57 years, with 209 women (45%) and 259 men (55%). Among them, 351 patients (75%) were managed in first intention at Cochin; 18 patients (4%) had lymph node extension and 33 patients (7%) had a metastasis at D0.

There was 315 sarcomas (72%) of size greater than 5 cm. The sarcomas were deep-situated in 386 cases (82%) and in the lower limb in 352 cases (75%). We had 217 (52%) FNCLCC grade 3 sarcomas. The most frequent histological subtypes were: undifferentiated and pleiomorphic cell sarcoma (104 tumors or 22%), myxofibrosarcoma (82 tumors or 18%), synovialosarcoma (45 tumors or 10%), myxoid and/or round cell liposarcoma (43 tumors or 9%), leiomyosarcoma (39 tumors or 8%), and dedifferentiated liposarcoma (29 tumors or 6%)

Regarding treatment, 416 patients (89%) had conservative surgery, 262 patients (56%) had radiotherapy, and 139 patients (30%) had pre, post, or pre and postoperative chemotherapy.

At 5 years, the overall survival was 60% (95% CI 55-66), the incidence of local recurrence was 14% (95% CI 10-17), the incidence of metastases was 28% (95% CI 23-32), and the incidence of revision surgery was 40% (95% CI 36-45).

Our results are comparable to those reported in the literature, but the outcome remains to be improved. We hope that our study can help clinicians to better orient and manage patients with STS.

159 Retrospective view on Campanacci grading of giant cell tumors of the bone

Duivenvoorden MJC. [1], Hemke R. [2], Bramer JAM. [1], Smithuis FF. [2], Kerkhoffs GMMJ.[1], Verspoor FGM.[1]
[1]Department of Orthopeadic surgery, [2] Department of Radiology and Nuclear Medicine, Amsterdam University Medical Centers, Amsterdam, The Netherlands

Introduction: Giant Cell Tumors of Bone(GCTB) are rare benign, locally aggressive meta-epiphyseal tumors of long bones. Campanacci grading(1) on conventional X-ray's is used to guide the optimal surgical trajectory. Aim of this study was to objectify if Campanacci grading influenced the treatment.

Method: All GCTB patients at the Amsterdam University Medical Centers between 2000-2021 were retrospectively evaluated. X-rays prior to treatment were graded by two radiologists and an orthopeadic surgeon, all specialized in musculoskeletal pathology. It was objectified if Campanacci grade 1, 2 and 3 were followed by curettage with cementoplasty or allograft, short Denosumab plus curettage and En-Bloc resection, respectively.

Results: Overall, 52 GCTB patients were identified after exclusion of 8 patients with lesions in the axial skeleton. The lesions were located in the femur, tibia and radius in respectively 17 (33%), 11 (21%) and 6 (11,5%). 18 patients (35%) had Campanacci grade 2 and 34 (65%) had grade 3. The main treatment for grade 2 was a curettage, 16 patients (89%). With grade 3, 21 (62%) patients had a curettage and 10 (19%) had an En-bloc resection.

Conclusion: Most patients had Campanacci grade 2 and 3 GCTB. Grading did not seem to influence treatment pathways. Grading disease severity seem important, however age, location and other clinical aspect are important to create the optimal, individualized treatment plan.

1. Campanacci M, Giunti A, Olmi R. Giant cell tumours of bone. A study of 209 cases with long term follow up in 130. ITALJORTHOPTRAUMATOL. 1975;1(2):249-77.

161 Angioleiomyoma of the foot: Clinical and functional outcomes of surgical treatment in a case series

Ipponi E., Bechini E., Ruinato AD., De Franco S., D'Arienzo A., Capanna R., Andreani L .
Department of Orthopedics and Trauma Surgery, University of Pisa, Pisa, Italy

Background: Angioleiomyoma is a benign soft-tissue tumor that arises from the smooth muscle cells in the tunica media of the blood vessels. Although the the most common location for these neoplasms is the uterine wall, they can also originate from lower limbs. Altogether, these neoplasms account for 0.2% of all those located in the foot and ankle region. Signs and symptoms of foot angioleiomioma can be a localized pain, swelling and functional impairment.

To this date, only case reports and case series with short sized populations have been reported in literature to describe the clinical picture of these neoplasms and the effectiveness of surgical treatment.

Methods: Thirteen cases suffering from angioleiomyoma of the foot underwent surgical resection in our institution between January 2017 and January 2022. For each case we recorded pre-operative and post-operative symptoms, as well as their pre-operative and post-operative functional status according to both MSTS and AOFAS scores. Eventual complications and local recurrence were reported.

Results: Each patient had an at least mild pain before surgical treatment. The mean pre-operative MSTS and AOFAS scores were 22.1 and 76.8 respectively. The mean tumor size was 17.7mm. Pre-operative Each patient received a resection with wide margins. None had local recurrences nor major complications at their latest follow-up.

After surgery, the mean post-operative MSTS and AOFAS scores increased to 29.5 and 98.8 respectively. Each case had a marked increment of their functionality and a reduction of their pain after surgery.

Conclusions: Our results suggest that surgical approach with tumor resection should be considered a safe and reliable treatment for foot angioleiomyomas in light of the extremely low risk of local recurrence and due to the good post-operative pain relief and functional restoration that can be obtained after the treatment.

162 Reconstruction after pelvic bone massive resection: Evolution and actuality of D-printed technology

Andreani L., Cosseddu F., Shytaj S., Ipponi E., Mani O., D'Arienzo A., Capanna R.
Department of Orthopedics and Trauma Surgery, University of Pisa, Pisa, Italy

Background: Pelvic reconstructions after massive bone resections are among the most challenging practices in orthopedic surgery. Whether the bone gap results after a trauma, a tumor resection, or it is due to a prosthetic revision, it is mandatory to reconstruct pelvic bone continuity and rebuild the functional thread that connects spine and hip joint. Several different approaches have been described in literature through the decades to achieve those goals. To this date, 3D printed implants represent one of the most promising surgical technologies in orthopedic oncology and complex reconstructive surgery.

Methods: We present our experience with 17 cases who underwent massive pelvic bone resections and subsequent reconstruction using 3D-printed prostheses. In our study, we included both patients who had a one-step or a two-step surgical approach. Cutting jigs were used to increase cutting precision. For each patient we collected pre-operative and post-operative clinical and radiological data. Cases with a Follow-Up of 6 months or less were excluded.

Results: Out of our 17 patients, 9 suffered from bone tumors: 5 primary bone sarcomas and 4 metastases. Resection was limited to the periacetabular region alone in 9 cases whereas it was extended also to the iliac wing in 4 cases and to the anterior pelvis in the remaining 4 cases. The oncological outcome of the 9 cases treated for bone tumors were classified as follows: 3 DOD, 3 CDFs, 2 NED, 1 AWD. All the 3 cases who died of disease during the follow-up developed a local recurrence of the neoplasm. Six of our 17 cases (35%) developed at least one local complication: of these, 3 were local recurrences. Mean pre-operative VAS score was 5.7 (3-9), while the post-operative one was reduced to 1.8 (0-9). The average pre-operative MSTS score was 8.2, but at the latest follow-up the value increased to 22.30. T-student tests proved that the difference between pre-operative and post-operative values was significant ($p<0.001$). Both MSTS score and VAS score had the tendency to get better as the follow-up time increased, as testified by Pearson correlation tests ($p<0.040$).

Conclusions: Our data confirm the idea that 3D printing and custom made implants are promising technologies that one day could shape the future of orthopedic oncology and reconstructive surgery.

165 Tibia localisation and curettage are major risk factors for local recurrence in giant cell tumor of bone

Mahdal M. [1], Pazourek L. [1], Apostolopoulos V. [1], Adamkova KD. [2], Mudry P. [3], Zambo S. I. [4], Tomas T. [1]
[1] First Department of Orthopedic Surgery, St. Anne's University Hospital and Faculty of Medicine, Masaryk University, Brno, Czech Republic; [2] Clinic of Comprehensive Cancer Care, Masaryk Memorial Cancer Institute, Brno, Czech Republic; [3] Department of Pediatric Oncology, University Hospital Brno and Faculty of Medicine, Masaryk University, Brno, Czech Republic; [4] First Pathology Department, St. Anne's University Hospital and Faculty of Medicine, Masaryk University, Brno, Czech Republic

Background: Giant cell tumor of bone (GCTB) is a primary bone tumor, characterised by local aggressive growth and low metastatic potential. The preferred treatment of GCTB is curettage with the use of a local adjuvant. The purpose of the study was to identify the risk factors for local recurrence and to compare the functional outcomes after curettage and en-bloc resection.

Methods: The group included 102 patients with giant cell tumor of bone treated between 2006 and 2020 in our institution. The mean age of patients was 34.4 years (15–79). The follow-up period was 8.32 years (2–16) on average. Based on the obtained data, the risk factors of local recurrence were examined. The functional outcomes were evaluated retrospectively based on the MSTS scoring.

Results: The incidence of local recurrence in patients who underwent curettage was 29.8% and was significantly higher than resection (p=0.0221). Tibia localisation was an independent risk factor for local recurrence regardless of the type of surgery (p=0.0373). The rate of local recurrence after preoperative treatment with denosumab followed by curettage was significantly higher (42.85%) than after resection (p=0.0307). Statistically significantly (p<0.00001) the MSTS score was lower for resection (21.9) than curettage (26.96).

Conclusion: Tibia localisation and curettage are major risk factors for local recurrence in GCTB regardless of neoadjuvant denosumab treatment.

This study was supported by Project No. NU22-10-00054 from the Ministry of Healthcare of the Czech Republic

166 Impact of the association of amputation and radiotherapy on soft tissue sarcoma prognosis

Yoon DJY. [1], Abou Al Ezz M. [2], Kreps S. [3], Boudou-Rouquette P. [2], Larousserie F. [2], Feydy A. [2], Dumaine V. [2], Cladiere-Nassif V. [2], Anract P. [2], Biau D. [2]
[1] Université Paris Cité, Inserm U1132 BIOSCAR, Paris, France; [2] Hôpital Cochin, Paris, France; [3] Hôpital Européen Georges Pompidou, Paris, France

Introduction: Soft tissue sarcomas (STS) are a group of rare and heterogeneous tumors that often arise in the limbs. Although their treatments are discussed in a multidisciplinary approach, it is not unusual that the amputation appears to be the best compromise between oncologic control and aggressiveness of treatments, sometimes associated to (neo)adjuvant radiotherapy. In this work, we assessed patients treated by amputation for STS and classified them whether they were treated by (neo)adjuvant radiotherapy. Thus, we described the characteristics of patients and tumors and the results at 5 years of follow-up.

Characteristics: We studied 51 patients undergoing amputation surgery, median age 55 years, 24 women (47%). Among them, 43 patients (84%) had positive lymph node and 41 patients (80%) had metastatic extension. 37 tumors (82%) were bigger than 5cm, 50 tumors (98%) were located deep, 25 tumors (49%) were found at the distal lower limb and 32 tumors (73%) were stage 3 FNCLCC. The main histological subtypes were undifferentiated and pleiomorphic sarcomas (13 tumors = 25%), synovial sarcoma (11 tumors = 22%) and malignant peripheral nerve sheath tumors (4 tumors = 14%).

Treatments: 13 patients (25%) had adjuvant radiotherapy, and 33 patients (65%) had adjuvant chemotherapy. After amputation, 45 patients (88%) had negative margin.

Results: At 5 years of follow-op, the overall survival rate was 37% (95% IC 24-57), the incidence of local recurrence was 13% (95% CI 5-24), the incidence of metastasis was 66% (95% CI 48-80), and the reoperation rate was 13% (95% CI 5-24). The overall survival rate was statistically different in two groups (p=0,011) : the survival rates were 9% (95% CI 1-58) for the 'Radiotherapy' group, and 51% (95% CI 34-75) in the 'No radiotherapy' group. There was no difference regarding the local recurrence, metastasis and reoperation.

Conclusion: Compared to patients treated by amputation without radiotherapy, patients receiving radiotherapy have an extremely low life expectancy. Local recurrence is slightly higher in the radiotherapy group, but less than what might suggest the aggressive biology of the tumor. Therefore, we recommend that adjuvant radiotherapy be used, in selected cases, even for patients undergoing amputation.

167 Impacts of preoperative denosumab treatment on bone metabolism in young patients with giant cell tumor of bone

Joo MW. [1], Cho YJ. [1], Lee HK. [1], Lee Y-S. [2], Chung Y-G. [3]
[1] St. Vincent's Hospital, [2] Incheon St. Mary's Hospital, [3] Seoul St. Mary's Hospital, College of Medicine, The Catholic University of Korea, Seoul, Republic of Korea

Background & Objectives: Since clinical use of denosumab was approved by the Food and Drug Administration of United States in 2013, the monoclonal antibody for receptor activator of nuclear factor-kappa B ligand has been used for down-staging giant cell tumor of bone (GCTB) to perform less-morbid operations. Nevertheless, because GCTBs are prevalent in young adults, it is concerned that high-dose denosumab therapy may have a long-term adverse effect on normal bone metabolism. Thus, we investigated the serial data on bone metabolism in patients with GCTB who had neoadjuvant administration of denosumab.

Methods: This study was a retrospective medical record review of GCTB patients who underwent preoperative denosumab treatment followed by surgery at our institution from 2016 to 2019. We analyzed relevant data on bone mineral density (BMD) and laboratory findings such as bone turnover markers.

Results: A total of 10 patients were identified including five females and five males. The median age was 31.5 (range, 17 - 45) years. 120 mg of denosumab was subcutaneously injected every four weeks and additional shots were administered on the 8th and 15th days of the first month of treatment according to the standard protocol provided by the pharmaceutical manufacturer. The mean number of preoperative denosumab administration cycles were 5 (range, 4 - 6). Compared with before denosumab treatment, changes in BMDs (g/cm2) of lumbar spine, femoral neck, trochanter, and total hip were +5.28%, +3.5%, +4.76% and +2.94% at one year after denosumab treatment, +1.17%, +2.47%, +2.82% and +0.78% at two years, and +0.57%, +0.04%, -0.64% and +0.71% at three years, respectively. And changes in N-terminal propeptide of type 1 procollagen and C-telopeptide of collagen type 1 were -40.03% and -41.57% at one year after denosumab treatment, -14.13% and -17.62% at two years, and +2.39% and +0.38% at three years. Hypercalcemia or hypocalcemia was not observed in any patients.

Conclusion: In our series, BMD increased at one year after preoperative denosumab treatment, then tended to decrease. Bone turnover markers decreased at one year, then tended to increase. Long-term follow-up studies with more cases should be necessary to identify changes in bone metabolism such as rebound phenomenon afterwards.

170 The prognostic value of the serum level of C-reactive protein for survival of children with Ewing's sarcoma

Errani C.[1], Traversari M.[1], Cosentino M.[2], Manfrini M. 1, Basoli S. [1], Tsukamoto S.[3], Mavrogenis A.[4], Aiba H.[5], Bordini B.[2], Donati D.[1]
[1] Clinica Ortopedica e Traumatologica III a prevalente indirizzo Oncologico, IRCCS Istituto Ortopedico Rizzoli, Bologna, Italy; [2] Laboratorio di Tecnologia Medica, IRCCS Istituto Ortopedico Rizzoli, Bologna, Italy ; [3] Department of Orthopaedic Surgery, Nara Medical University, , Nara, Japan; [4] First Department of Orthopaedics, National and Kapodistrian University of Athens, School of Medicine, Athens, Greece; [5] Department of Orthopedic Surgery, Nagoya City University, Aichi, Japan

Background: Ewing' sarcoma is a highly aggressive malignant small round-cell tumor that affects mainly children and adolescents. A raised level of C-reactive protein (CRP) has been found to be an indicator of poor prognosis in several cancers. The purpose of the present study was to evaluate the prognostic role of CRP in children with Ewing's sarcoma. Identification of reliable prognostic factors could help to identify high risk patients which may require a different treatment and follow up.

Methods: We made a retrospective study on 151 children undergoing multimodal treatment for Ewing'sarcoma in appendicular skeleton from December 1997 to June 2020. We investigated potentially clinical and laboratory prognostic factors. We analyzed the following factors: patient age, gender, tumor site, tumor size (≥200 mL or <200 mL), metastasis at presentation, treatment methods (neoadjuvant or adjuvant chemotherapy, radiotherapy, surgery), response to chemotherapy, patient outcome including occurrence of local recurrence or metastasis, survival time. We analyzed several inflammatory biomarkers suggested in previous studies: CRP, neutrophil count, lymphocyte count, monocyte count, platelet count, serum hemoglobin, alkaline phosphatase, lactate dehydrogenase, neutrophil-lymphocyte ratio, platelets-lymphocyte ratio.

Results: Univariate Kaplan-Meier analyses of laboratory biomarkers and clinical parameters showed that pathological CRP, metastatic disease at presentation were poor prognostic factors associated with overall survival and disease recurrence at 5 years ($p < 0.05$). A multivariate Cox regression model showed that pathological CRP [HR of 3.67; 95% CI, 1.46 to 10.42] and metastatic disease [HR of 4.27; 95% CI, 1.58 to 11.47] were associated with a higher risk of death at 5 years ($p < 0.05$). In addition, pathological CRP [HR of 2.66; 95% CI, 1.23 to 6.01] and metastatic disease [HR of 2.56; 95% CI, 1.13 to 5.55] were associated with a higher risk of disease recurrence at 5 years ($p < 0.05$).

Conclusions: Our findings demonstrated that CRP was associated with prognosis of children with Ewing's sarcoma. We recommend pre-treatment measurement of the CRP in order to recognize children with Ewing sarcoma who are at greater risk of death or local recurrence.

171 Wound infection after resection of sarcomas at the groin: Does antibiotic prophylaxis reduce the risk of infection?

Klein A. [1], Wieser A. [2,3], Dürr HR. [1]
[1]Orthopaedic Oncology, Department of Orthopaedics and Trauma Surgery, [2] Department of Infectious Diseases and tropical Medicine; University Hospital, LMU Munich; [3] German Centre for Infection Research (DZIF) Partner site Munich , Germany

Introduction: Sarcoma resection around the groin area is anatomically in many cases a challenge for the surgeon. Those surgeries are frequently associated with postoperative infections. The guidelines don´t recommend an antibiotic prophylaxis for resection of soft tissue tumors. So we suppose, prophylactic antibiotic application may reduce the risk of surgical site infections.

The aim of this study is to evaluate the risk of postoperative infection after sarcoma resection in the area of proximal thigh and groin in respect to the effectiveness of antibiotic prophylaxis.

Patients and methods: For this study, 331 Patients with sarcomas located in the gluteal, adductor and groin area were included. All patients were surgically treated between 2003 and 2020. The indication of antibiotic prophylaxis was large and deep sarcomas with awaiting of complex and long dissection of tumor. The standard antibiotic for prophylaxis was a cephalosporine. We recorded every infection causing revision surgery within 6 months postoperatively. 233 patients (70.7%) received perioperative application of antibiotic prophylaxis. In 104 cases (31.4%) the antibiotic application was extended for 3-7 days because of complex preparation or long duration of surgery. Preliminary results lead to a change of antibiotic prophylaxis: more frequently ampicillin with sulbactam was used.

Results : Surgical site infection occurred in 76 cases (23%). Revision due to infection was necessary in 62 cases (26.5%) with perioperative antibiotic prophylaxis vs. 14 cases (14.4%) without antibiotic application (p=0.018). In 104 cases with extended duration of antibiotic prophylaxis, the rate of infection was 35.6% (37 of 104 cases). The rate of infection in the group without extended application of antibiotics was 17.2% (39 of 227 cases; p>0.001). The comparison of prophylaxis with cefuroxime and ampicillin/sulbactam showed a reduction of infection rate (27.8% vs 20%), but not significant (p=0.631).

Discussion: We were able to confirm the well-known risk factors (intraoperative blood loss, duration of surgery) for the occurrence of surgical site infection. Our study design did not prove an advantage of peri-/postoperative antibiotic application with the aim to reduce the infection rate. This fact is due to the preselection of the compared patient groups (bias). However, if antibiotic prophylaxis is used, the spectrum of expected germs should be taken into consideration.

172 Patterns and impact of local recurrence for conventional central chondrosarcoma in Norway. Who, how and when to follow-up

Thorkildsen J. [1,2], Åge Myklebus T. [2,3], Norum O-J. [1], Zaikova O.[1], Sellevold S. [1], Strøm TA. [1]
[1]Division of orthopaedic surgery, Oslo University Hospital, Oslo, Norway; [2]Cancer Registry of Norway, Oslo, Norway; [3]Department of Research and Innovation, Møre and Romsdal Hospital Trust, Ålesund, Norway

Background: The patterns and impact of local recurrence(LR) in the setting of conventional central chondrosarcoma (CCCS) of bone is not clear and guidelines for follow-up(FU) lack an evidence base.

Method: We performed an observational study of LR in a national cohort of CS of bone based at the NCR with quality control of all variables and extensive review1-3. We analysed the time and mode of presentation, management and attainment of local control in addition to the impact of LR on rate of metastasis and death. We analysed features of low and high risk in prognostic analysis.

Results: 50% of 40 LR were symptomatic and 50% were discovered by routine surveillance. Time to first LR was 1.4 years (0.2-1.4) and mean time to metastasis after this was 1.7 years (0.1-3.3). LR was associated with increased risk of metastasis HR=4.1 and death overall HR=9.3. OF 32 first LR, 27 cases underwent treatment with curative intent and 44% achieved local control. Oslo risk3 divides the cohort into a low and high risk subgroup also in the setting of LR and FU schemes can be tailored accordingly. Low risk cases need only 5 years of FU and have higher likelihood of achieving local control after LR.

Conclusion: 50% of CCCS LR were asymptomatic and discovered by routine surveillance. LR was associated with risk of metastasis and death, but this was driven by those at high risk at primary diagnosis (Oslo high risk). Most are low risk CCCS and FU can be discontinued at 5 years.

1. Thorkildsen J, Norum OJ, Myklebust TA, Zaikova O. Chondrosarcoma local recurrence in the Cancer Registry of Norway cohort (1990-2013): Patterns and impact. J Surg Oncol. Dec 14 2020;doi:10.1002/jso.26308
2. Thorkildsen J, Taksdal I, Bjerkehagen B, et al. Chondrosarcoma in Norway 1990-2013; an epidemiological and prognostic observational study of a complete national cohort. Acta Oncol. Jan 11 2019:1-10. doi:10.1080/0284186x.2018.1554260
3. Thorkildsen J, Taksdal I, Bjerkehagen B, Norum OJ, Myklebust TA, Zaikova O. Risk stratification for central conventional chondrosarcoma of bone: A novel system predicting risk of metastasis and death in the Cancer Registry of Norway cohort. J Surg Oncol. Mar 5 2020;doi:10.1002/jso.25883

174 Spino-pelvic reconstruction combined with free vascularized fibular graft in the treatment of Ewing sarcoma

Albayrak B., Cengiz T., Büyükceran İ., Coşkun HS., Dabak N.
Department of Orthopedics and Traumatology, Faculty of Medicine, Ondokuz Mayıs University, Samsun, Turkey

Introduction In malignant pelvic tumors, a limb-sparing procedure is a more favorable treatment for the patient than hemipelvectomy, but it challenges the surgeon. These cases present two patients with spinopelvic fixation after tumor resection and reconstruction with vascularised fibular graft (VFG).

Case-1
A 15-year-old male patient applied to the orthopedics outpatient clinic for about two months with low back pain on the left side. He had muscle weakness in the lower extremities, more prominently on the left. A massive mass in the iliac wing was detected, and the biopsy revealed the diagnosis of Ewing sarcoma.

Case-2
A 16-year-old female patient with pain in the right pelvic region has been admitted to the outpatient clinic. Imaging studies have revealed lytic lesions in the right iliac wing. The biopsy has been performed, and the diagnosis of Ewing sarcoma has been made.
Following the neo-adjuvant chemotherapy, iliac wing resection and sacro-pelvic fixation were planned for both patients.

Surgical Procedure: After total resection of the iliac wing, the sacrum and the acetabulum were fixed with two spinal pedicle screws. The reduction was achieved with 2 rods, and bone-to-bone (sacrum-acetabulum) contact was established with a VFG. The whole procedure was performed under neuromonitorisation. The patients did not develop any complications in the clinical follow-ups and mobilized with partial weight in the 1st month and full weight in the 3rd month.

Conclusion: In pediatric patients, biological reconstruction such as spinopelvic fixations combined with VFG should be considered for limb salvage and may prevent secondary deformities after resection of the massive bone.

176 A rare localization of metastasis of pleuro-pulmonary blastoma in a four year-old-boy

Albayrak B., Cengiz T., Büyükceran İ., Coşkun HS. Dabak N.
Department of Orthopedics and Traumatology, Faculty of Medicine, Ondokuz Mayıs University, Samsun, Turkey

Introduction: Pulmonary blastoma is a rare lung tumor responsible for 0.25-0.5% of primary pulmonary malignancies. Pleuro-pulmonary blastoma (PPB) is a subtype of this tumor with a poor survival rate. Metastases are present in 43% of PPB cases and typically involve the brain, mediastinum, pleura, and diaphragm. In this case report, the treatment of pubic arm metastasis of the above-mentioned tumor has been described in a pediatric patient.

Case Report: A 4-year-old male patient was operated on two years ago with the diagnosis of right lung PPB. Upon detection of metastasis in the left pubic arm, he was referred to our outpatient clinic. In the physical examination, all the systems were normal except functional pain in the left groin. Imaging studies have revealed lytic lesions located in the left pubic arm. The diagnosis is confirmed as metastasis via biopsy. The patient's treatment was decided by a multidisciplinary tumor team. Following the neoadjuvant chemotherapy, surgical resection has been planned.

Following the left pubic bone resection, cryosurgery was performed on the resected bone by a modified technique. This modified technique consists of a combination of direct pouring and a pressurized system. Following the thawing process, the resected part of the pubic bone was replaced in its original location, and fixation was achieved with plate-screw osteosynthesis through the symphysis. At the one-year follow-up, no complication occurred, and the patient was ambulatory without any functional loss.

Conclusion: PPB is an aggressive, intrathoracic neoplasm of early childhood, and its prognosis is generally poor. The pubic arm is an unexpected metastasis area for PPB. Good result with an adequate surgical technique combined with cryotherapy has been obtained on this patient, but long-term follow-ups are needed. Biological reconstructions must be considered for this type of tumor, especially in younger populations.

177 A rare localization for osteosarcoma: Proximal fibula

Muslu O., Cengiz T., Şimşek Ş., Coşkun HS., Dabak N.
Department of Orthopedics and Traumatology, Ondokuz Mayıs University, Samsun, Turkey

Introduction: Osteosarcoma is the most common primary malignant bone tumor, especially in young patients. It is usually located around the knee, especially in the distal femur and proximal tibia. The fibula is a rare localization for osteosarcoma, constituting only 2% of all osteosarcomas. This case represents a patient diagnosed with osteosarcoma involving the fibular head.

Case Report: An 18-year-old male patient presented at our center with complaints of pain and palpable swelling in the right knee. The patient also described numbness along the course of the peroneal nerve from the knee to the ankle.

On the plain radiograph, a lesion was determined which was destroying the cortex of the right fibula head, showing periosteal reaction and containing opacities. The biopsy results were reported as conventional osteosarcoma. Following the neo-adjuvant chemotherapy, positron emission tomography (PET) scans were used, and as no metastasis was determined, wide surgical resection was planned. A lateral approach was used, and wide resection was performed in the proximal fibula lesional area, preserving the peroneal nerve. The intraoperative frozen study has demonstrated negative surgical margins; thus, the procedure has been terminated. At the 1-month follow-up, the complaints improved dramatically.

Conclusion: Proximal fibula localization has been reported in the literature as an uncommon localization for osteosarcoma. When preserving the peroneal nerve, insufficient resection may be made, and it must be kept in mind that local recurrence can result from this.

178 Evaluation of bone and soft tissue tumors of the shoulder girdle

Büyükceran İ., Şimşek Ş., Bayar E., Cengiz T., Albayrak B., Coşkun H.S., Dabak N.
Department of Orthoapedics and Traumatology, Faculty of Medicine, Ondokuz Mayıs University, Samsun, Turkey

Introduction: Tumors around the shoulder are often misdiagnosed due to other pathologies. Especially muscle and tendon pathologies such as rotator cuff tears cause a delay in the diagnosis of musculoskeletal system tumors. This study examined the diagnostic distribution of bone and soft tissue tumors around the shoulder girdle.

Materials and Methods: In this retrospective study, 469 patients with complaints of pain and swelling around the shoulder between January 2017-2022 were included. 245 patients with non-tumoral pathologies were excluded from the study. After the initial assessment by the multidisciplinary tumor council, 22 of 224 patients were excluded and finally, the study consists of 202 patients

Results: Lesions were evaluated as benign in 105 (51.98%) of 202 patients. The mean age was 39.3 years. Benign bone lesions were found in 81 of 105 patients, and benign soft tissue lesions were found in 24 patients. The cystic lesion was detected in 40 cases with a benign bone tumor. Of the 97 malignant lesions, 49 were found to be secondary to metastasis. The lung was the most common origin for the metastatic lesions of the shoulder. Of the 48 patients, 27 were identified as malignant bone tumors and 21 as malignant soft tissue tumors. While the most common malignant bone tumor was Ewing sarcoma, the most common malignant soft tissue tumor was found to be a malignant mesenchymal tumor.

*Conclusion :*In patients presenting with complaints of pain and/or swelling around the shoulder, tumoral lesions will not be seen rarely, it should be always kept in mind for the differential diagnosis. It should be kept in mind that lung cancer metastasis may occur in the shoulder girdle due to anatomical neighborhood considerations.

179 Percutaneous cryoablation for the treatment of extra-abdominal desmoid tumors

Errani C. [1], Facchini G. [2], Papalexis N. [2], Peta G. [2], Spinnato P. [2], Traversari M. [1], Aiba H. [3], Miceli M. [2], Donati D. [1]
[1] Clinica Ortopedica e Traumatologica III a prevalente indirizzo Oncologico, [2] Radiologia Interventistica, IRCCS Istituto Ortopedico Rizzoli, Bologna, Italy ; [3] Department of Orthopedic Surgery, Nagoya City University, Aichi, Japan

Background: Surgical resection, radiation therapy and chemotherapy are all accepted as standard treatments for extra-abdominal desmoid tumors, but their effectiveness has been limited by frequent local recurrence. The aim of this study was to determine outcomes and prognostic factors for patients with primary and locally recurrent extra-abdominal desmoid tumors who underwent percutaneous cryoablation.

Methods: We prospectively analyzed 14 consecutive patients with symptomatic extra-abdominal desmoid tumors who underwent percutaneous cryoablation between September 2020 and January 2022. Data on progression-free survival (PFS), objective response rate, and total volume lesion (TVL) were collected. All complications were documented and graded according to the CIRSE Classification System for Complications.

Results: The patients were 5 males and 9 females with a mean age of 51 years (17-66). The median follow-up was 18.1 months (range, 12-26 months). The PFS was 77.8% at 1 year. Objective response was obtained for 78.6% of patients and a complete response for 35.7% of patients. Mean TVL of extra-abdominal desmoid tumors before cryoablation was 146.7cm3 (SD 72.5). Mean change of TLV one year after cryoablation was 55.6%. All patients who had complete cryoablation showed symptomatic response, with no local recurrence. In patients with large extra-abdominal desmoid tumors who were treated with partial cryoablation, the local recurrence occurred outside cryoablation zones. Adverse events rate occurred in 7 patients (50%). Five patients (35.7%) had grade 2 complications: edema and increased pain in the days following cryoablation. Two patients had a grade 3 complications (14.3%): 1 second-degree skin burn, and 1 pleural effusion.

Conclusion: Cryoablation seems to be a safe and effective minimally invasive treatment for symptomatic extra-abdominal desmoid tumors with low and transient toxicity, but it is likely of limited use in patients with larger tumors that have untreatable regions due to involvement of vital structures.

180 Evaluation of the diagnostic accuracy of percutaneous core needle biopsy in bone and soft tissue tumors

Cengiz T. [1], Muslu O. [1], Özbalcı A.[2], Barış YS. [3], Coşkun HS. [1], Dabak N. [1]
[1]Department of Orthopedics and Traumatology, Ondokuz Mayıs University, Samsun, Turkey; [2]Department of Radiology, Ondokuz, [3]Department of Pathology, Ondokuz Mayıs University, Samsun, Turkey

Background & Objectives: Percutaneous core needle biopsies are less invasive, do not require hospitalization, and have lower costs and complications than open biopsy methods. This study aimed to evaluate the diagnostic accuracy and reliability of percutaneous core needle biopsy.

*Method*s: 250 core needle biopsy results of 244 patients who were diagnosed with bone or soft tissue tumors by percutaneous core needle biopsy method and underwent surgery were included in the study. Percutaneous core needle biopsy results and excisional biopsy results were compared.

Results: The orthopedic surgeon took 163 percutaneous core needle biopsies, and 87 imaging-guided percutaneous core needle biopsies were taken by the interventional radiologist. As a result of the statistical analysis, the sensitivity of percutaneous core needle biopsy in diagnosing benign tumors was 78.9%, the specificity was 100%, and the diagnostic accuracy rate was 95.2%. In malignant tumors, the sensitivity was 94%, specificity 99.1%, and diagnostic accuracy 96.4%.

Conclusion: Percutaneous core needle biopsy is a highly safe and effective method for diagnosing bone and soft tissue tumors. Managing patients with a multidisciplinary approach increases diagnostic success. Since its results and treatment costs are promising, percutaneous core needle biopsy is an excellent alternative to open biopsy techniques.

181 Resurfaced allograft-prosthetic composite for proximal humerus reconstruction in children with bone tumors

Errani C. [1], Palmas M. [1], Traversari M. [1], Aiba H. 2, Spazzoli B. [1], Frisoni T. [1], Ali N. [1], Campanacci L.[1], Donati D.[1], Manfrini M.[1]
[1] Clinica Ortopedica e Traumatologica III a prevalente indirizzo Oncologico, IRCCS Istituto Ortopedico Rizzoli, Bologna, Italy; [2] Department of Orthopedic Surgery, Nagoya City University, 1, Azakawasumi, Nagoya, Aichi, Japan

Background: Reconstruction of proximal humerus in children following resection of bone sarcoma is challenging. The main problem in children is the small size of bone. We reported the results of a new surgical technique for proximal humerus reconstruction after bone tumor resection in children.

Methods : We analyzed retrospectively 18 children with proximal humerus sarcomas who underwent intra-articular resection and reconstruction with resurfaced allograft–prosthetic composite. The patients' medical records were reviewed for clinical and functional outcomes as well as post-operative complications. The functional evaluation of the patients was done at the end of the follow-up using Musculoskeletal Tumor Society (MSTS) scoring system.

Results: There were 9 males and 9 females, with a mean age of 10 years old (range 4–15 years) at the time of the diagnosis. The mean length of proximal humeral resection was 16cm (range 8 – 28 cm). The mean follow-up was 8,5 years (range 2–19). Local recurrence was observed in 1 of 18 patients (5,56%) after 25 months and the patient underwent surgical treatment and he is alive and free of disease after 57 months from last surgery. Mechanical failure was observed in 9 of 18 patients (50%) between 5 months and 72 months after first surgery (mean 28 months): six patients had prosthesis loosening that required revision surgery, two patients underwent reverse shoulder arthroplasty for shoulder instability and one patient had a nonunion at the allograft-host junction who requires revision with bone autografts and a new synthesis. The mean MSTS functional score at the last follow-up was 23.2 (range 20 – 26). Three patients had an MSTS score > 25 (excellent result), 14 had an MSTS score between 25 and 21 (good result) and two patients had an MSTS score < 20 (mild result).

Conclusions : Resurfaced allograft–prosthetic composite may represent an alternative surgical technique for proximal humerus reconstruction in children with bone sarcomas. Although its success is limited by high risk of complications, resurfaced allograft–prosthetic composite seems to be a viable option to preserve the bone stock in very young patients.

182 Characterization of the tumor microenvironment in jaw osteo-sarcomas towards prognostic markers and new therapeutic targets

Bertin H.[1], Rédini F.[2], Gomez-Brouchet A.[3]
[1]Nantes Université, CHU Nantes, Service de chirurgie maxillo-faciale et stomatologie, , France; [2]Nantes Université, UnivAngers, CHU Nantes, INSERM, CNRS, CRCI2NA, Nantes, France; [3]Cancer biobank of Toulouse, IUCT Oncopole, Toulouse University Hospital, Toulouse , France

Background: The purpose of this study was to investigate the bone resorption, as well as the vascular and immune microenvironment, of jaw osteosarcomas and to correlate these features with patient clinical outcomes

Methods: We studied 50 JO biopsy samples by im-munohistochemical analysis of tissue microarrays (TMAs). We investigated the bone remodel-ing markers RANK/RANKL/OPG, the endothelial glycoprotein CD146, and biomarkers of the immune environment (CD163 and CD68 of macrophages, CD4+ and CD8+ of tumor-infiltrating lymphocytes (TILs), and an immune checkpoint PD-1/PD-L1). The biomarkers were analyzed for their influence on progression (recurrence and metastasis), overall survival (OS), and disease-free survival (DFS).

Results: A strong and significant correlation has been found between CD163 staining and lower OS and DFS. The level of CD4+ and CD8+ staining was low and non-significantly associated with survival outcomes. High levels of RANK and RANKL were found in the tumor samples and correlated with lower DFS.

Conclusion: Our findings suggest that CD163+ TAMs represent markers of poor prognosis in JO. Targeting TAMs could represent a valuable therapeutic strategy in JO.

183 Delay in diagnosis and treatment of primary bone tumors during COVID-19 pandemic in Poland

Ciechanowicz D.[1], Pawlik J. [1], Szyjkowska M. [1], Kwapisz B. [2], Mądry M. 2, Kotrych D.[3]
[1]Department of Orthopaedics, Traumatology and Musculoskeletal Oncology, Pomeranian Medical University, Szczecin, Poland; [2]Department of Orthopaedics, Traumatology and Orthopaedic Oncology, Collegium Medicum University in Zielona Gora, Zielona Gora, Poland; [3]Department of Children Orthopaedics and Musculoskeletal Oncology, Pomeranian Medical University, Szczecin, Poland

Background & Objectives: The COVID-19 pandemic has affected all of the medical specialties, including orthopedic oncology. Therefore, the aim of the study was to assess how it influenced the diagnostic and therapeutic processes for patients with bone neoplasms.

Methods: We evaluated 87 patients treated due for bone neoplasms before (Group I, n = 36) and during the COVID-19 pandemic (Group II, n = 51). A delay in diagnosis was defined as the period between the initial clinical symptoms and the date of referral to an oncology center. The patients from Group II were asked to complete a short questionnaire regarding the COVID-19 pandemic.

Results: The median general delay in diagnosis before the pandemic was 7 months, while during the pandemic, it was 10 months (p = 0.728). The biopsy delay was lower in the pre-pandemic group: median-6.5 vs. 12 days (p = 0.025). The patients from Group II were diagnosed with larger tumors compared to those in Group I: the median values were 75 vs. 56 mm (p = 0.025), respectively. After an X-ray examination, the bone neoplasms were suspected more frequently in the Group II: 63% vs. 44% cases (p = 0.024), respectively. In Group II, 20 (60.8%) cases of SARS-CoV-2 infection were reported, however, no respiratory failure cases were noticed.

Conclusion: The pandemic affected the diagnostic process of primary bone tumors, resulting in delays in performing biopsies. During the pandemic, the patients reported larger diameters of their bone lesions.

187 Establishment of patient-specific complex in-vitro models for sarcomas from surgical specimen

Regenbrecht M.[1], Loskutov J.[2], Regenbrecht C. [2,3,4], Sauer, R.[5], Tunn P-U.[6], Niethar M. [6,7]
[1]Department of Oncology, Helios Klinikum Berlin-Buch, Berlin, Germany;
[2]CELLphenomics GmbH, Berlin, Germany; [3]ASC Oncology GmbH, Berlin, Germany;
[4]University Hospital Göttingen, Institute for Pathology, Göttingen, Germany ;
[5]Department of Pahtology,
[6]Department of Orthopedic Oncology, Helios Klinikum Berlin-Buch, Berlin, Germany; [7]Department of General Orthopedics, University of Greifswald, Greifswald, Germany

Background: Patient-specific cell culture models of PD3D (patient-derived 3D cell culture-models of carcinomas have become valuable tools for therapeutical decision making. Compared to the progress in treating carcinomas in the past decade clinical benefits in terms of response rates and overall survival for sarcoma patients lacks behind. Representative clinical models are missing. Here, we report the efficient establishment of PD3D-models for sarcomas.

Methods: 3D-cell-culture was established for 30 sarcoma patients using fresh tumor tissue obtained intraoperatively (incisional biopsy n=11, resection specimen n=19). Initially, tissue was processed in accordance to existing protocols for carcinoma organoids. Media conditions and tumor sampling was continuously optimized by using vital tissue from resection specimens after neoadjuvant radio- or chemotherapy in correlation to preoperative MRI and interdisciplinary consultation with pathology to exclude interference with resection margins. For quality control and pathological evaluation, formalin-fixed PD3D-models were embedded in paraffin (FFPE) and stained analgous to donor tumor tissues.

Results: 30 PD3D-models have been established from 16 subtypes of sarcomas. Take rates from biopsy samples and standard culture conditions were around 8%. Optimized media conditions and sampling from resection specimens in correlation to MRI improved take rates to 80%. Pathological examination of PD3D models confirmed original diagnoses and revealed that PD3D-models recapitulate the key properties of the original tumor in all established models. Median time from surgery to possible drug screening was 35 days.

Conclusions: PD3D-models of sarcomas can be routinely established, irrespective of subtype. Optimal culture conditions differ significantly from those for carcinoma. Preoperative correlation with MR imaging is recommended to obtain suitable vital tumor tissue for establishment of PD3D-models. Pathological phenotype of PD3D-models corresponds to original tumor tissue. Models can be used for drug sensitivity screening in a reasonable amount of time.

188 Analysis of late septic complications of pelvic reconstruction after internal hemipelvectomy, types I and II by Enneking, a single-center experience

Anatolii D., Hryhorii K.
National Cancer Institute, Kyiv, Ukraine

Introduction: Reconstruction of the pelvic ring after internal Hemipelvectomy of types I, II by Enneking is performed as a natural goal of an onco-orthopedic surgeon to restore the bone area in order to restore function. But post-resection pelvic reconstruction differs significantly from long bone endoprosthetic reconstruction, specially due to the number of complications. This leads to repeated (sometimes disabling) surgical interventions, significantly worsening the patient's quality of life.

Aim: To study the feasibility of using rigid metal structures for pelvic ring reconstruction based on the analysis of long-term observations and analysis of complications of such type of surgery.

Materials and methods: We analyzed the results of long term observation (more than 2 years) of 27 patients with malignant tumors who underwent hemipelvectomy internal with pelvic ring reconstruction with/or without arthroplasty. Patients' age ranged from 9 to 57 years. The majority of patients had chondrosarcoma (20), 5 patients had osteosarcoma, and 2 had Ewing's sarcoma.
The follow-up period ranged from 25 to 74 months. The average observation time was 44,4 ± 6,6 months. Patients were divided into two group depending on resection type. 1 st group – 20 patients who underwent hemipelvectomy internal of types I, 2 nd group contained 7 patients after hemipelvectomy internal of types II including periacetabular resection with arthroplasty (hemipelvectomy II, I-II, II-III). We evaluated number of deep infections complication and limb function by MSTS scale in all patients. Reconstruction with a metal-polymer spacer endoprosthesis was performed in 24 patients. In 3 patients reconstruction was performed using an individual prosthesis with 3D printing technology.

Results: In 1 st group deep infections were occurred in 8 patients (40 %). Implant removal was performed in that cases. The MSTS in patients of the 1 st group who underwent hemipelvectomy with removal of the endoprosthesis was 58,33 %. In patients who did not have deep infection MSTS was 71,63 % ($p>0.05$
All patients of 2 nd group had late deep infections, in 4 it led to the removal of the endoprosthesis and limb amputation, 3 of them are living with a fistula. Functional results by MSTS were below 50%.

Conclusions: The complication rates for treatment outcomes of 1 st and 2 nd group call into question the feasibility of complex reconstructive interventions in patients with internal hemipelvectomy. The absence of any reconstruction in the resection of pelvic bones in hemipelvectomy internal of types II by Enneking will not lead to significant decrease in quality of life, and possibly vice versa, because it reduces the risk of reoperation and does not improve limb function at all. This requires further research. The need for pelvic ring reconstruction after hemipelvectomy I types remains unresolved problem due to the large number of complications.

189 The results of palliative surgical treatment for metastatic cancer in the spine. Single-center experience

Anatolii D., Hryhorii K.
National Cancer Institute, Kyiv, Ukraine

Introduction: Vertebral lesions with bone metastases in cancer patients are observed in 30-40% of cases. In the structure of tumor pathology of the spine, its metastatic lesions account for up to 96%. Minimally invasive vertebroplasty is considered the best method of preventing vertebral compression fractures, but in case of actual fractures, open surgery is unavoidable.

Aim: To show the results of open decompression interventions based on the experience of one onco-orthopedics department of the Ukrainian NCI.

Materials and methods: Twenty-seven patients with metastatic vertebral lesions underwent surgery, 15 (55.6%) male, 12 (44.4%) femal, and the average age of the patients was 48.9±2.4 years. Prior to surgical treatment, all patients underwent ac omplete clinical examination, including an assessment of bone and visceral dissemination, ECOG, severity of pain (visual analog scale), quality of life (QLQ30), neurological status (Frankel scale), life expectancy (prognostic scale Tokuhashi).

Results: The results of surgical treatment of patients were evaluated according to rthopedic and oncological criteria. Improvement of neurological status after surgical treatment was achieved in 19 (70.37%) patients, neurological status in 3 (11.2%) patients did not change. Worsening of neurological symptoms was noted in 5 (18.51%) patients. Improvement in quality of life was noted in 17 (62.96%) patients, deterioration - in 3 (11.2%). No dynamics was observed in 7 (25.92%) of the operated patients. The median survival of patients with metastatic renal cell carcinoma was 8.1 ± 1.64 months. When comparing the actual and predicted survival rates (according to the Tokuhashi scale), it was found that the expected 1- year survival rate was 21%, and the actual survival rate was 27%. The average life expectancy of patients with bone metastases of prostate cancer was 15.2 ± 3.2 months. According to the Tokuhashi prognostic scale, the expected 1-year survival rate was 42%, and the actual survival rate was 67%.

Conclusions: The data obtained indicate a significant role of palliative surgical treatment of secondary bone lesions of the spine, which significantly improves the quality of life of patients (62.96%) by reducing the intensity of pain (up to 81.48%), restoring neurological and motor functions of the limbs (in 70.37% of cases). The rest of the patients have negative dynamics due to the generalization of the tumor process.

190 Ballon kyphoplasty in the treatment of multiple myeloma: The role of level selection on multiple segmental disease of the spine

Albayrak B., Cengiz T., Coşkun HS., Dabak N.
Department of Orthopaedics and Traumatology, Faculty of Medicine, Ondokuz Mayıs University, Samsun, Turkey

Background & Objectives: Multiple myeloma is a B cell-origin disease of the bone marrow. It can affect any bone in the body but especially the spine. Spine involvement in multiple myeloma is usually generalized, and treating these lesions can be challenging. Conventional surgical procedures must be reserved for patients with neurological deficits or spinal instability. Minimal invasive procedures such as cement augmentation via balloon kyphoplasty or vertebroplasty have recently become popular for treating multiple myeloma with spine involvement. This study aimed to investigate our institution's mid-term results of percutaneous balloon kyphoplasty (PBK) in patients with multiple myeloma.

Methods: Patients admitted to our clinic between July 2021-December 2022 with the diagnosis of multiple myeloma have been retrospectively investigated. There were 78 patients with multiple myeloma with spinal involvement. Among them, patients treated with BKP were selected for the study. During the BKP procedure, a bone biopsy was obtained through the pedicle to confirm the diagnosis of multiple myeloma. Patients treated conservatively are excluded from the study.

Results: The study consists of 13 patients (18 levels). 10 patients were male, and 3 were female. The mean age of the patients was 63,2. The mean follow-up period was 8.9 months. There was a single-level lesion in 4 patients, while there were multiple segmental lesions in 9 patients. Five levels were L4, three levels L3, four levels L2, three levels L1, two levels T12 and one level T11. No cement leakage to the epidural space has been observed. Local kyphosis angle improved from 22,2 degrees to 12,5 degrees postoperatively. The mean preoperative visual analog score (VAS) improved from 8,28 to 2,35 in the immediate postoperative period, and the sixth-month follow-up score was 2,64. There was a better clinical outcome in the BKP procedure in low-lumbar segments compared to the thoracolumbar junction, especially in patients with multiple-segment spine involvement.

Conclusion(s): BKP is a minimally invasive and safe procedure for treating spinal lesions in multiple myeloma. In the presence of multiple-level involvement, clinical assessment should be made carefully to select the level of BKP. According to our procedure, in case of multiple-level involvement, the most caudal vertebrae must be selected to better restore the patient's local kyphosis angle and pain scores.

191 The role of arthroscopy in intraarticular tumor treatment: How often do malignancies occur?

Valentini M., Oljaca A., Smolle M.A, Regvar K., Leithner A., Bergovec M.
Orthopaedics and Traumatology, Medical University of Graz, Graz, Austria

Background and Objectives: Arthroscopy is a widely accepted surgical method for a variety of orthopedic conditions, though its role in treating intraarticular tumors remains unclear. The aim of our study is to perform a literature review and report complications of using arthroscopy in tumor treatment as well as the known malignancy cases.

Methods: A PubMed search was performed combining the MeSH terms (Arthros*) and all term variations of tumors from the 2020 WHO Classification of Tumors of Soft Tissue and Bone, from the beginning to 2021. We identified 6507 papers for title review, 1201 abstracts were further analyzed; 369 articles matched the inclusion criteria. We screened tumor type, joint involved, demographic data, postoperative outcomes and complications, in particular malignancies.

Results: The total number of patients in all studies is 1435. Complications were reported in 73 studies: 355 patients developed complications (24.7%). These included: recurrence (17.2%), intraoperative or postoperative complications (5.6%), malignancy (1.3%). More than one surgery was required in 211 patients (14.7%). The malignancies included 5 synovial sarcomas, 4 metastases, 3 osteosarcomas, 3 chondrosarcomas, 2 lymphomas, 1 epithelioid sarcoma, 1 liposarcoma; in 13 knees, 2 hip, 2 shoulder, 1 elbow, 1 thumb CMC joint. Local (10 wide open resections/reconstructions, 3 amputations) and systemic (15 metastatic disease, 7 DOD) outcomes were screened.

Conclusions: Arthroscopy has proven to be safe for selected benign tumors, with low complication and recurrence rates. Great caution and expertise in tumors is needed before starting arthroscopy in unclear lesions; although overall risk of malignancy at arthroscopy is low.

192 Non oncologic and oncologic causes of revision surgeries in soft tissue sarcomas

Yoon DJY. [1], Abou Al Ezz M. [2], Kreps S. [3], Boudou-Rouquette P. [2], Larousserie F. [2], Feydy A. [2], Dumaine V. [2], Cladiere-Nassif V. [2], Anract P. [2], Biau D. [2]
[1]Université Paris Cité, Inserm U1132 BIOSCAR, Paris, France; [2]Hôpital Cochin, Paris, France; [3]Hôpital Européen Georges Pompidou, Paris, France

Surgical management for soft tissues sarcomas (STS) is challenging, to achieve optimal oncologic control and preserve functional anatomy. In some cases revision surgeries may be required, however they are usually more complex than the initial surgery and carry a higher risk of complications. Moreover, there is no standardized strategy because of the heterogeneity of histological subtypes, and the need to adapt to the adjuvant treatment protocol.

In this work we highlighted reoperations after initial STS surgery, out of our database from 468 limb and trunk soft tissue sarcomas (STS) operated at Cochin Hospital, AP-HP, from 2012 to 2019. All reoperations were counted as an independent event, until the 5th reoperation, and classed into 5 categories : infection, plastics, local recurrence, margin revision and other.

Characteristics of sarcomas The median size of sarcomas was 8,1 cm; 315 sarcomas (72%) were larger than 5 cm. The sarcomas were deep-situated in 386 cases (82%) and in the lower limb in 352 cases (75%). We had 217 (52%) FNCLCC grade 3 sarcomas. At day 0, 18 patients (4%) had lymph node extension and 33 patients (7%) had a metastasis. As for the treatment, 416 patients (89%) had conservative surgery with negative margin for 354 cases (77%); 262 patients (56%) had radiotherapy, and 139 patients (30%) chemotherapy.

Results: Among the total of 277 reoperation events that were counted, the most common reasons for reoperations were infection (112 events, 40%) and plastic management (69 events, 25%). Local recurrence (34 events, 12%) and margin revision (33 events, 12%) were also reported. The first reoperation accounted for 65% of the total events, with 180 out of 277 cases being performed at the first revision surgery; and the number of reoperations decreased as the number of surgeries increased. Out of 468 patients in our database, 180 patients (38%) had at least one surgical revision; and the count of 5 surgeries was observed for 3 patients (0,6%).

Conclusion: Our results showed that the most common reasons for reoperations were infections and plastic issues, and that the first reoperation accounted for the majority of the events. We confirm the complex and challenging nature of treating STS, and the importance of careful planning and execution of surgical procedures to minimize the need for revision surgeries.

193 Alternatives for reconstruction of femoral nerve

Buendia Pérez J. [1,2], Martín Antona E. 1,3, Gómez Martínez de Lecea C. [1,2], Casarrubios Barrera J. [1,2], Nieto Ramos H. [1,2], Manrique Gamo E. [1,4], García Maroto RC. [1,4], Cebrián Parra JL. [1,4], Leyva Rodriguez F. [1,2]
[1] Musculoskeletal Oncology Unit, [2] Plastic Surgery Dept, [3] General Surgery Dept, [4] Orthopaedic Surgery Dept, Hospital Clínico San Carlos, Madrid, Spain

Background and Objectives: Although complete lesions of femoral nerve are not very common, they result in an impaired limb which usually receive less reconstructive effort than it should. Crural nerve reconstruction is usually mistreated resulting in a low-quality of life for patients. Few techniques are previously described with variable functional results.

Method: We describe two different approaches for femoral nerve reconstruction by means of a compound nerve graft intra-abdominally or neurotization with selective obturator nerve branches in the thigh.

Results: During the last three years (2019-2022) we performed 4 reconstructions with the described techniques in our referral center of sarcoma. With proper rehabilitation programs patients achieved an active walk and an improved quality of life.

Conclusions: Femoral nerve reconstruction is a reliable procedure with different alternatives that should not be overlooked despite the possible difficulties for it's success such as big gaps or prolonged time of re-innervation. Whenever it is well planned and performed we can obtain good outcomes in quality of life and functional results.

194 Outcomes of surgical treatment for localized tenosynovial giant-cell tumor of the foot and ankle: A case series

Ipponi E., Ruinato AD., De Franco S., Lombardi L., Cordoni M., D'Arienzo A., Andreani L.
Department of Orthopedics and Trauma Surgery, University of Pisa, Pisa, Italy

Background and objectives: Tendonsynovial giant cell tumor (TGCT), also termed Giant cell tumor of the tendon sheath (GCTTS), is a slow-growing, benign but locally aggressive tumor that originates from tendon sheaths or bursas. Although GCTTS mainly occurs in the hand and in the extremities of the upper limb, around 3-5% of these tumors arise from foot and ankle. Localized lesions in this area often present as firm masses or nodules with slow but continuous progression through months and years. Pain associated with weight-bearing, as well as limitations in joint motions may be reported, depending on tumors' location. Surgery is the treatment of choice for the definitive eradication of GCTTSs, in particular for their localized forms, with the aim to eradicate the neoplasm and restore lower limb's functionality.

Methods: Thirteen cases suffering from GCTTS of the foot and ankle underwent surgical resection in our institution between January 2017 and January 2022. For each case we recorded pre-operative and post-operative symptoms, as well as their pre-operative and post-operative functional status according to both MSTS and AOFAS scores. Eventual complications and local recurrence were reported.

Results: Each patient had an at least mild pain before surgical treatment. The mean pre-operative MSTS and AOFAS scores were 23.1 and 72.5 respectively. The mean tumor size was 17.7mm. Pre-operative Each patient received a resection with wide margins. Two cases (15%) had local recurrences. None had major complications at their latest follow-up. After surgery, the mean post-operative MSTS and AOFAS scores increased to 28.0 and 90.0 respectively.

Conclusion: Resection with wide margins for foot and ankle GCTTS is effective in restoring patients' lower limb functionality and is associated with reasonable local recurrence rates.

195 Early outcomes of immediate and delayed reconstruction following sarcoma resection in a single sarcoma referral center: A descriptive study

Lhuaire M.[1,2,3], Habibi K. [1], Garrido I. [1], Prive S. [1], Khoshim K. [1], Anract P.[3], Biau D. [3], Lantieri L.[1]
[1]Department of Plastic, Reconstructive and aesthetic surgery, [2]Department of Imaging research, Cardiovascular research Center of Paris – Inserm UMR970, Hôpital Européen Georges Pompidou, Paris, France; [3]Department of Anatomy and Organogenesis of Saints-Pères, Faculté de Médecine Paris-Descartes, Université Paris Cité, Paris, France

Background and Objectives: The timing of reconstruction following the resection of a soft-tissue sarcoma is debated. Although it does not appear to impact post-operative complications rates, oncologic outcomes and safety [1-2-3], it is sometimes useful to wait for surgical margins before soft tissue reconstruction. The aim of this descriptive study was to describe early post-operative outcomes and complication rate in immediate or delayed reconstruction following sarcoma resection in a single sarcoma referral center.

Methods: This is a retrospective descriptive study of a single sarcoma referral center between February 2020 and 2023 which included a consecutive cohort that underwent immediate or delayed reconstructions (pedicled or free flaps) following resection of an extremity or trunk and soft tissue or bone sarcomas. Demographic characteristics, post-operative course and complications outcomes were described.

Results: Among the 73 patients included, 56 patients underwent immediate and 17 delayed reconstructions. The rate of complete resection (R0) was of 93% (n = 68). Forty-nine patient underwent free flap and 24 patients underwent pedicled flap procedures. The most frequent complication was operative site infection (19% ; n=14), followed by flap necrosis (10% ; n=7), hematoma (7 % ; n=5), Arterial thrombosis (5% ; n=4) ; venous thrombosis (3% ; n = 2) ; Flap failure (5% ; n=4). There were no statistical differences between of complication rates in immediate vs delayed procedures (42% vs 47%; p=NS). There was also no statistical differences of complications rates between pedicled or free flap groups (50% vs 42% ; p=NS). Overall complication rate requiring repeat surgical intervention was 46% (n=33). No death was recorded during the early postoperative period and all patient presented wound healing

Conclusion: Immediate or delayed reconstruction is currently possible following a soft-tissue sarcoma resection. Should margins be cleared, a delayed reconstruction can be performed. A high rate of early postoperative complication must be expected.

197 Outcome and prognosis of synovial sarcoma: Experience of a tertiary care centre of India

Rohela H., Batra U., Pasricha S.
Orthopaedic oncology, Rajiv gandhi cancer institute and research center, Delhi, India

Background: Synovial sarcoma represents 8% of all soft tissue sarcoma (STS). It is a high grade STS, and 50% of patients develop metastasis. It is characterized by local invasiveness and a propensity to develop distant metastases.

Aim: To study the demographic pattern and perform survival analysis with evaluation of factors effecting the survival outcome.

Methodology – An observational analysis of 39 biopsy proven primary resectable metastatic or non-metastatic synovial sarcoma cases was performed. Patients with resectable lung nodules, dimension greater than 5 cm dimension, margins < 1 cm/ involved were offered adjuvant Adriamycin based chemotherapy and/or local radiation therapy.

Results- Mean age of 39.6 years, no sex predilection observed. Extremity and lower limb sarcomas and deep location and more than 5cm of dimension were more common. 15 % cases were metastatic all at presentation with lung nodules. 85 % underwent wide local excision and 15 % amputation. 69 % had < 1cm nearest free margin and 1 with margins involved.

Overall survival(OS) at 5 years using log rank test was evaluated. The survival rate in the distant only and distant with local recurrence group was < 5 % whereas 60 % survival rate in the local alone recurrence group. 23 patients had recurrence ,15 with distant and 4 with local and 4 with both local and distant recurrence

Local recurrence was significantly higher in in lesions of deep location or nearest free surgical margin <1cm. Size, location or neoadjuvant chemotherapy or radiotherapy had no significant effect on OS. Adjuvant chemotherapy (p value- 0.467) and radiotherapy (p value- 0.682) also had no significant effect on OS.

Conclusion: In Non-metastatic or resectable metastatic lung nodules in Synovial sarcoma cases early surgical excision with wide margins was found to be most effective treatment. To establish the role and indications of Neo adjuvant and adjuvant therapies further studies with larger sample size is required.

198 Comparison of the diagnostic performances of core-needle biopsy in myxoid versus non-myxoid tumors

Rohela H., KimH-S., Han I., Lee C., Kim Y
Orthopaedic oncology, Rajiv gandhi cancer institute and research center, Delhi, India

Background: Despite the overall diagnostic utility of core needle biopsy (CNB) comparable to incisional biopsy, increased diagnostic errors have been suggested of CNB for myxoid soft tissue tumors. This study compared the diagnostic performance of CNB between myxoid and non-myxoid soft tissue tumors.

Methods : 369 patients who underwent ultrasound-guided CNB prior to resection for soft tissue tumors were classified into two groups according to resection pathology; myxoid group (n = 75) and non-myxoid group (n = 294). One-hundred and ninety-three patients were male and the median age of the patients was 40 years. Two-hundred and sixty-three tumors were malignant.

Results: CNB correctly diagnosed malignancy in 84% (58 of 69) for the myxoid group and 95% (184 of 194) for the non-myxoid group. For diagnosing histologic grade of soft tissue sarcoma, CNB correctly identified high grade in 78% (18 of 23) for the myxoid group and 74% (94 of 128) for the non-myxoid group. Correct diagnosis rate of histological type was significantly lower in the myxoid group (63% [47 of 75] in the myxoid group and 83% [242 of 294] in the non-myxoid group, p = 0.013).

Conclusion: Our study suggests that CNB is useful for myxoid soft tissue tumors of the extremity, with regard to diagnosing malignancy and histologic grade. However, CNB was less useful for identifying histologic subtype in myxoid tumors than in non-myxoid tumors.

199 Vascularized fibula with and without extracorporeal radiotherapy for limb salvage surgery in Indian patients

Rohela H., Tiwari A., Mehta S., Sharma SK., Arora R.
Orthopaedic oncology, Rajiv gandhi cancer institute and research center, Delhi, India

Background: Reconstruction of segmental bone defects following resection of bone sarcomas is a challenging procedure. Vascularised fibula grafts alone or in combination with extracorporeal radiotherapy and reimplantation of tumor bone have long been established as a method of reconstruction of such defects, with satisfying results. Prompted by paucity of data on Indian patients, we report our experience with vascularised fibula graft for patients undergoing limb salvage surgery for sarcomas of bone.

Material and methods: A total of 25 patients underwent the procedure from December 2008 to December 2014. Femur was the commonest site and osteosarcoma was the commonest diagnosis. Intercalary resection was done in 19 patients and arthrodesis in 6 patients. Vascularised fibula was used in combination with extra corporeally irradiated bone in eight patients, and alone in 17 patients. Results: All but one limb could be salvaged, and all but three patients had united at final follow up. Combination of extracorporeal radiotherapy and reimplantation with vascularised fibula fared better than vascularised fibula alone in terms of time to union (9.6 months vs 12.2 months) and rate of graft related complications (14.2% vs 62.5%).

Conclusion: Reconstruction with VFG with or without ECRT has a good and predictable functional outcome. Though manageable with active intervention, complications were more commonly seen with vascularised fibula alone than a combination of the two techniques.

200 Extraskeletal Ewing sarcoma : Experience in a tertiary cancer care centre of India

Rohela H., Batra U., Pasricha S.
Orthopaedic oncology, Rajiv gandhi cancer institute and research center, Delhi, India

Background: Ewing sarcoma can arise in either bone or soft tissue. Extra skeletal Ewing sarcoma (EES) is an uncommon primary tumor of the soft tissues, accounting for 20-30% of all reported cases of ES.

Aim: Was to investigate demographic distribution, survival analysis and factors effecting the survival and recurrence in patients of EES.

Methods: Retrospective study of 19 biopsy proven EES was performed. Overall survival (OS) using log rank test and factors affecting OS and local recurrence (LR) were evaluated for the entire cohort.

Results: patients with EES had a mean age of 19.5 and was more commonly seen in male (63%). Axial location (58%) and solitary presentation (84%) were more common. Average size was 11 cm, 3 of 19 were metastatic at presentation with lung beings the most common site for metastasis. 17 received NACT, 16 with VAC-IE regimen and 1 underwent second line with GEM/DOCE regimen. Unplanned surgery was done in 2 of 19. 3 patients received definitive RT and 13 underwent surgical wide local excision. 2 of 13 showed good response to NACT. 10 patients required readmission out of which 6 patients had chemotherapy related complications, 2 had surgical site complications and one patient developed secondary AML post completion of treatment.

Total of 4 patients had recurrence. One had local recurrence alone, one had distant recurrence alone and 2 patients had distant and local recurrence both.

Tumor size >10 cm, axial location, previous unplanned surgery was associated with higher LR rate. The mean overall survival was 32 months (2.66 years), with higher rates seen in non-metastatic and non-recurrent setting.

Conclusions: Early and accurate diagnosis is the key to the management of EES with promising results were seen via NACT and RO resection regimen. But further studies with larger study groups are needed to standardize the treatment protocol and evaluate its efficacy.

201 Reliability and role of mutation-specific H3F3A (Histone 3-3) G34W immunohistochemistry to differentiate giant cell tumor of bone from its clinicoradiologic and histologic mimics: An institutional study

Rohela H., Pasricha S. Manish P., Gurudutt G. , Anila S., Akshay T., Meenakshi K., Anurag M.
Orthopaedic oncology, Rajiv gandhi cancer institute and research center, Delhi, India

Giant cell tumor of bone (GCTB) is a benign neo- plasm, which can sometimes be a diagnostic challenge, espe- cially in small biopsies, due to its histologic benign and malignant mimics. We evaluated the role of H3.3 G34W im- munohistochemistry (IHC) antibody in diagnosing GCTB and its role in differentiating it from its close histologic mimics. A total of 120 cases (80 cases of GCTB and 40 cases of histologic mimics) were retrieved and subjected to IHC. Of 80 cases of GCTB, 72 cases showed a positive nuclear immunoexpression, while all 40 cases of histologic mimics of GCTB showed a negative staining for H3.3 G34W IHC. Sensitivity and speci- ficity of this mutation-specific antibody for diagnosis of GCTB was 90% and 100%, respectively, while, the positive predictive value and the negative predictive value were 100% and 83.3%, respectively. A positive expression of H3.3 G34W was seen in all 5 cases of GCTB, postdenosumab therapy, as well as, in all 3 cases of malignant giant cell tumor. The presented study showed that H3.3 G34W mutation-specific IHC is a reliable and specific marker for GCTB and can help distinguish it from the histologic mimics due to distinct therapeutic implications.

202 Neoadjuvant chemoradiation in the management of high-risk adult soft tissue sarcoma: A single-center experience

Pinto I.[1], Dinis T. [1], Martins L. [1], Silva A.[1], Fonseca R.[2], Freitas J.[2], Tavares P. [2], Borrego M. [1], Casanova J.[2]
[1]Department of Radiotherapy, [2]Tumor Unit of the Locomotor Apparatus (UTAL), Centro Hospitalar e Universitário de Coimbra, Portugal

Introduction and Purposes: The role of neoadjuvant chemoradiation (NA-CRT) in the treatment of high-risk soft tissue sarcomas (HRSTS) remains unclear. In addition to early treatment of micro-metastasis, chemotherapy acts as a radiation-sensitizing agent offering promising results in disease control with tolerable toxicity. The purpose of this study was to analyze toxicity, local control and survival outcomes after NA-CRT.

Materials and Methods: Retrospective analysis of patients with HRSTS treated with NA-CRT followed by surgery between 2002-2022. Chemotherapy with Adriamycin 90mg/m2+Dacarbazine 900mg/m2±Vincristin 2mg bolus+Ifosfamide 10mg/m2 and radiation with 50-54Gy/25-30fr. Toxicity was evaluated using CTCAE v5.0 and survival outcomes by the Kaplan–Meier and log rank test. α=0.05.

Results: We included 17 patients, most male (70,1%) with a median age of 50 years (18-78). Tumors mostly located in the extremities (64,7%) with median length >10 cm (76,5%). Pleomorphic sarcoma in 29,4% and G3 in 76,5%. All patients completed treatment, with mainly hematologic toxicity (grade 1-2 in 58,8%). 52,9% developed radiation dermatitis (grade 1-2 in 47,1%). Wide excision was done in 58,8%, with R0 in 81,3%. Complete pathological response in 11,8%, necrosis ≥90% in 41,7%. Postoperative complications occurred in 41,2%, mostly related to wound healing. With a median follow-up of 59 months, the 5-year overall survival (OS) was 56,6%, disease specific survival (DSS) 62,3%, disease free survival (DFS) 52,3%, locoregional disease free survival (LRDFS) 92,9%. R0 resections led to significantly better LRDFS (50% vs. 100%, p=0.019).

Conclusions: This strategy is feasible, with high local control rates and manageable toxicity.

206 Completion of the Surveillance AFfter Extremity Tumor surgerY (SAFETY) 200 patient international randomized controlled trial: Feasibility metrics and the definitive trial

Ghert M.[1] on behalf of the SAFETY Investigators
[1] Department of Orthopaedic Surgery, McMaster University, Hamilton, Canada and University of Maryland, Baltimore, USA

Background: Following surgical resection of a high-risk extremity soft-tissue sarcoma (STS), between 40 and 50% of all patients will develop a local or distant recurrence. Earlier detection of a less advanced disease recurrence may prolong survival; therefore, intensive post-operative surveillance, especially of the lungs, is routine practice. However, the adverse effects of intensive surveillance must also be considered, including healthcare costs, false-positive results, the financial/emotional burden on patients, and unnecessary radiation exposure.

Methods: The Surveillance AFter Extremity Tumor surgerY (SAFETY) trial is an international multi-center randomized controlled trial (RCT) that addresses the following question: Does the frequency and mode of surveillance affect patient survival following extremity soft-tissue sarcoma (STS) surgery? Patients are randomized into one of four surveillance groups for the first two years of follow-up: (1) CXR every three months, (2) CT every three months, (3) CXR every six months, or (4) CT every six months. The primary outcome is overall survival at five years. The secondary outcomes include serious adverse events and patient reported outcomes. The SAFETY RCT pilot phase was designed to enroll 200 patients by January 2023 to confirm definitive study feasibility.

Results: At the time of abstract submission in February 2023, 205 patients have been randomized across 28 enrolling clinical sites in ten countries (Argentina, Australia, Austria, Brazil, Canada, Italy, Malaysia, the Netherlands, Spain, and the USA). An additional eight clinical sites are in the active start-up phase. Patient interest in the trial has matched or exceeded expectations and pilot study metrics (data quality, protocol adherence, and participant retention) support the feasibility of transitioning to the definitive study.

Conclusion: The SAFETY investigators have successfully demonstrated the ability to coordinate international RCTs through the PARITY trial and continue to do so in the SAFETY trial. The SAFETY pilot feasibility metrics support transition to the definitive study. Further expansion of the SAFETY international collaborative network will be critical for the recruitment of the 1000 patient SAFETY target sample size, and EMSOS members are encouraged to visit the study website at www.SAFETYrct.com to register as an investigator.

207 Central adjudication committee and clinical site investigator agreement on outcomes in lower extremity oncologic endoprosthetic reconstruction: A secondary analysis of the PARITY trial

Giglio V. [1], Slawaska-Eng D.[2], Gazendam A. [2], Kendal J.[3], Bernthal N. [3], Ghert M. [2]
[1]University of Limerick, Limerick, Ireland; [2]McMaster University, Hamilton, Ontario, Canada; [3] University of California, Los Angeles, Los Angeles California, USA

Background: The inherent subjectivity of a surgical site infection (SSI) diagnosis poses a challenge in the design of surgical trials as it may lead to outcome assessment bias when the primary outcome is a SSI. To counter this, Central Adjudication Committees (CACs) are often used to minimise the variability in outcomes assessment. In this study, we determined the agreement between the study CAC and the clinical site investigators in the primary and secondary outcome assessments in the context of a large randomized controlled trial (RCT).

Methods: This study is a secondary analysis of the Prophylactic Antibiotic Regimens in Tumor Surgery (PARITY) trial. PARITY was a large multicenter international blinded RCT that assessed the effect of a 5-day regimen of postoperative prophylactic intravenous antibiotics to a 1-day regimen on the rate of SSI in patients undergoing endoprosthetic reconstruction of the femur or tibia for oncologic indications. The blinded PARITY CAC adjudicated all potential primary and key secondary outcome events identified during the 1-year study follow-up. Cohen's kappa statistic was used to determine the level of agreement between the CAC and the clinical site investigators for the outcomes of SSI (primary), reoperations and antibiotic related complications (secondary).

Results: The primary outcome of SSI diagnosis demonstrated a substantial level of agreement (0.699 [95% CI, 0.595 – 0.803]) between the CAC and the site investigators. Categorization of the SSI (superficial, deep, organ space) showed moderate agreement (0.470 [95% CI, 0.382 – 0.558]). Secondary outcomes such as the types of reoperations and the indication for reoperation showed substantial to almost perfect agreement, whereas antibiotic related complications showed fair agreement as (0.241 [95% CI, 0.000 – 0.474]).

Conclusions: There was a substantial, however not perfect, level of agreement between the PARITY CAC and site investigators in the diagnosis of a SSI and the causes and types of reoperations. The type of SSI and the occurrence of an antibiotic related complication were frequently not in agreement. Therefore, the PARITY CAC was helpful in minimizing the variability in outcomes assessment in the PARITY trial.

208 Stewart-Treves syndrome : How far should we cut ?

Buteau P., Shumelinsky F., Donckier V., Kapanci B.
Surgical Oncology department, Institut Jules Bordet, Brussels, Belgium

Background: Stewart Treves syndrome (STS) is a rare angiosarcoma that may occur in a limb affected by chronic lymphedema. Globally, the pathogenesis, incidence, treatment management and prognosis of STS remain unclear.
This study aims to review the cases of patients diagnosed with STS in a tertiary cancer center and to evaluate their prognosis after treatment.

Methods: This is a retrospective study undertaken in the Institut Jules Bordet hospital, reviewing the patients treated for STS between 1980 and 2022. Patients with STS were identified from our pathology department database. Data obtained from electronic records included demographics, treatments (surgery, chemotherapy, radiotherapy), margins status, and incidence of local (LR) and distant recurrence. Progression-free survival (PFS) and overall survival (OS) were analyzed with the Kaplan-Meyer method.

Results: Eight patients with 9 STS were identified. All patients were women, with a mean age of 61 (53.7-68.53). Six patients presented lymphedema of the upper limb after axillary lymph node dissection for breast cancer; one had congenital lymphedema, and one was consecutive to inguinal lymph node dissection for vulvar carcinoma. Five (62.5%) patients underwent surgery as first line treatment. The mean follow-up was 57.5 (13.8-101.2) months. At least one LR occurred in 8 (88.9%) STS. The median number of LR was 4 (1.98-4.70). 3 patients (37.5%) developed metastasis. The median PFS was 6 (2-14) months. The median OS was 23 (9-64) months. Two patients are free of disease and alive at the end of the study period.

Conclusions: STS is a rare and aggressive disease with a poor prognosis. STS appears to occur as a late complication of chronic lymphedema, justifying long-term vigilance in those patients. Optimal treatment or therapeutic combination must be evaluated in larger studies or meta-analyses.

209 Use of synthetic bone graft PRO-DENSE(TM) in the surgical treatment of benign bone tumors

Vélez R.[1,2,3], García-Carrasco M.[1,2], Oleo-Taltavull R.[1], Lara Y.[1]
[1]Orthopaedic Surgery Department, Vall d'Hebron University Hospital, Universitat Autònoma de Barcelona, Barcelona, Spain; [2] Tumors and Reconstructive Surgery Unit, Orthopaedic Surgery Department, Vall d'Hebron University Hospital, Barcelona, Spain; [3] Musculoskeletal Tissue Engineering Group, Vall d'Hebron Research Institute. Universitat Autònoma de Barcelona, Barcelona, Spain

Background & objectives: Benign bone tumors are usually treated by intralesional curettage. There are many options for treatment of the residual bone defect. In recent years there has been a progressive increase in the use of synthetic bone grafts, such as PRO-DENSE TM (calcium sulfate and calcium phosphate). The aim of this paper is to illustrate our experience with the use of PRO-DENSE (TM).

Methods: Observational, retrospective study in which clinical data were obtained from patients treated by curettage and filling of the bone defect with PRO-DENSE (TM) in a tertiary hospital from 2017 to 2022.

Results: Thirty-three cases of benign bone tumors were obtained, with a mean age of 30 years old [9-64], treated with intralesional curettage and filled with PRO-DENSETM bone substitute. The most frequent diagnoses were enchondroma (8/33), fibrous dysplasia (7/33), aneurysmal bone cyst (4/33), essential bone cyst (3/33). The predominant location was femur (11/33), hands (8/33), tibia-fibula (5/33) and humerus (3/33). The mean size of the bone lesion in the anteroposterior plane was 46 mm in the longitudinal axis [2-115] and 29 mm in the transverse axis [2-60]. In terms of complications there were 3 cases of fracture (9%), 3 local recurrences (9%) and 2 infections (6%). The overall reoperation rate was 21%. The median time to full weight bearing was 4 weeks [0-12]. Time to radiographic bone substitute resorption was 2.7 months [0.5-10] for partial resorption and 6.2 months [2-18] for total resorption.

Conclusions: The use of PRO-DENSE is a viable option for the reconstruction of cavitary bone defects after intralesional curettage of primary benign bone tumors.

210 Total bone recellularization by perfusion: Preliminary results to a new protocol in tissue engineering

Evrard R.[1,2], Manon J.[1,2], Fieve L.[1], Cornu O.[1,2], Lengele B.[1,2], Schubert T.[1,2]
[1] Institut de Recherche Expérimentale et Clinique (IREC), UCLouvain, Brussels, Belgium; [2] Cliniques Universitaires Saint-Luc (CUSL), Brussels, Belgium

Introduction: In the field of limb salvage surgery, massive bone allografts have always been a difficult surgical option because of their high complication rate. Having demonstrated the in vivo superiority of perfusion-decellularized massive bone allografts, we wanted to go further in terms of tissue engineering. Indeed, if decellularized bone demonstrates better biological properties, bone recellularized with recipient stem cells should further increase the vitality and bone incorporation of the graft.

Methods: Two porcine femurs were decellularized using the same nutrient artery as in our perfusion-decellularization protocol. This method described by our team allows a complete decellularization of the bone (with the exception of the articular cartilage).
The bones were incubated in an individual custom-made bioreactor. This bioreactor allowed the bone to be immersed sterilely in standard proliferation medium for a minimum of one month. As the nutrient artery was still cannulated, we used it for cell seeding with continuous perfusion in a closed system. A total of 200 million pig's GFP-AMSCs (Green Fluorescent Protein-Adipose Mesenchymal Stem Cells) were injected into each bone at a frequency of two injections/week (when the medium is changed) for the first three weeks.

After 1 month of incubation, bones were prepared for GFP immunohistochemistry (IHC). Ki67 and Osteocalcin analysis are ongoing.

Results: The sterility of the graft was always maintained and its immersion was always assured.

IHC showed that the GFP-AMSC quickly attached themselves to the vascular and osseous collagen. We could observe living cells after 1 month. A lot of cellular debris were also visible around in large vessels, showing traumatic diffusion probably related to the different boluses. Furthermore, no osteoplast could be clearly identified as filled by a GFP cell. However, we observed areas where the majority of vascular lacunae, including the finest capillaries, were filled with GFP cells. Medullary space was also lightly filled with GFP-AMSC in irregular areas.

Conclusion: Our perfusion protocol allowed us to thoroughly decellularize a massive bone allograft. We have yet gone one step further and demonstrated the feasibility of recellularization by perfusion of MSCs. This protocol still has to be refined to achieve a total bone recellularization that could come closer to a living bone graft.

211 Case series: Option of healing with secondary intention is a valid treatment option - Not all wounds needs to close primarily or reconstructed. Sometimes doing less gives the patients more

Eyrique G. [1],Surendra S.[2], Serene S.[2] , Muhammad SI.[2], Noorriyanti FS.[2] , Riham H.[2] Arrazeen H.[2]
[1]Musculoskeletal Oncology unit, Orthopedic Dept. Hospital Kuala Lumpur, Malaysia; [2] Orthopedic and Traumatology Dept. Hospital Keningau, Sabah, Malaysia

This is a case reports of 2 cases done in out institution that a post resection we had opted for healing by secondary intention rather than na immediate skin coverage via SSG or reconstruction.

First case is a report of a patient who presented with a history of what resembled a skin-tag on the plantar aspect of his left foot, which later grew in 4 months, causing discomfort during ambulation. Little did we know that the growth was just the tip of the iceberg of a vicious malignant melanoma lurking underneath with metastasis. work up had been done for the patient. A wide surgical resection was performed and wound was left to heal via secondary intention. The aim of this report is to create awareness of early suspicious and detection of MM, which could lead to a better prognosis and the acceptance of post excision allowance for wound to heal via secondary intention healing.

The second case is a Dermatofibrosarcoma Protuberans (DFSP) is a rare soft tissue sarcoma characterized by plaque like tumor derived from mesenchymal cell. In this case, the patient with a gradual enlarging tumor over his left forearm for the past 10 years, started as a painless growth after a foreign body removal procedure. The tumor grew up to 16 x 11.5 cm during review by our institution. Wide Local Excision (WLE) was done without any skin reconstruction – to be healed by secondary intention.

Both the cases had been reviewed upto a year post surgery and patient presented with emaculate wound healing and scarring without recurrence and granulated till surface not causing excavating deformity - joint mobility around the wound is at full range without contractures.

Sometimes doing less is giving the patient more.

213 Giant atypical lipomatous tumors of the thigh: A case series

Ipponi E., Di Lonardo M., Bechini E., Cordoni M., D'Arienzo A., Capanna R., Andreani L.
Department of Orthopedics and Trauma Surgery, University of Pisa, Pisa, Italy

Introduction: Atypical Lipomatous Tumors (ALTs), also known as Well-Differentiated Liposarcomas (WDLPSs) are low-grade locally aggressive soft tissue tumors. Although metastases are exceptionally rare, these neoplasms have the tendency to grow and progressively increase their size, occupying a significant share of the volume in the compartment they arise from. Large sized ALTs of the thigh, in particular, can cause functional impairment of the surrounding muscles and potentially be responsible for external compression of major vessels and nerves, with negative implications for the lower limb's functionality. The treatment of choice for giant ALTs of the thigh is surgical resection with wide margins, which represents a challenging procedure especially if the neoplasm comes in proximity with noble structures such as large sized arteries and nerve trunks. The aim of our study is to assess risks and effectiveness of surgical resection, evaluating complications, local recurrences and post-operative functionality.

Methods: We present our experience with giant ALT (larger diameter of 10 cm or more) of the thigh that underwent surgical treatment in our institution between 2017 and 2022. Each patient's personal data and tumor size were evaluated alongside with their pre-operative functional status according to the MSTS score. The quality of surgical margins was analyzed. MRI scans were performed both pre-operatively and during patients' follow-up. Intra-operative and post-operative complications, as well as local recurrences were recorded. Patients' post-operative functionality was assessed using the MSTS score.

Results: Twentythree cases were included in our study. Tumors' mean major diameter was 19.1cm. The mean pre-operative MSTS score was 25.9. Surgical resection was performed with wide margins in 15 cases, while the approach resulted to be marginal in the remaining 8 cases. The only major post-operative complication reported in our cohort was a seroma, successfully treated with percutaneous drainage. Only 2 of our cases developed a local recurrence after surgery. The mean post-operative MSTS score was 29.1.

Conclusions: Our outcomes testify that careful surgical resection can be effective in treating giant ALTs of the thigh in reason of good functional outcomes, low complications risks and reasonable local recurrence rates.

214 Mid to long-term clinical results of the LUMiC® prosthesis for reconstruction after periacetabular tumor resection

Evenhuis RE. [1], Bus MPA.[1], Fiocco M. [2], Broekhuis D. [1], van de Sande MAJ.[1,3]
[1]Department of Orthopaedic surgery, Leiden University Medical Center, Leiden, The Netherlands; [2]Department of Biomedical Data Science, Section Medical Statistics and Bioinformatics, Mathematical Institute Leiden University, Leiden, The Netherlands; [3]Princess Máxima Center for Pediatric Oncology, Utrecht, The Netherlands

Background & Objectives : Previously, we reported promising early results for periacetabular tumor reconstructions with the LUMiC prosthesis. We now evaluate the mid-to long-term outcomes focusing on the cumulative implant survival and the reason for failure.

Methods: One hundred thirty-three patients with type 2 or 2/3 internal hemipelvectomy from 11 centers were included. Median age was 61 years (IQR 48-74) and median follow-up was 4.5 years (95%CI 3.8-5.2). Eighty patients (60%) were treated for a primary bone tumor, 37 (28%) for a osseous metastatic lesion. Complications were scored according to the Henderson classification.

Results: In total, 155 reoperations were performed among 69 patients (52%), of which 2/3th took place in the first 6 months. Ultimately 27/133 (20%) implant failures occurred, of which 2 (2%) recurrent dislocations (H1), 2 (2%) early aseptic loosening (H2A), 4 (3%) late aseptic loosening (H2B), 1 (1%) intraprosthetic dissociation (H3A), 2 (2%) peri-prosthetic fractures (H3B) at implantation, 9 (7%) early infections (H4A), 4 (3%) late infections (H4B) and 3 (2%) due to tumor progression (H5B). The cumulative incidence at 2, 5 and 10 years for mechanical (H1-3) implant failure was 4.3%, 6.5%, 8% and for infection (H4) this was 7.2%, 10%, and 10.8% respectively.

Conclusion: Mid- to long-term results are reassuring once the “critical” period of 6 months has passed since infection and dislocation are the most frequent cause of implant failure in this period. The uncemented LUMiC stem seems to be a durable reconstruction method with a low frequency of aseptic loosening. The primary LUMiC remains in situ in 106 (80%) patients at last follow-up.

Disclosure of interest : Our institution received an unconditional research grant from ImplantCast GMbH, Buxtehude Germany.

220 Diaphyseal endoprosthetic reconstruction for humeral metatstases. Experience in a provincial referral island hospital

Beirutti I. [1], Bongiovani D. [2], Antonili C. [3], Santana E. [4], Francés M. [5]
[1]Orthopaedic Surgery and Traumatology, Bone and soft tissue tumor Committe, [2]Pathological anatomy, [3]Oncology Medical, [4]Muscle skeletal radiology, [5]Plastic and reconstructive surgery, University Hospital of Gran Canaria, Canary Island, Spain

Introduction : Patients with pathologic diaphyseal humeral fractures, who are in a generally good condition and with life expectancy of more than 6 months, are expected to have positive surgical outcomes. An extensive literature has subsequently demonstrated that the intercalary prosthesis has many advantages, including immediate pain relief, early return to function, and preservation of the adjacent joints.

Methods: Patients with bone metastases in the diaphysis of the humerus, with pathological fracture, who had an indication for local resection and endoprosthesis reconstruction (MUTARS), whose decision in the tumor committee of the University Hospital of Gran Canaria estimated a life expectancy greater than 12 months were studied, from 2015 to 2020. Those patients with oligometastatic were included, whose basal situation corresponded to Karnofsky score 90-100pts prior to the fracture, who had adequate clinical control, and follow-up. The visual analog scale was used, and functional outcomes were evaluated using the Musculoskeletal Tumor Society (MSTS) score system UE, and complications were evaluated.

Results: 9 patients, 5 men and 4 women, with a mean age of 67.1 years; 2 patients with oligometastatic due to breast carcinoma, of which 1 was a man, and died with a 3-year follow-up, 2 renal cancer, 3 lung cancer histopathology, non-small cell carcinoma, and 2 patients with plasmacytoma. All patients changed VAS from 8 to 10 points preop to 1 or 2 points in the 72h mediate postoperative period, mean hospitalization from 48 to 72h. MSTS was excellent at 90% in one week. 5 of them received preoperative radiotherapy, and the mean bone resection length was 8.9cm.

Conclusions: Intercalary endoprostheses have a high rate of complications of the prosthesis, such as aseptic loosening, periprosthesis fracture, neurapraxia, and infection, have been reported. The indications humerus reconstructions vary greatly depending on the anatomic extent and need to be individualized for each patient's situation. Early recovery from a procedure or surgery, such as prosthetic intercalary reconstruction, with an adequate functional outcome, weighs up the overall life expectancy and plays in favour of a good overall situation in the multidisciplinary treatment of the bone cancer patient/oncology patient

221 Locking mechanism failure and complications in MUTARS distal femur and proximal tibia endoprostheses: Are there differences between PE, PEEK and MoM?

Evenhuis RE. [1], Nes J. [1], Bus MPA. [1], Prof. Fiocco M. [2], Broekhuis D. [1], van der Wal RJP. [1], van de Sande MAJ. [1,3]
[1]Department of Orthopaedic surgery, Leiden University Medical Center, Leiden, The Netherlands; [2]Department of Biomedical Data Science, Section Medical Statistics and Bioinformatics, Mathematical Institute Leiden University, Leiden, The Netherlands; [3]Princess Máxima Center for Pediatric Oncology, Utrecht, The Netherlands

Background & Objectives: Over the years, the locking mechanism of MUTARS knee replacements has changed from polyethylene (PE) to PEEK-Optima (PEEK) and metal-on-metal (MoM) in an attempt to reduce the risk of mechanical implant failure. In this study, we assessed the cumulative incidence of locking mechanism failure per type of material, and potential risk factors for hinge failure.

Methods: We retrospectively reviewed 168 patients (60% males) with a MUTARS knee replacement performed between 1996-2022. Median age was 38 years (IQR 20-63). Median follow-up was 10.6 years (95%CI 8.4-12.8). Thirty-nine (23%) had a PE, 22 (13%) a PEEK-Optima, and 88 (52%) a MoM locking mechanism. A competing risk model with patient mortality and other failures was used to estimate the cumulative incidence of locking mechanism failure.

Results: Locking mechanism failure occurred in 19 patients, 6/39 (15%) of PE, 2/22 (9%) of PEEK and, 11/88 (13%) of MoM hinges. The cumulative incidence of hinge failure at 2, 5, and 10 years was 3%, 8%, and 13% for the PE group (n=6/39), 0%, 5%, and 5% for the PEEK group (n=2/22), and 0%, 4%, and 12% for the metal-on-metal group (n=11/88). Median time till locking mechanism failure was 7.5 years (IQR 3.9-10.3). No clear association was found between hinge failure and locking mechanism material, resection length, BMI and age.

Conclusion: Locking mechanism failure was, and still is, a topical issue since no difference is observed in locking mechanism failure over the past decades. Improvement of the locking mechanism is warranted since revision of the locking mechanism could expose subjects to (serious) secondary complications.

Disclosure of interest: Our institution received an unconditional research grant from ImplantCast GMbH, Buxtehude Germany.

223 Fear of cancer recurrence among childhood cancer survivors and their parents: A systematic review

Bruseker A., Meelen TS, Bramer JAM.
Amsterdam UMC, University of Amsterdam, Orthopaedics and Sports Medicine, Cancer Center Amsterdam, Amsterdam Movement Sciences, Amsterdam, The Netherlands

Background & Objectives: Primary bone tumours in the lower extremity mostly affect children and adolescents. After diagnosis, several arduous decisions must be made regarding surgical treatment. During follow-up, fear of cancer recurrence(FCR) may cause psychological distress and decrease quality of life(QoL). More information about FCR may allow for the development of strategies that optimize rehabilitation, increase QoL and decrease FCR associated burdens. Therefore, the objectives of this review were (1)to determine the prevalence of FCR in childhood cancer survivors(CCS) and their parents, (2)to determine FCR severity and (3)to determine the impact and effects of FCR.

Methods: A systematic literature review was conducted according to the PRISMA statements. PubMed was searched for studies reporting FCR data in CCS or their parents. Quantitative and qualitative syntheses were conducted.

Results: Seventeen studies were included(CCS=2556, parents=1172). The prevalence of FCR in CCS ranged from 25-89% and in parents 81-87%. FCR was more prevalent in adult CCS(81.2%) compared to adolescent and early young adult CCS(37.4%). Severe FCR in CCS and parents was present in 11.3% and 13.6%, respectively. The pooled mean FCR transformed to a 0-4 scale was 1.5±0.8 in CCS and 1.8±0.8 in parents. Symptoms, social cues and medical exams triggered FCR and increased severity. A high FCR was associated with lower QoL. FCR caused a decrease in self-examinations in some patients.

*Conclusion :*FCR prevalence was high, is relatively often severe and negatively affects QoL. This suggests the importance of early recognition and discussion of FCR during follow-up.

226 Study of the spatial heterogeneity of the osteosarcoma microenvironment in the resistance to treatment by digital pathology

Gomez-Brouchet A.[1], Mancini A. [2], Swider P. [2], Assemat P. [2]
[1]Département of Pathology, University Hospital of Toulouse, Toulouse, France; [2] Institut Mécanique des Fluides de Toulouse, CNRS, Toulouse, France

Introduction : osteosarcoma (OST) is characterized by a chaotic genome and a tumoral extracellular bone matrix (ECM), which are responsible for a multiscale spatiotemporal intratumoral heterogeneity. Digital pathology, by linking tissue structure and biology, allows to study at the tissue scale, the interactions between cells and the ECM, and to understand the mechanisms involved in the resistance to treatment.

Objectives : To develop a methodology inspired by porous media approaches, to study structural markers of intratumoral spatial heterogeneity including cell phases and ECM and To establish geometrical correlations between the spatial distribution of the microenvironment cells identified by immunohistochemistry and the bone phase, on 8 OST surgical specimens obtained after chemotherapy with the aim of orienting the post-surgical therapeutic strategy

Results : on the cell density maps, CD8 levels are low whatever the response to treatment. CD163 are numerous in all patients . Large CD68 osteoclasts are more numerous in MRs (distributed over the whole slice) than in BRs, located in contact with the bone trabeculae, suggesting their recruitment in BRs, to resorb the bone matrix formed in the tumor. The local correlation maps are very heterogeneous whatever the staining in MRs without any identified trend; on the contrary, in BRs, there is a negative correlation for CD163/CD68 (small cells), suggesting their recruitment in bone areas.

Conclusion : he original digital pathology methodologies developed here show that CD163 and CD68 small macrophages play a crucial role in the response to treatment and corroborate the interest in developing targeted therapies of the macrophagic microenvironment.

228 When and which reverse shoulder arthroplasty (RSA) should be used in tumor surgery?

Spazzoli B., Onofri A., Ostetto F., Bubbico E., Focaccia M., Tuzzato G., Bianchi G., Donati DM.
Orthopaedic Oncology Unit, IRCCS Istituto Ortopedico Rizzoli, Bologna, Italy

Introduction: In proximal humerus resection for bone tumours, when axillary nerve could be preserved, we usually select allograft composite prosthesis (APC) as reconstructive option for young patients. In adults, due to poor quality of rotator cuff, RSA may be preferred as primary implant, either with allograft or modular reconstruction. In our hand, a series of failed APC or modular endoprosthesis were then revised turning them in an RSA. The aim of this study is to evaluate the whole RSA patient group, to define when it should be implanted.

Methods: We performed a retrospective analysis on 18 patients who underwent RSA from 2006 to 2021. Mean age was 43 (16 – 70); Mean follow up 80 months (12 – 197). Nine RSA were made as primary implants, among them 6 modular and 3 with allograft. While the other 9 cases were implanted as revision cases: 7 after failure of OA allograft and 2 after loosening of a modular endoprosthesis. Mean resection length was 10.5 cms.

Results: Overall implant survival was 83% at 1 year, and 64% after 5 years. No significant difference in implant survival was reported among primary or revision cases (66% vs 65%). Whatever primary or revision cases, among 9 composite reconstructions only 1 case failed (11%), while in the modular group 4 by 9 cases failed (44%). Survival rate at 5 years was 88% for composite RSA, while 32% for modular RSA 32% (p=0,0486).

Conclusions: In most cases, composite RSA should be considered the best option as primary implant. However, this option can be applied also in revision cases after a previous OA allograft, APC or modular endoprosthesis.

229 **Work of a nurse practitioner in the princess maxima center**
Working together, multidisciplinary

Ros M., Walstijn L., Beekman L.
Princess Máxima Center for Pediatric Oncology, Utrecht, The Netherlands

Work of a nurse practitioner in the princess maxima center

- Daily work of a nurse practitioner in the hospital (telephone, punctures, day treatment / outpatient clinic)
- Case manager for patients with a bone tumor and guidance throughout the treatment
- Involvement with bone tumor patients en his / her family
- Involvement with shared decision making
- Alignment with home care (in case of problems, wound checkings)

Working together, multidisciplinary

- Preliminary discussion surgical patients
- Multidisciplinary consultation

230 Post-operative minimal residual disease models to study metastatic relapse in soft-tissue sarcoma patient-derived xenografts

Fischer S.[1,2,3], Creytens D.[3,4], De Vlieghere E.[1,3], Bekaert S.L.[3,5], Durinck K.[3,6,7], Van Roy N.[3,5,6], Hendrix A.[1,3], Lapeire L.[3,8], Sys G.[3,9], De Wever O. [1,3]
[1]Laboratory of Experimental Cancer Research, Department of Human Structure and Repair, Ghent University, Ghent, Belgium. ; [2]Department of Gastro-Intestinal Surgery, Ghent University Hospital, Ghent, Belgium; [3]Cancer Research Institute Ghent, Ghent, Belgium; [4]Department of Pathology, [5]Department of Biomolecular Medicine, Ghent University, Ghent, Belgium; [6]Pediatric Precision Oncology Lab, Ghent University, Ghent, Belgium; [7]Centre for Medical Genetics, [8]Department of Medical Oncology, [9]Department of Orthopedics and Traumatology, Ghent University Hospital, Ghent, Belgium

Background: Despite optimal treatment of primary soft tissue sarcoma, 50-80% of patients metastasize, even if minimal residual disease (MRD) was attained. There is a great need for preclinical models simulating MRD to better mimic patient disease progression.

Methods: Primary tumours and metastases from 5 sarcoma patients were transplanted in mice (patient-derived xenografts, PDX). Genetic, radiological and histological analysis quantitatively assessed primary tumour take/growth, MRD after tumour resection and spontaneous metastasis formation. The impact of the site of transplantation (subcutaneous vs. orthotopic) and immunodeficiency status (Swiss nu/nu vs. NSG) were compared. Spontaneous PDX metastasis were retransplanted in NSG mice and evaluated for tumour growth and disease progression.

Results: Radiological assessment revealed highest tumour take and spontaneous metastasis ratio in orthotopic NSG mice. Metastasis formation after a period of MRD was significantly affected by implantation site ($p=0.016$, $p=0.043$). Copy number variations and immunohistochemical characteristics of the original tumors were maintained. Stromal characteristics were better preserved after orthotopic transplantation. Retransplantation of PDX-metastasis showed poorest outcome, characterized by most efficient take rates and metastasis formation.

Conclusion: Orthotopic implantation in NSG mice followed by primary tumour resection reflects the patient's clinical situation and can be used to assess the impact of therapies on disease progression.

231 Mechanical failure of distal femur megaprosthesis due to a PEEK based lock mechanism

Sternheim A. [1], Factor S. [1], Gortzak Y. [1], Dadia S. [1], Segal O[1], Busari A. [2], Merose A. [1]
[1] National Unit of Orthopaedic Oncology, Tel Aviv Medical Center and Sackler Medical Faculty at Tel-Aviv University, Tel Aviv, Israel; [2] Material Failure Analysis Lab, Ben Gurion University, Israel

Introduction: The utilization of Polyaryl-ether-ether-ketone (PEEK) as a substrate for orthopedic hardware, due to traits such as, heat and deformation resistance, low weight and ease of manufacturing, has widened in recent decades. We report a relatively high failure rate of a PEEK lock based distal femur reconstruction system. We sought to evaluate the proportion of patients who experienced prosthesis failure, analyze the mechanism of failure and document the associated clinical findings.

Methods: A retrospective cohort study was performed, evaluating the medical charts of 56 patients who underwent distal femur resection and reconstruction with a PEEK lock based prosthesis between 2004 and 2018, finally including 46 patients. A clinical and biomechanical failure analysis was concurrently performed. Log-Rank test an univariate Cox Regression were applied to study the association with PEEK failure of the categorical and continuous variables respectively. Multivariable analysis was performed using the Cox Regression model.

Results: 21 of 56 (37.5%) patients experienced failure of the PEEK component. The mean time to failure was 63.5 months. We found a statistically significant relation between patients weight and PEEK component failure, HR (95% CI) 1.06, p=0.002. Mean body weight for patients who experienced PEEK component failure was 77.5 Kg (SD 15.927 Kg) and 63.64 (SD 23.615 Kg) for the patients that did not experience component failure. Failed PEEK implants were analyzed after retrieval to understand and present in figures the root cause of failure.

Discussion: PEEK lock based distal femur reconstruction system failure is related to patients weight according the statistical analysis and to inappropriate machining as well as inadequate quality control during the production process, according the biomechanical analysis. We are currently not using the system for primary reconstruction. The use of PEEK based weight bearing articulating components should be further assessed utilizing larger cohort prospective studies.

234 Clinical significance of DNA methylation status in soft tissue sarcomas

Joo MW. [1], Kim H. [2], Park HS. [3], Yoo C-Y. [3], Kim SH. [4], Lee JH. [4], Lee SK. [5]
[1] Department of Orthopaedic Surgery, [2] Division of Medical Oncology,
[3]Department of Hospital Pathology, [4]Department of Radiation Oncology,
[5]Department of Radiology, St. Vincent's Hospital, College of Medicine, The Catholic University of Korea

Background & Objectives: Regardless of the histologic subtype and grade, doxorubicin-based chemotherapy has commonly been applied for advanced soft tissue sarcomas. However, the prognosis is poor in cases with recurrence or metastasis. In order to develop novel treatment strategies, it is necessary to further understand the molecular biology of soft tissue sarcomas. Recently, sarcoma classification according to DNA methylation profiling has been proposed and verified. This study aims to analyze epigenetic changes observed in soft tissue sarcomas, focusing on DNA methylation, and to find relevant clinical implications.

Methods: We retrospectively reviewed the medical records of patients with soft tissue sarcoma in the musculoskeletal tumor registry and analyzed DNA methylation status from the tissue samples of the patients stored at the biobank by using Illumina Infinium® MethylationEPIC kits. Sample processing and analysis were performed according to the protocol provided by the manufacturer. The normal control group included samples from normal tissues collected at the time of soft tissue sarcoma surgery.

Results: A total of 39 samples from 34 sarcoma patients were obtained, of which 5 samples were normal controls. Liposarcoma and leiomyosarcoma were the most common, and most were AJCC stage III. In the hierarchical cluster analysis, it was demonstrated that normal controls and soft tissue sarcoma group were distinguished in DNA methylation pattern. Within the soft tissue sarcoma, the different subtypes of liposarcoma and leiomyosarcoma were also separated. Furthermore, it was observed that the DNA methylation status of sarcomas with histologic grade 2 and grade 3 was also differentiated.

Conclusions : In cases that is difficult to determine whether those are benign or sarcoma, DNA methylation analysis can help improve the accuracy of the diagnosis. In addition, the difference in DNA methylation pattern and gene expression according to histologic grade of sarcomas suggests the need for further research on the role of DNA methylation as a prognostic and predictive biomarker, and a target for treatment.

235 The clinical outcomes of using bioactive glass and tricalcium phosphate in the surgical treatment of benign bone tumors

Okay E. [1], Sarikas M. [2], Demiroz S. [3], Kanay E. [1], Ozkan K. [1], Gurkan V. [2]
[1]Department of Orthopaedics and Traumatology, Istanbul Medeniyet University Goztepe Prof.Dr.Suleyman Yalcin City Hospital, Istanbul, Turkey; [2]Department of Orthopaedics and Traumatology, Kocaeli University Faculty of Medicine, İzmit, Kocaeli ; [3]Department of Orthopaedics and Traumatology, Bezmialem Vakif University Faculty of Medicine, Istanbul, Turkey

Background & Objectives: Benign bone tumors are usually treated by curettage. and bone grafting. There are many options for filling the resultant defect. Bioactive glass is becoming more commonly used for this purpose. This study aims to compare the clinical outcomes between bioactive glass and tricalcium phosphate.

Methods: A total of 48 patients (26 patients with bioactive glass, 22 patients with tricalcium phosphate) with benign bone lesions were retrospectively evaluated. After the surgery, all patients were followed up at least 6 months for the clinical and radiological assessment.

Results: The average age was 42 years (9-69 years) for the tricalcium phosphate group and 36 years (6-66 years) for the patients treated with bioactive glass. The average graft volume used was 26 cc (5-90 cc) for the tricalcium phosphate group and 16 cc (5-40 cc) for the bioactive glass group. The mean follow-up was 15 months (12-20 months) for bioactive glass group and 8 months (6-10 months) for tricalcium phosphate group. Plate fixation was performed in 13 patients (11 in bioactive glass group, 2 in tricalcium phosphate group). 18 tumors (8 tricalcium, 10 bioactive glass) were located in upper extremity. 29 tumors (13 tricalcium phosphate, 16 bioactive glass) were located in lower extremity. One lesion was located at sacrum. 4 cases had transient wound drainage. One patient had reoperation due to recurrence.

Conclusion: The surgical treatment of small and medium sized lytic benign tumors has good results with both types of graft that were studied. Using bioactive glass as bone void filler shows a good alternative to tricalcium phosphate.

238 Functional outcome of Pirogoff amputation. About two cases

Manrique E. [1], García-Maroto R.[1], Buendía J. [2], Escobar D. [3], Cebrián JL.[1]
[1] Orthopaedic Surgery and Traumatology, [2] Plastic Surgery, Musculoesqueletal Sarcomas Department. Hospital Clínico San Carlos, Madrid, Spain; [3]Orthopaedic surgery and Traumatology. Lower Limb department. Hospital Infanta Leonor, Madrid, Spain

Background: Pirogoff amputation refers to the osteoplastic amputation distal to the ankle joint, talus resection and bone fusion of the tibia and the calcaneus. Its advantages are as follows: less loss in limb length, the possibility of full weight bearing, and the use of a more anatomical prosthesis. Transmetatarsal or Chopart/Syme amputations often result in poor clinical outcomes.

Objective: To show that the Pirogoff amputation is an alternative to the treatment of foot tumors whose reconstruction is highly complex with doubtful functional results.

Methods: Two cases of sarcomas of the foot. One man 54 years old and one woman of 77. The etiology were synovial sarcoma and sclerosing rhabdomyosarcoma respectively in which reconstruction would entail a long recovery period with little chance of adequate functionality.
A pirogoff amputation and fixation with two screws was performed.
In both cases, progressive partial loading with crutches was authorized according to tolerance at three weeks postoperatively.

Results: The average functional score (MSTS) of the patients was 22 points in both cases.
They needed a crutch for long distances used a cosmetic shoe.
At three months after surgery, they presented radiological consolidation.

Conclusions: This treatment is proposed as an alternative to traditional amputation levels, particularly in cases in which, due to the sarcoma, foot reconstruction is not possible and therefore the possibility of a less radical and less limiting procedure is considered.

Tibiocalcaneal Pirogoff arthrodesis can be a surgical alternative in forefoot and midfoot destructions to achieve a well-covered, comfortable stump with a minimum of leg-length shortening that is easy to fit with a prosthesis and even allows some limited barefoot mobility. This can be considered a treatment of choice, leading to an optimal functional outcome.

245 Physiotherapy treatment and early recovery of oncological patients after lung metastatic wedge resection. An observational study

Cotti M., Venturini E., Ruggiero A. , Abbruzzese A. , Guerrini C. , Peccerillo V. Culcasi A.
RIZZOLI Orthopedic Institute, Medicina Fisica e Riabilitativa, Bologna, Italy

In Italy every year are diagnosticated approximately 500 new cases of bone cancer and the most common site of metastasis are lungs. Whenever is possible, the gold standard treatment consists in an ablative surgery. According to the position and the dimension of the metastasis the goal of the surgery is to minimize tissues removal.

In multidisciplinary approach, physiotherapy treatment is considered important to prevent post-surgical pulmonary complications, to reduce pain, to recover respiratory volumes and pre-operative functional performance. In literature, physiotherapy treatment provided after thoracic surgery included several approaches as Active Cycle of Breathing Technique (ACBT), breathing exercises with incentive spirometer and early ambulation.

We decided to asses functional outcomes with the “One minute sit to stand test” (1MSTST). The 1MSTST is valuable alternative to 6MWT to estimate functional exercise performance in pulmonary patients. It consist in counting how many times the patient is able to stand up from a chair and sit back in one minute time.

The aim of this presentation is to describe the rehabilitation program after wedge resection surgery for patients with bone cancer metastasis, focusing on functional and breathing performance during hospitalization and at 3 and 6 months follow-up.

246 Preclinical evaluation of previously identified targets for fluorescence-guided surgery in paediatric Ewing sarcoma

Rijs Z. [1], Jeremiasse B. [2], Hiemcke-Jiwa L. [3], Sier C. [4], van Driel P. [5], van der Steeg A. [2], van de Sande M. [1]

[1] Department of Orthopedic Surgery, Leiden University Medical Center, The Netherlands; [2] Department of Surgery, [3] Department of Pathology, Princess Maxima Center for Pediatric Oncology, The Netherlands; [4] Department of Surgery, Leiden University Medical Center, The Netherlands; [5] Department of Orthopedic Surgery, Isala hospital, The Netherlands

Background & Objectives: Ewing sarcoma (ES) is an aggressive bone and soft-tissue tumor. Treatment consists of chemotherapy followed by surgery with- or without radiotherapy1. Intraoperative distinction between healthy and tumorous tissue is challenging, especially after chemotherapy and at complex anatomical locations. Targeted fluorescence-guided surgery (FGS) can facilitate complete and less mutilating tumor resections by visualizing tumor tissue during surgery. This can be done with a tumor-specific target, a targeting moiety conjugated to a fluorophore (tracer), and a dedicated camera system2. A systematic review selected CD99, CXCR4, NPY-R-Y1, LINGO-1, IGF-1R, and CD117 as promising targets for FGS of ES3. This study aims to evaluate these targets for FGS in ES.

Methods: Immunohistochemical (IHC) staining with monoclonal antibodies against the previously selected targets were performed on ES biopsies (n=13) and resection specimens including surrounding healthy tissue (n=8). Subsequently, specific binding of fluorescent tracers to targets that showed good IHC results were evaluated in-vitro on human ES cell lines (A673 and RD-ES) with flow cytometry and immune-fluorescence microscopy.

Results: IHC analysis showed strong CD99 expression in all and variable CD117 expression in a subset of ES tumors, while staining of normal tissue was minimal. CXCR4, NPY-R-Y1, LINGO-1, and IGF-1R did not show promising IHC results and were excluded. Corresponding to IHC results, flow cytometry and immune-fluorescence microscopy displayed strong CD99 and lower CD117 expression in ES cells.

Conclusion: This study demonstrates good potential for CD99 as a target for FGS in ES.

References:

1. Gaspar et al. (2015). Ewing Sarcoma: Current Management and Future Approaches Through Collaboration. Journal of clinical oncology: official journal of the American Society of Clinical Oncology, 33(27), 3036–3046. https://doi.org/10.1200/JCO.2014.59.5256

2. Hernot et al. (2019). Latest developments in molecular tracers for fluorescence image-guided cancer surgery. The Lancet. Oncology, 20(7), e354–e367. https://doi.org/10.1016/S1470-2045(19)30317-1

3. Bosma et al. (2018). Introducing fluorescence guided surgery into orthopedic oncology: A systematic review of candidate protein targets for Ewing sarcoma. Journal of surgical oncology, 118(6), 906–914. https://doi.org/10.1002/jso.25224

247 Motor replacement after neoadjuvant radiotherapy in upper limb sarcoma surgery - what point of time is reasonable?

Spiegel C., Weschenfelder W., Müller M., Hofmann GO.
Trauma-, Hand- and reconstructive- Surgery, University Hospital Jena, Jena, Germany

Background & Objectives: Resection of soft tissue sarcoma including wide margins in the upper limb may cause loss of motoric function of forearm and especially the hand due to the quality of resection relating to Disease-Free- and Overall-Survival. Furthermore neoadjuvant radiotherapy causes higher rates of soft tissue infection and wound healing problems.

Methods: We present a case of a 61-year-old woman with a painless progressive swelling in the proximal dorsal left forearm in a timeline of 3 months. After MRI and core needle biopsy a high grade (G3) sarcoma was detected. A neoadjuvant radiotherapy was implemented with a total dose of 60Gy. The resection included the extensor digitorum muscle bundle (R0-resection) with postoperative loss of extension of all digits except the forefinger and thumb of the left hand. Follow-up after 3 months demonstrated no recurrence on MRI. An operative motor replacement with distal resected flexor carpi ulnaris (FCU) muscle was performed 4 months after prior resection. Postoperatively Motor functional therapy and Mirror therapy were performed.

Results: 16 weeks after motor replacement the patient is back at work as a secretary with a nearly physiological function of all fingers. The range of motion is almost age appropriate. No wound healing problems are noticed.

Conclusion: Despite wound healing problems and higher rates of soft tissue infections after neoadjuvant radiotherapy, motor replacement is a valid method to rebuilt loss of muscle and resulting function deficits. No special antibiotic prophylaxis is recommend.

248 Targeted therapy in sarcoma treatment by gene sequencing – new opportunities and higher precision

Müller M., Weschenfelder W., Spiegel C., Schrenk KG., Hofmann GO.
Trauma-, Hand- and reconstructive- Surgery, University Hospital Jena, Jena, Germany

Background & Objectives: The increased use of genetic diagnostics in cancer has found specific translocations and fusions in sarcomas. Currently, the targeted therapy derived from this is still little used, but its importance will increase in the future.

Methods: We present the case of a 32-year-old man who developed a painless mass on the distal dorsal left humerus within 6 months. MRI and core needle biopsy showed a high-grade RET::TRIM33 fusion gene-associated pleomorphic sarcoma. The patient received a neoadjuvant therapy with selpercatinib for a period of four weeks with immediate clinical shrinkage of the tumour. MRI proofed a final reduction of the tumour by 90 % of the original size. This allowed for a smaller extent of resection with negative margins, sparing parts of the distal triceps brachii muscle. Adjuvant therapy with selpercatinib and local radiotherapy with a total dose of 60Gy followed.

Results: 12 weeks after tumour resection and completed adjuvant therapy, the patient is still undergoing rehabilitation. MRI follow-up showed no recurrence. Range of motion is not impaired except for active elbow extension. Surgical motor replacement has not been necessary yet.

Conclusion: Targeted neoadjuvant and adjuvant therapy of sarcomas associated with gene fusion detected by gene fusion sequencing could be an effective tool to support less invasive resection of functional soft tissue in sarcoma surgery. In addition, there is the possibility of better local control and overall survival in patients with high-grade sarcomas.

251 Natural history of solitary osteochondroma: Review of 103 cases of solitary osteochondroma

Sungmin K., Sung-Taek J.
Department of Orthopedic Surgery, Chonnam National University Hospital, Gwangju, Republic of Korea

Background: Osteochondroma can arise as a solitary lesion or as part of an inherited condition known as multiple hereditary exostosis (MHE). The spontaneous regression of solitary osteochondroma was first introduced in 1835. The spontaneous regression of osteochondroma is considered a rare phenomenon and statistical analysis of the spontaneous regression of osteochondroma has been performed. This study was designed to analyze the occurrence of the spontaneous regression of osteochondroma. We retrospectively reviewed cases of solitary osteochondromas in our institution with more than 2-year follow-ups.

Materials and Methods: We retrospectively reviewed 244 cases of osteochondroma in patients with osteochondroma in our institution from August 1998 to August 2019. Nineteen patients with multiple exostosis and 121 cases with less than 2-year follow-ups were excluded. One hundred three cases with solitary osteochondroma were reviewed. We compared the risk factors in the spontaneous regression group to those in the non-regression group. The risk factors included age, sex, anatomical location, morphological type, and the height and base width at the maximal tumor size during follow-up. Univariable and multivariable logistic regression analysis were performed to compare the parameters.

Results: The mean follow-up duration was 5.5 years. Seventeen (16.5%) cases showed spontaneous regression, 16 cases of sessile-type osteochondroma and one case of pedunculated-type ($p = 0.042$). Osteochondromas located at the distal femur and the humerus were more likely to show regression compared to osteochondromas located in other locations ($p = 0.004$). Sex, age at diagnosis, and the height and base width of the osteochondromas did not show differences between the regression group and the non-regression group.

Conclusion: The spontaneous regression of osteochondroma is not as rare as previously reported. The spontaneous regression of sessile-type solitary osteochondromas located at the distal femur or proximal humerus was common.

252 The prognostic value of the modified Glasgow prognostic score in the management of patients with chondrosarcoma : A multicentre study

Ben-Gal O.[1], Doonan J.[1], Cosker T. [2], Kenneth R.[3], Stevenson J.[4], Cribb J.[5],Baker G. [6], Pollock R. [7], Gupta S. [1]

[1]Glasgow Royal Infirmary, Glasgow, UK; [2]Nuffield Orthopaedic Centre, Oxford University Hospital Foundation Trust, UK; [3]The Newcastle Upo,n Tyne Hospitals, UK

[4]Royal Orthopedic Hospital, Birmingham, UK; [5]The Robert Jones and Agnes Hunt Orthopaedic Hospital, UK; [6]Musgrove Park Hospital, Northern Ireland, UK; [7]Royal National Orthopaedic Hospital, Stanmore, UK

Aims: The prognostic role of systemic inflammatory biomarkers in patients with Chondrosarcoma remains unclear and evidence is lacking. mGPS is an inflammation-based prognostic score consisting of preoperative CRP and albumin that is validated in multiple carcinomas and its use in STS is also recommended. This national multicenter study aimed to investigate the prognostic significance of preoperative systemic inflammatory biomarkers and primarily the mGPS in the prediction of Chondrosarcoma patient survival.

Method: Patients who underwent an elective resection of primary or secondary chondrosarcoma between January 2006 and December 2020 were identified from prospectively maintained databases of seven collaborating bone sarcoma units in the UK. Laboratory and clinical data as well as oncologic outcomes were collected from the patient's record with a minimum of 2 years of follow-ups. Data were analyzed using uni- and multivariate analysis.

Results: A total of 549 patients were included in our study. We found that increased mGPS, tumour grade, size, age, local recurrence, metastasis, inflammatory markers and ratios apart from WBC, were significantly associated with reduced overall survival. mGPS was able to stratify the OS of patients in all grades of chondrosarcoma, especially when divided into groups 0 and 1 or 2.

Conclusion: Our finding indicates that inflammatory markers and mGPS score strongly correlated with the survival of chondrosarcoma patients. We recommend its use in the early assessment of chondrosarcoma patients to better stratify prognosis, reinforce decision making and improve clinical outcomes.

253 Retrospective analysis of bone metastasis resection and reconstruction with megaprosthesis

Puertas JP., Valcárcel A., Valero G., Fernández JA., Salcedo C, Martínez G.
Hospital Universitario Virgen de la Arrixaca, Murcia, Spain

Objectives: To evaluate the impact of megaprosthesis on survival and quality of life in oncologic patients with bone metastases, as well as the possible complications derived from it.

Material and Methods: A retrospective study of 34 patients with bone metastases in femur, tibia and humerus, surgically treated by radical tumor resection and subsequent reconstruction with megaprosthesis, at the Hospital Universitario Virgen de la Arrixaca (Murcia-Spain), between January 2015 and April 2022, was performed. The SPSS program was used to evaluate the overall survival of the sample using the Kaplan Meier method, the rate of implant failure as well as the occurrence of post-surgical complications according to the Henderson classification and the functional results obtained, according to the Musculoskeletal Tumor Society Scale (MSTS).

Results: Implant survival was 100% and three patients presented Henderson complications. Overall patient survival was 62.8% at 1 year, 43% at 2 years and 25.6% at 5 years, with an overall mean of 33.59 months (Table 2). The mean MSTS value was 26.58.

According to the anatomical location of the metastases (Table 3), survival of patients with lesions in the femur was 64% at 1 year, 48% at 2 years and 23% at 5 years. In those with lesions in the humerus it was 53% at 1 year, 21% at 2 years and 11% at 5 years. In cases of tibial injury, survival at 5 years was 100%.

Conclusions: The mega prosthesis has been shown to increase the quality of life and survival of patients with bone metastases, being a valid option for limb-sparing surgery. However, this method is not free of complications and should be closely monitored.

254 Primary thoracic wall malignancy in children, outcome after surgical treatment and options for functional evaluation

Bekkering W.P., Fremouw L.M.M.
Máxima sports & movement center. Princess Máxima Center for paediatric oncology, Utrecht, The Netherlands

Introduction: Primary thoracic wall malignancy is a rare aggressive and diverse entity in children and account for less than 2% of solid tumours in paediatric cancer patients. Ewing sarcoma is the most common malignant histology followed by osteosarcoma and rhabdomyosarcoma. Multimodal treatment of paediatric chest wall tumours includes a combination of chemotherapy, surgery and/or radiation. The resection of the tumour and the subsequent reconstruction of the chest wall is a surgical challenge causing large defects requiring complex reconstruction. Advances in cancer therapy have improved short- and long-term survival but significant functional and cosmetic challenges remain particularly for large chest wall defects in the very young. A limited number of studies have been published concerning the functional outcome of young patients after thoracic wall surgery due to paediatric cancer.

Aim of the study is to review the literature on outcome of thoracic wall surgery due to paediatric cancer and to indicate the most important outcome domains en instruments. Secondly composing a core set to evaluate survivors.

Method: Literature search / review on thoracic wall surgery due to paediatric cancer (Outcome & Measures)

Results: 14 articles were selected after reading full-text and included. Complications of surgical resection and reconstruction can include scoliosis, cosmetic disfigurement, chronic pain and activity restriction due to inadequate thoracic protection. Adverse effects of radiation can include pulmonary or cardiac dysfunction, functional impairment, secondary malignancy, and chest wall hypoplasia, especially when exposed in the prepubertal age group. The late effects of chemotherapy in children include increased risk of developing cardiac, endocrine, or musculoskeletal conditions, as well as second malignancies.

Conclusion: Based on the findings of the literature search a core set for functional evaluation has been conducted.

255 Complex clinical evaluation of the patient treated with oncologic shoulder replacement - the follow up of 31 cases

Zacha W., Bohatyrewicz A.j, Ziętek P., Szczypiór-Piasecka K., Kotrych D.
Department of Orthopedics, Traumatology and Orthopedic Oncology,
Pomeranian Medical University of Szczecin, Szczecin, Poland

Background: Shoulder gridle is the third most common location of primary bone tumor occurrence and the sixth most common location of bone metastasis in the locomotor system. Complex treatment of these diseases is a challenge in many aspects. Besides performing the surgery itself, there is a great significance in the proper diagnostics and qualification to kind of surgery or systemic treatment, as well as postoperative rehabilitation.

Objectives: We evaluated patients after oncological endoprosthetic replacement of proximal humerus in terms of septic and aseptic complications incidence, pain assessment and patient satisfaction after the procedure. Further objectives included finding out what occurred to be the biggest problem for patients following surgery and what activities were the most difficult for them. The goal was to assess available questionnaires and scores in terms of their utility in everyday practice.

Methods: Thirty one patients aging 15 to 84, in whom oncological endoprosthetic replacement of proximal humerus was performed between 2010-2019 were examined. Their shoulder and elbow joints range of motion were examined. All patients were evaluated according to DASH questionnaire, MSTS and Mayo Elbow Score scores. Subsequently, they were categorized in 6 groups: by the age, sex, kind of tumor, number of surgeries, and by the prosthesis type.

Results: Mean total range of motion amounted to 145,1 degrees, mean MSTS score 0,61 and mean DASH questionnaire was 38,49. Patients assessed their pain at 4,01 in MSTS score on average. There were 21% postoperative complications, of which 5 (15%) were aseptic and 2 (6%) of septic origin.

There were no statistically significant differences in combined range of motion, DASH, MSTS and Mayo Elbow Score questionnaires between age groups, sexes, patients with primary tumors or bone metastases, between anatomical and reverse endoprosthesis. Statistically patients with one surgery scored better in DASH and MSTS questionnaires than patients after revision surgery.

Conclusions: Patients after oncological endoprosthetic replacement of proximal humerus can perform everyday activities. Activities requiring greater range of motion or strength are troublesome for some patients. Limited range of motion, especially flexion and weakness of upper limb were the biggest issues especially in revised cases.

256 Functional and survival outcomes of patients following Harrington procedure for acetabular complex metastatic lesions

Plaud A.[1], GaillardJ.[1], Le ThuauA.1[1], AgeneauP. [1], Berchoud J. [1], AFouasson-Chailloux A.[2], Crenn V. [1]
[1]Clinique Chirurgicale Orthopédique et Traumatologique, [2]Médecine physique et réadaptation locomotrice, Nantes Université, CHU Nantes, Nantes, France

Background: The Harrington surgical technique allows the management of complex, extensive bone lesions, using pins and cement to consolidate bone for acetabular cup positioning. However, it might be associated with a high reoperation rate, and the functional result of this surgery is not precisely described in the literature.

Methods: In a monocentric retrospective study including all patients operated from the Harrington procedure associated with THA, between 2005 and 2020, we aimed to assess preoperative and postoperative function, reoperation-free survival, and overall survival.

Results: Function improvement was significant for Parker score (preoperative: 3.6±2.0; 6 months follow-up: 6.6±3.2; 12 months follow-up: 7.6±2.1) and Musculoskeletal Tumor Society (MSTS) score (preoperative: 31.1±16.2%; 6 months follow-up: 67.7±30.6%; 12 months follow-up: 82.4±24.0%). Among the 21 included patients, reoperation-free survival rate was 76.1% [CI95%: 58.1-99.7] at six and twelve months, with the main complications being pin migration (50.0%) and infection (25%). Patient overall survival rate was 76.2% [95%CI: 59.9-96.7] at six months and 61.9% [95%CI: 59.9-96.7] at 12 months.

Conclusion: These results underlined significant functional improvements following the conventional Harrington procedure; with acceptable reoperation rate.

259 Osseous metastases of uterine leiomyosarcoma: Analysis of survival & surgical management

Çepni Ş.[1], Erdoğan Y.[1], Veizi E.[1], Sezgin B.S.[1], Güreşçi S. [2], Sekmek S. [3]
[1]Department of Orthopedics and Traumatology, [2]Department of Medical Pathology, [3]Department of Medical Oncology, Ankara City Hospital, Ankara, Turkey

Background: Uterine leiomyosarcoma (LMS) is a rare subtype of uterine malignancies and accounts for 1% of them. Few uterine leiomyosarcomas metastasize to the bone. There are only a few case series in the literature. In this study, we investigate the rate of metastasis to bone and patient survival of uterine LMS.

Methods: 108 patients diagnosed with uterine LMS between 2004 and 2021 at our medical center were elavuated for this study. Date of biopsy and diagnosis, date of bone metastasis detection, time of death and overall survival were noted. Time from diagnosis to bone metastasis and time from bone metastasis detection to death were calculated.

Results: Bone metastases were detected in 9 of 108 patients (8.3%). Three patients had a humeral metastasis, 3 had a femoral metastasis, 3 others had a pelvic involvement. All patients with bone metastases were accompanied by visceral organ involvement. Bone metastasis was after an average of 33 ± 33.4 (range 2 – 112) months after the original LMS diagnosis. Overall survival after bone metastasis was 31.6 ± 24.7 (range 8 – 77) months. Three patients underwent palliative surgery for their bony metastases.

Conclusion: Survival after bone metastasis was less than 5 years (5 out of 9 patients, 55.5%). Survival was not different between patients who underwent palliative surgery and those who did not. Patient evaluation should be individual, and their general health status should be evaluated before applying any palliative procedure.

260 Oncologic outcome after partial or total sacrectomy for primary malignant tumors and local recurrent carcinoma/rectal cancer

Weidlich A. [1], Schaser K-D. [1], Disch A. [1], Weitz J. [2], Schwabe P. [3] Melcher I. [3], Dragu A.[1], Fritzsche H.[1]
[1]University Center for Orthopedics, Trauma Surgery and Plastic Surgery,
[2]Department of Visceral, Thoracic and Vascular Surgery, University Hospital Carl Gustav Carus Dresden, Germany; [3] Center for Musculoskeletal Tumor Medicine, Vivantes Hospital Spandau, Germany

Background & Objectives: Primary malignant tumors of the sacrum, selected solitary metastases or direct pelvic tumor invasion of the sacrum represent indications for partial or total resection. The aim was to describe the oncosurgical management, complication profile and to analyze own treatment results after partial/total sacrectomy.

Methods: From 2015 to 2022, all patients who underwent either complete, partial or hemisacrectomy in University Hospital Dresden or Vivantes Hospital Spandau due to a primary malignant bone tumor or locally recurrent rectal cancer of the sacrum were included. Patients with metastatic disease or patients in whom sacrectomy was not indicated oncologically were excluded. Tumor entity, local recurrence/metastasis/survival rate and complications were retrospectively analyzed.

Results: 27 pat. (m/f: 14/13, mean age 58 (16-86) yrs) with chordoma (n=10), sarcoma (n=8: 3 osteo-, 2 pleomorphic, 1 chondro-, 1 rhabdomyo-, 1 myxoid lipo-) or local recurrent colorectal carcinoma (n=9) of the sacrum were included. There was total sacrectomy in 9, partial in 10 and hemisacrectomy in 8 pat.. In 13 pat. the resection was navigation-assisted. 13 pat. also underwent spinopelvic fixation with double rod construct. An omentum majus transfer and reconstruction with VRAM flap were performed in 20 and 10 pat.. Median follow-up was 18 (1-88) months. R0-resection was seen in 81.5% (no significant difference using navigation). 81.5% of pat. suffered from one or more complications (infection n=18, implant-associated n=6). Median overall survival was 70 months (sarcoma/chordoma/carcinoma: 29/74/68 months), local recurrence occurred in 16% (sarcoma/chordoma/carcinoma 57%/11%/67%), 40% developed distant metastases (sarcoma/chordoma/carcinoma: 43%/11%/11%), 5 patients died (sarcoma/chordoma/carcinoma: n=2/1/2). Pat. with R0-resection showed significantly better local recurrence-free survival.

Conclusion: Resection of sacral tumors is surgically challenging and associated with a high complication profile. Carcinoma patients show less favourable systemic tumor control. Navigation offers significant gain in intraoperative orientation, even if there currently seems to be no oncological benefit. Oncological outcome parameters and the morbidity of sacrectomy have to be compared in prospective multicenter studies regarding to the use and different methods of spinopelvic reconstruction as well as the combination of surgery and stereotactic body radiation therapy.

261 Artificial Intelligence Bot ChatGPT: is it a trustworthy and reliable source of information for patients?

Valentini M., Szkandera J., Smolle M.A., Scheipl S., Leithner A., Andreou D.
Orthopedics and Traumatology, Medical University Graz, Graz, Austria

Introduction: Since its introduction in November 2022, the artificial intelligence chatbot ChatGPT has taken the world by storm. Among other applications, it has been used by patients as a source of information on diseases and their treatment, but little is known about the quality of the sarcoma-related information ChatGPT provides. We therefore performed this study to evaluate how accurate, comprehensive, up-to-date, and useful ChatGPT answers to sarcoma-related questions are.

Methods: The ChatGPT responses to a sample of 25 questions on orthopedic oncology were evaluated by 3 independent sarcoma experts (2 orthopaedic surgeons and 1 medical oncologist). Each response was graded on 5 different aspects using a 5-point Likert scale, for a maximum of 25 and a minimum of 5 points per answer, with higher scores indicating a higher quality of the ChatGPT response. The answers were further verified and compared with authoritative resources and international guidelines.

Results: The mean score the ChatGPT answers achieved was 16.2 (range, 7.5 - 23.5). Six answers were classified as very good, with a mean score of 21-25, 9 as good (mean score, 16-20), while 5 answers each were classified as poor (mean score, 11-15) and very poor (mean score, <10). ChatGPT fared considerably worse with treatment-related questions, with 55% of its responses classified as poor or very poor, than with general questions (85% of responses good/very good) and definitions (60% of responses good/very good). The worst overall scores were documented in the question whether the response contained relevant factual errors, while the best scores were recorded on how comprehensive the answer was.

Conclusions: Based on the extraordinary popularity ChatGPT achieved in only a few months, artificial intelligence chat bots may quickly become an everyday health information source for patients in the future. In its current version, the answers ChatGPT provided on a rare disease, such as sarcoma, were found to be of a very inconsistent quality, with some answers being classified as very good and others as very poor. ChatGPT generally fared better with general questions and poorly with questions on specific treatment options. Sarcoma physicians should be aware of the risks of misinformation ChatGPT poses and advise their patients accordingly.

262 Oncologic and functional outcomes after resection of soft tissue sarcomas of the extremities and trunk: Retrospective analysis of prognostic factors after neo-/adjuvant radiotherapy

Fritzsche H.[1], Thalheim D. [1], Hofbauer C. [1], Weidlich A. [1], Jentsch C. [2], Kirchberg J. [3], Schaser K-D. [1]
[1]University Center for Orthopedics, Trauma Surgery and Plastic Surgery, [2]Institute and Outpatient Clinics of Radio-oncology, [3] Department of Visceral, Thoracic and Vascular Surgery, University Hospital Carl Gustav Carus Dresden, Dresden, Germany

Background & Objectives: Due to their biologic heterogeneity often marked resistance to radiochemotherapy and poor prognosis, soft tissue sarcomas (STS) continue to represent a diagnostic and therapeutic challenge. Multimodal therapy concepts are recommended for STS. There is controversy regarding the prognostic benefits and the complication profile of neoadjuvant vs. adjuvant irradiation. The aim was to analyze oncologic, functional, and quality-of-life (QoL) outcomes and complications after resection of a STS in relation to neo-/adjuvant radiation.

Methods: From 1999 to 2018, 213 patients underwent resection of STS on the extremities and trunk. Functional and oncologic outcomes (tumor entity, grading, local recurrence rate, metastasis rate, survival rate and complications) were analyzed and compared regarding neo-/adjuvant radiotherapy. In addition, disease-related QoL (SF-36) and limb function (MSTS) were quantitatively analyzed. Univariate (log-rank) factor tests were performed according to Kaplan-Meier, factors influencing survival were analyzed using Cox regression.

Results: Significant prognostic factors ($p<0.05$) for reduced cumulative survival were found to be R1/R2 resection, high-grade sarcomas and primary metastasis. There was no difference in local recurrence rate between neo- and adjuvant radiotherapy, but metastasis-free interval was significantly shorter in the neoadjuvant group. The MSTS-score showed 20.4±7.9 points (45.3±17.6%) without any significance between neo- and adjuvant radiotherapy. The SF-36 was not significantly reduced in physical/psychomental items with 41.0±14.1/ 49.6±12.2 points. In 28 irradiated pat. (neoadjuvant 12/27, adjuvant 16/92) there were infections requiring revision ($p=0.004$). In multivariate analysis, age ($p=0.002$), grading ($p=0.009$), metastasis ($p<0.001$), local recurrence ($p=0.017$) and complications requiring revision ($p=0.024$) influenced relative survival.

Conclusion: In soft tissue sarcomas, age, resection status, grading, metastasis, local recurrence and complications significantly influence relative survival. Multimodal therapies including radiotherapy are essential for long-term prognosis. Timing of radiotherapy did neither change resection status and local recurrency rate nor influence function and quality of life. However, a markedly increased rate of infectious complications and a significantly shorter metastasis-free interval are observed with neoadjuvant radiotherapy.

263 Double approach for internal hemipelvectomy: Pararectal and Kocher Langenbeck incision

Scheer R. [1], Van Driel LJ[1], Lo G. [1], Hompes D. [1], Douchy T. [1], Wafa H. [2]
[1]Department of Surgical Oncology, [2]Department of Orthopaedics, University Hospital Leuven, Belgium

Background and Objectives: Internal hemipelvectomy is the preferred treatment option for localized pelvic sarcomas if good functionality is expected in the remaining limb. Wide exposure is crucial for identifying major neurovascular structures in proximity of the tumor. The utilitarian approach and its modifications are the standard to achieve this goal but they are associated with a 30-40% risk of wound problems and flap ischemia. The pararectal incision provides excellent access to the pelvis, retroperitoneum and even the femoral region. Combined with a Kocher Langenbeck incision, the bony pelvis and surrounding structures can be exposed. Theoretically, better vascularization of the skin flaps can be achieved by using this combined surgical approach.

Methods: Six internal hemipelvectomies combining a pararectal approach with a Kocher-Langenbeck incision with a minimum followup of one year were included in this study. There were four males and two females with a mean age of 38.7 years (range, 14-76 years). Three patients had osteosarcoma, two chondrosarcomas and one recurrent giant cell tumour of bone. Three patients underwent type II-III resection, two patients type I-II-IV resection, while the remaining patient underwent type I-II resection according to Enneking and Dunham. Three patients received coned hemipelvic implants (LUMiC®) and one patient received a custom made hemipelvic implant.

Results: One patient had a small area of wound dehiscence where the distal limb of the pararectus incision was extended across the inguinal crease to resect a misplaced biopsy incision. At a mean followup of 26.5 months (range, 12-49 months), five patients were alive with no evidence of disease while one was alive with pulmonary metastasis. There were no cases of local recurrence, deep infection, or prosthetic dislocation.

Conclusions: The combined pararectal and Kocher Langenbeck incisions is a safe approach providing excellent access to the pelvis. The pararectal incision is versatile and can be adapted to expose the retroperitoneum, deep pelvis and femoral region. Better vascularization of the skin flaps can be achieved preventing wound dehiscence and flap necrosis. A larger cohort is needed to confirm our results.

264 Spontaneous tumor lysis syndrome in solid sarcomas. Case report and systematic literature review

Medellin MR.[1], Avila V. [2], Arbelaez P. [1], Mesa O.[3]
[1] Orthopaedic Oncology - Sarcoma Clinic, [2] Internal Medicine Unit, [3]Pathology Unit, Fundación CTIC Luis Carlos Sarmiento Angulo, Bogotá, Colombia

Background & Objectives: Tumor lysis syndrome (TLS) is a life-threatening disorder characterized by metabolic derangements. The purpose is to present a clinical case, and subsequently evaluate all the available cases on tumor lysis in sarcomas and their presentation.

Methods: After reporting a case, a systematic literature search using the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) guideline was performed. The available literature until December 2022 was assessed and methodologically qualified with the Modified Coleman Score.

Results: We present the case of a 57 years-old patient with a massive inflammatory myofibroblastic sarcoma invading the scapula, that developed spontaneous tumor lysis syndrome before treatment. After resolving the syndrome, the patient underwent a Tikoff–Lindberg´s procedure, with a satisfactory outcome.

In the systematic review, 15 case reports with solid sarcomas and tumoral lysis were identified. The mean Modified Coleman score was 46 (43 - 50), and there was a total of 16 cases described (8 males / 8 females). The mean follow-up time for all cases was 6.3 months (1 – 22). The mean age at the time of presentation was 40 years old (8 – 78). The main histotypes reported were: rhabdomyosarcoma in six patients (38%), leiomyosarcoma in three patients (19%) and osteosarcoma in two patients (12%). Metastases at presentation were recorded in 15 patients (94%).

Tumoral lysis was observed after chemotherapy in 11 patients (67.8%) or spontaneous at diagnosis in five patients (32.2%), no reports were identified of tumoral lysis after radiotherapy. The cases were identified after a mean of 7.9 days (1 to 28), and six patients (38%) did not survive after the syndrome´s treatment. At last follow-up, 11 patients were died. Further statistical analysis or meta-analysis could not be performed due to paucity of data and heterogeneity.

Conclusions: Tumor lysis syndrome is a very complex acute situation that requires early identification and treatment. The presentation in sarcomas is rare, and more often seen after cytotoxic treatment (chemotherapy). The main sarcoma types identified in this review were rhabdomyosarcomas or leiomyosarcomas. The mortality rate is high, but the prognosis is adequate as long as the episode could be managed effectively.

265 Internal type I and I-IV hemipelvectomy for primary pelvic bone tumors and reconstruction with distal femoral structural allograft. Case series of a Cancer Center

Arroyave SA, Gómez LC., Soto Montoya C., Franco Betancur A.
Orthopedic and Traumatology, fellowship Oncological Orthopedics, Department of Oncological Orthopedics, National Institute Center, Bogotá, Colombia

Background and objectives: Reconstruction after resectioning malignant bone pelvic tumors results in a significant surgical challenge. In recent years, internal hemipelvectomy has become the mainstay of surgical treatment for zone I and IV tumors. Several reconstructive techniques related to type I and I-IV hemipelvectomies have been published, with no evidence of their superiority. This study aimed to describe the clinical, functional, and operative results following internal hemipelvectomies type I and I-IV reconstructed with distal femoral structural allograft.

Methods: The authors analyzed eight patients who underwent type I and I-IV internal hemipelvectomies reconstructed with distal femur allograft. Records between 2013 and 2022 were collected in a highly complex cancer center.

Results: A total of 8 patients between the ages of 22 and 52 were included, with a follow-up between 3.5 months and nine years. The primary diagnosis was chondrosarcoma. We found a graft non-union rate of 37.5%. No peri-implant infections or mechanical failures were recorded. The mortality rate was 25%, and deaths were secondary to cancer progression. The mean MSTS (Musculoskeletal Tumor Society) was 56.6%.

Conclusions: Type I and I-IV internal hemipelvectomies present a considerable rate of intra- and post-operative complications. Structural allograft reconstruction of the distal femur offers biomechanical advantages, and functional results are acceptable; however, there is a lack of evidence of superiority compared to resections without reconstruction. The most frequent non-oncological complication with this technique was the non-union of the allograft. The results suggest that the mortality rate is related to the primary histological diagnosis.

266 Resection margins and local recurrence after resection of pelvis and sacrum tumors using patient specific instruments (PSI) : A single institution retrospective study of 42 patients

Bourbotte-Salmon F.[1,2], Lataste F.[3], Massardier E.[4], Ropars M.[5], Meurgey A.[6], Vaz G.[1,2], Gouin F.[1,2]
[1] Service de chirurgie oncologique, Centre Léon Bérard, Lyon; [2]Service de chirurgie orthopédique, centre médico-chirurgical des Massues, Lyon; [3]Service de chirurgie orthopédique et traumatologique, Hôtel-Dieu, CHU de Nantes; [4] Service de chirurgie orthopédique et traumatologique, Hôpital Edouard Herriot, Lyon; [5] Service de chirurgie orthopédique et traumatologique, CHU Pontchaillou, Rennes; [6]Service d'anatomopathologie, centre Léon Bérard, Lyon, France

Background and objectives : Obtaining clear margins in pelvis and sacrum in bone tumor surgery is a demanding challenge. Small series have shown encouraging results with PSI used for bone cutting, with high rate of clear margins and few or no local recurrences. The aims of this study were the analysis of bone and soft tissue margins, local recurrence cumulative incidence, distant metastases and overall survival.

Methods : patients who underwent surgical removal of a pelvic or sacral tumor using PSI were included, (34 primary malignant bone tumors, 3 malignant soft tissues tumors with bony extension, 3 locally aggressive benign bone tumors, 2 single metastases from other primary cancers). Bone and soft tissues margins were analyzed according to the UICC (Union for International Cancer Control) classification. Overall survival, local recurrence free survival or distant metastasis rates were established by Kaplan Maier's method. Finally, cutting guides positioning was assessed by surgeons with a semi-quantitative scale ranging from 5 (excellent positioning) to 1 (positioning failure).

Results : 42 patients were included, with an average follow-up of 49 months [4-112]. 95% of bone margins were R0, 1 patient (2.5%) had R1 bone margins and 1 patient (2.5%) had R2 bone margins. 76% of soft tissues margins were R0 and 21.5% were R1. Three-years overall disease-free survival was 70% [57.5; 86.0]. Three- years cumulative incidence of local recurrence and distant metastasis were respectively 20.6% [6.7; 32.5] and 19.7% [6.4; 31.1]. Fifty cutting guides with PSI were used : excellent or good positionning was obtained in 93.3 of cases, while only 6.7% of the guides had medium or poor positionning.

Conclusion : PSIs demonstrate excellent accuracy in obtaining clear margins within bone. However, the rate of local recurrence remains high : safety and confidence provided by the PSIs could encourage surgeons to be more conservative with soft tissues.

268 Tibial turn-up in oncological reconstruction: Rationale alternative for massive distal femur bone loss. Case report

Arroyave SA.[1], Gómez LC.[1], Soto Montoya C.[1], Franco Betancur A. [1], Chaustre JF. [2]
[1]Orthopedic and Traumatology, Oncological Orthopedics, Department of Oncological Orthopedics, [2]Orthopedic and Traumatology, Department of Traumatology, Hospital Universitario San José, Bogotá, Colombia

Background and objectives: Severe distal femoral bone loss and involvement are common in treating bone sarcomas. Despite the advances in chemotherapy and reconstruction, some patients will undergo limb amputation. Tibial turn-up plasty is a reconstructive procedure used to increase the length of above-knee amputations using the ipsilateral tibia as a vascularized pedicle graft. The objective of the study is to discuss the surgical technique, current indications, and a literature review about this surgery.

Methods: This case report describes a 45-year-old male with a periprosthetic infection in the left knee with a previous history of endoprosthetic reconstruction secondary to parosteal osteosarcoma. We performed a tibial turn-up plasty as an alternative to a high above-knee amputation, maximizing the stump length and providing the possibility of the adequate prosthetic fitting.

Results: The total construct length from the tip of the trochanter to the osteotomy was 35,7 centimeters, compared to 13,6 centimeters in the case of amputation without the tibial turn-up. Two years after surgery, the patient had an adequate prosthesis fitting, performed gait without aids, and resumed his working activity.

Conclusions: Currently, limb salvage is achievable in a high proportion of bone sarcomas. However, many patients will undergo further amputations secondary to recurrence, mechanical failure, infections, and fractures. The tibial turn-up plasty aims to achieve a longer and more functional femoral stump for those patients requiring above-knee amputations presenting with massive distal femoral bone loss or tumor involvement and in extremely young patients where the predicted limb-length discrepancy is unacceptable.

269 Surgical treatment of Ewing's sarcoma of the calcaneus in children

Kobys VL. [1], Fidelskyi VV. [2], Konovalenko VF. [3], Bovkun VM. [2], Bezverhy OM. [2], Ivasjuk OM. [1], Matyushok OF. [1], Dovzhenko MM. [1]
[1] Kyiv Cancer Center, Kyiv, Ukraine; [2] Institute of Experimental Pathology, Oncology and Radiobiology n.a. Kavetskyi R.E., Kyiv, Ukraine; [3] National Children't Specialized Hospital "Okhmatdyt", Kyiv, Ukraine

Introduction: Sarcoma of the calcaneus occurs in 1% of cases, so there are only isolated publications on its surgical treatment. Surgical treatment of Ewing's sarcoma of the calcaneus includes: amputation of the limb, replacement of the calcaneus defect with an allograft, or a composite allograft and vascularized fibula, or a composite allograft and a vascularized segment of the ilium, or endoprosthesis of the calcaneum.

The purpose of our study: to evaluate the effectiveness of organ-preserving reimplantation surgery of autoclaved calcaneus with vascularized fibula.

Materials and methods: Evaluation of surgical treatment of Ewing's sarcoma of the calcaneus in 2 patients aged 13 and 16 years 6 and 1.5 years after surgery was carried out. Patients were treated according to the EE-99 protocol with preoperative radiation therapy. Before the diagnosis was established, treatment was carried out according to the program of acute hematogenous osteomyelitis with antibiotic therapy and the introduction of decompression needles.

The operation consisted of removal of the calcaneus, harvesting of the fibula with a vascular pedicle, autoclaving of the calcaneus for 20 minutes at a temperature of 120°C, reimplantation of the calcaneus with the fibula on vascular anastomoses, metal osteosynthesis.

The results: Gypsum immobilization lasted from 3 to 6 months. Recovery of gait occurred 6 and 9 months after the operation, respectively. There was no graft resorption. Patients move freely, although they have flat feet, which requires the use of insoles. Patients without signs of the disease remain under dispensary observation.

Conclusions: Reimplantation of autoclaved calcaneus with vascularized fibula can be the operation of choice for total sarcoma lesions of calcaneus in children and young patients.

271 Low-grade fibromyxoid sarcoma and subtypes: a literature review of a challenging diagnosis

Kleine EA. [1], Hemke R. [2], Savci Heijink DCD. [3], Janssen SJ. [4], Bramer JAM. [4], Verspoor FGM. [4]
[1] Department of Research, [2]Radiology, [3]Pathology, [4]Orthopaedics, University Academic Hospitals UMC – location Academic Medical Center AMC, Amsterdam, the Netherlands

Background and objectives: Low-grade fibromyxoid sarcoma (LGFMS) is a rare disease, classified as a soft tissue sarcoma and categorized as a malignant fibroblastic tumor by the World Health Organization (WHO) in 2020. It has a deceitfully benign appearance in general being painless, slow-growing, and low in cellularity and mitotic rate. However, it does cause metastasis. Histopathologically, it consists of swirling fibroblastic cells with a tortuous growth pattern and myxoid areas. The subtypes of hyalinizing spindle cell tumor with grand rosettes (HSCTGR) or hybrid form with a sclerosing epithelioid fibrosarcoma (SEF) are similar but differ histopathological. The aim of this study is to evaluate the currently available knowledge on the full spectrum of LGFMS and its subtypes through a literature review, with regard to symptoms, diagnostics, treatment modalities, outcome and follow-up.

*Method*s: Literature search (Pubmed, Embase) up to February 2022 included 233 articles (n= 689 cases) plus 3 cases at our tertiary referral center, resulting in a total of 698 cases. Comparisons for different resection margins were made: R0 ‘clear’ and R1 ‘microscopic cells’.

Results: LGFMS (n=533), uncertain low-grade but FMS (n=17) and subtypes; HSCTGR (n=96) and SEF hybrid (n=52), arose in young adults (median 35, IQR 21-49 years) at various locations. Pathologically positive for mucin-related antigen 4 (MUC4) (96%) and translocations of FUS-CREB1/2 or EWSR1-CREB1/2 genes (85%). Most patients received surgery (97%) and only a small amount got (neo)adjuvant therapies. At final follow-up (median 3, IQR 1-6.5 years) three-quarter had no evidence of disease, 16% was alive with disease, and 8% died of disease. Overall, 92% survived (median 2.9, IQR 1.3-7 years), 29% of patients had local recurrences (median 3.1, IQR 1.3-7 years), and 18% developed metastasis (median 2.6, IQR 0-10.3 years) after primary surgery. Comparison between R0 (n=195) and R1 (n=73) led to a significant difference in survival and recurrence, in benefit of the R0 group. Survival was seen in 96% and 88%, and recurrences occurred in 12% and 38%, respectively.

Conclusion: This large review of Low-grade fibromyxoid sarcomas and its subtypes showed that a wide resection is recommended, recurrent disease can occur decades after primary resections, adequate proof of (neo)adjuvant treatments is lacking, and more research is necessary to evaluate the effect of long-term outcomes.

272 Spanish multi-centre megaprosthesis study (megaprot). Preliminary results

Pérez I.[1], González F.[1], Gracia I.[2], Peiró A.[2], de la Calva C.[3], Angulo M.[3], Hernández N.[4], Merino J.[4], Zarzuela VM.[5], Puertas P.[6]
[1] Orthopaedic surgery, Ramón y Cajal Universitary Hospital, Madrid, Spain; [2] Orthopaedic surgery, Santa Cruz y San Pablo Universitary Hospital, Barcelona, Spain; [3] Orthopaedic surgery,Hospital Universitario y Politécnico La Fe, Valencia, Spain ; [4] Orthopaedic surgery, Cruces Universitary Hospital,Bilbao, Spain; [5] Orthopaedic surgery, General Universitary Hospital, Valencia, Spain; [6] Orthopaedic surgery, Virgen de la Arreixaca Universitary Hospital., Murcia, Spain

Introduction: Megaprostheses have become the gold standard in the treatment of bone tumours. The Spanish musculoskeletal tumour group (GRETAL) examined the experience of the last 40 years and collected the largest megaprosthesis database yet on the subject. The aim of this study is to review the indications, complications, and survival of this historical series.

Methods: This is a multicentre retrospective observational study conducted in twelve Spanish hospitals. We selected patients where a megaprosthesis was implanted due to a bone tumour or the failure of a reconstructive procedure following tumour surgery. The data collected included demographic data, clinical data (aetiology, anatomical region, tumour stage, etc.), surgical data (margins, resection length, type of implant, fixation, etc.) and mortality.

Results: From 1981 to 2021, 595 megaprostheses were implanted. Patients presented with osteosarcomas (34.9%), bone metastases not originating from sarcoma (20.7%) and chondrosarcomas (18.2%), among others. The distal (35.1%) and proximal femur (28.9%) were the most frequent anatomic locations. One-hundred-and-ninety-five patients underwent a first revision surgery and 54 a second revision surgery, which failed in 12 patients who needed a third revision surgery. In primary surgeries, megaprosthesis survival was 71.4% at 5 years and 63.5% at 10 years. The most common mode of failure after primary surgery was structural failure (26.0%), followed by aseptic loosening (22.1%).

Conclusions: This is the largest collaborative study to date on megaprostheses. It analyses their performance in the treatment of bone tumours with a view to making a contribution to the improvement of treatment protocols.

*This research was carried out by the MEGAPROT study group: Pérez I., Sanz M.C., González F., Gracia I., Machado P., Peiró A., de la Calva C., Angulo M., González P., Asua L., Arteagoitia I., Hernández N., Merino J., Zarzuela V.M., Valcárcel A., Puertas P., Valero-Cifuentes G., Godoy A., Fernández F., González-Acha J., Esnaola P., Coll-Mesa L., Baz C., Álvarez-Garma A., Orce A., Chaves I., Cebrián J.L., García R., Pablos O., Maireles M., Fontalva M.L., Garcés C., Estelles L.R.

279 Treatment of severe complications following reconstructions with 3D printed implants in oncologic patients - 14 year experience

Kotrych D.[1], Prowans P. [2], Ziętek P. [1], Zacha W. [1], Pawlik J. [1], Ciechanowicz D. [1], Bohatyrewicz A. [1]
[1]Department of Orthopaedics, Traumatology and Musculoskeletal Oncology, [2]Department of Plastic Surgery, Pomeranian Medical University of Szczecin, Szczecin, Poland

Background & Objectives: Reconstruction of massive bone defects in patients with primary and metastatic bone tumors is a significant problem because of the extent of surgery and high postoperative complication rate.

The Authors have presented reasons of failures and methods of therapy of patients having severe complications due to previously implanted 3 D printed custom made endoprostheses primarily used for oncological defect reconstructions.

Methods: The material composed of 72 selected patients diagnosed with bone tumors treated with custom made arthroplasty at Musculoskeletal Oncology and Plastic Surgery Departments of Pomeranian Medical University of Szczecin, Poland between 2009 and 2023. Fourty nine patients suffered from primary bone tumors and another twenty three had metastatic lesions. All of them were operated with the usage of custom made systems and reconstructive techniques aiming anatomical bony restoration. The second look surgical procedures included: revision arthroplasty, periprosthetic fracture treatment, recurrence and complex infection treatment with local intraoperative and subsequent aimed systemic antibiotic therapy, as well as plastic surgery.

Results: Complications occurred in 22 patients (31 %) . The most frequent complication was infection which occurred early after or during chemotherapy in 6 cases. Late infection was observed in 5 cases. In 2 cases skin necrosis was present. We treated 3 patients due to periprosthetic fractures. Recurrence occurred in 2 patients with primary lesions and 4 with bone metastases. The survival rate was mainly dependant on the kind of tumor, range of resection and time of diagnosis. In most cases it was the reason for the recurrence or further dissemination of the disease.

Conclusions: The Authors have emphasised the need of special assessment in patients with 3D printed custom made implants from the beginning of planning procedure, perioperative care and further out - patient controls. One of the most important aspects is osseointegration process around the implant which is varied in different clinical stages.

280 Shared decision making in primary malignant bone tumor surgery in children and young adults. Decisional conflict, decisional regret and perception in children, young adults, their parents and physicians

Blom KJ.[1,2] , Bekkering WP. [2], Fiocco M.[2,3,4], van de Sande MAJ.[2,5], Schreuder HWB.[2,6], van der Geest ICM.[6], Jutte PC.[7], Ploegmakers JJW. [7], Merks JHM.[2], Bramer JAM.[1,2,8]

[1]Amsterdam UMC location University of Amsterdam, Department of Orthopedic Surgery and Sports Medicine, Amsterdam, The Netherlands; [2]Princess Máxima Center for Pediatric Oncology, Utrecht, the Netherlands; [3]Mathematical Institute, Leiden University, Leiden, the Netherlands; [4]Department of Biomedical Data Sciences, Medical Statistics Section, Leiden University Medical Center, Leiden, the Netherlands; [5]Department of Orthopedic Surgery, Leiden University Medical Center, Leiden, the Netherlands; [6]Department of Orthopedic Surgery, Radboud University Medical Center, Nijmegen, the Netherlands; [7]Department of Orthopedic Surgery, University Medical Center Groningen, Groningen, the Netherlands; [7]Orthopedic Surgery and Sports Medicine, Amsterdam Movement Sciences, Cancer Center Amsterdam, Amsterdam UMC, University of Amsterdam, The Netherlands

Background & objectives: Children and young adults needing surgery for a primary malignant bone tumor around the knee face a difficult, life changing decision. This study describes the level of shared decision making (SDM) experienced and preferred by these patients, their parents and physicians in surgical consultations, and its relation to experienced decisional conflict and decisional regret.

Methods: Multicenter, cross-sectional cohort study. Patients (age 5-25) who underwent surgery for a primary malignant bone tumor around the knee in the Netherlands between 2012 and 2015 were included. Patients and their parents, were invited to complete the SDM-Questionnaire-patient (SDM-Q-9), Decisional Conflict Scale (DCS), Decisional Regret Scale (DRS) and Control Preferences Scale (CPS). Physicians of these patients completed the SDM-Questionnaire-physician (SDM-Q-Doc) and CPS.

Results: Twenty-four patients >16 years with twenty-two parents, and ten parents of patients between 5 and 16 years old, completed the questionnaires. Fourteen patients (78%), twenty-eight parents (96%) and twenty-three physicians (92%) preferred a shared relationship in decision making. Patients' median SDM-Q-9 score was 60 (8.9-97.8), parents' 77.8 (8.9-100) and physicians' 82.2 (66.7-97.8). The SDM-Q-9 scores of patients (r_s=-0.753, $p<0.01$) and parents (r_s=-0.850, $p<0.01$) correlated with their DCS scores. DCS scores were correlated with decisional regret in patients (r_s=0.701 $p<0.01$) and parents (r_s=0.405, $p<0.05$).

Conclusion: Patients, parents and physicians agree on sharing responsibility choosing surgical option. Patients and parents who reported more involvement in the decision-making process experienced less decisional conflict; less decisional conflict was associated with less decisional regret. These findings show the importance of SDM in these life changing surgeries.

282 Collapse of the mechanical tumor prosthesis stretching mechanism: Rescue with electromagnetic expandable prosthesis

Balacó I. [1], Cabral J. [1], Figueiredo P. [2], Monjardino M. [1], Madeira O. [1], Carvalho M. [1], Sá Cardoso P. [1], Ling Tah Pu[1], Carvalho A.[3], Alves C. [1]
[1]Department of Pediatric Orthopaedics, [2]Department of Pediatric Rehabilitation, [3]Department of Pediatric Oncology, Hospital Pediátrico – CHUC, EPE, Coimbra, Portugal

Objective: Expandable prostheses are a reconstructive option for limb in skeletally immature patients, requiring tumor resection and concomitant removal of the growth plate. One of the rare complications of these prostheses is mechanical failure of the lengthening device. We describe the clinical case of a patient with osteosarcoma, who underwent extended resection and reconstruction with an expandable prosthesis, complicated with sudden limb length discrepancy (LLD) after mechanical failure of the elongation device.

Methods: 8 years old girl, with distal left femur metadiaphyseal osteosarcoma, Enneking IIB. Uderwent 14cm distal femur resection of and reconstruction with expandable prosthesis. Successive mechanical elongation without complications, total 4.4cm. Definitive epiphysiodesis of contralateral distal femur. LLD<1cm at maturity, with full range-of-motion and painless activities. Regular follow-up until 16 years of ag. Fell from trampoline, with consequent sudden LLD, due to damage of the mechanical elongation system of the prosthesis and collapse of total previous lengthening.

Results: Discussed options with family, who considered LLD unacceptable and refused contralateral shortening. Chosen. Surgery 8months after the prothesis collapse: revision with an elongation electromagnetic prosthesis. Total electromagnetic lengthening of 4.6cm for 2months. At 18 years-of-age, the elecrtromagnetic prosthesis was replaced by a definitive modular prosthesis, maintaining the proximal femoral stem, replacing the tibial stem to correct previous valgus alignment. 1year postoperatively, she has no pain, presents residual radiological LLD 7mm, without need for compensation, but with limited knee motion (Extension-5o, Flexion-70). MSTS=25

Conclusion: Revision of LLD after expandable prosthesis mechanical system failure is a difficult surgery, which entails significant risks of infection, uncertainty in lengthening and restriction of joint mobility. In this case, we could correct LLD, but were unable to maintain knee range-of-motion.

Relevance: We describe an unusual case, in which we used an elongation prosthesis electromagnetic device to resolve a complication associated with a mechanical expandable prosthesis.

284 The quality of life of patients with bone tumors of the lower limbs treated with salvage surgery: a long-term follow-up study

Venturini E., Cotti M., Morri M., Ruisi R., Meneghini M., Raffa D., Abbruzzese A.
Physical medicine and Rehabilitation, Istituto Ortopedico Rizzoli, Bologna, Italy

Musculoskeletal cancers are extremely rare, accounting for approximately 0.2% of all cancers, 14% are bone sarcomas, which occur more frequently in children and adolescents. The most frequent location is at the metaphyseal level of the femur (42%) and tibia (19%).

Surgery and chemotherapy treatments have significantly increased survival rates for patients with bone tumor. The early rehabilitation goal for these patients after surgery is to promote an earlier recovery with best possible autonomy. In literature, there are few data about the association between the early functional recovery and quality of life and further long-term studies are needed. The quality of life is measured with several scales that include a set of non-specific domains for bone tumor patients.

For this reason, a specific assessment scale, the Bt-DUX, was introduced and validated in 2013 to measure the quality of life of patients with bone cancer of the lower limbs. In 2019 the Bt-DUX scale was validated in Italian.

The aim of the study is to describe the quality of life of patients undergoing salvage surgery of the lower limb for musculoskeletal tumors with a long follow-up and to investigate the association with early functional recovery.

285 Rotationplasty as reconstructive or salvage surgery for patients with bone sarcoma: choice or last option?

Balacó I.[1], Monjardino MP.[1], Anacleto G.[2], Cabral J.[1], Sá Cardoso P.[1], Figueiredo P.[3], Sousa C.[4], Carvalho A.[5], Alves C.[1]
[1]Department of Pediatric Orthopaedics, Hospital Pediátrico – CHUC, EPE, Coimbra, Portugal; [2]Department of Vascular Surgery, CHUC, EPE, Coimbra, Portugal; [3]Department of Pediatric Rehabilitation, CHUC, EPE, Coimbra, Portugal; [4]Department of Pediatric Oncology, Portuguese Oncology Institute, IPO Porto, Portugal; [5] Department of Pediatric Oncology, Hospital Pediátrico – CHUC, EPE, Coimbra, Portugal

Background&Objectives : Rotationplasty is indicated in the management of femoral bone sarcomas in children. It is also an option for managing chronic osteoarticular infections, or non union, as an alternative to femoral amputation. The principle of rotationplasty is to remove the affected knee and to apply a rotation of 180° to the distal part of the lower limb in order to give the ankle the function of a neo-knee. With an adapted prosthesis, patients may resume their social activities by keeping most of their lower limb, thus avoiding complications of amputation(ghost limb pain, proprioceptive deficit, psychological disorders) or limb reconstruction in the very young(limb length discrepancy, need for further procedures). The surgery is complex, with vascular, infectious, and psychological risks, that must be discussed with patients

Methods: We present our experience in treating pediatric bone sarcomas with rotationplasty. We describe patients characteristics, complications and results

Results: We reviewed 6 cases, 3male: 3female, median age 13.5years(3-17), median follow-up 56months(7-122). 4 osteosarcoma, 2 Ewing sarcoma, 3 cases with metastases at diagnosis. 4 cases had rotationplasty as initial surgery, 2 as salvage limb procedure, after infection following tumor resection and reconstruction with allograft in one case and megaprosthesis in the other. We had 5 cases with Winkelmann type IIA1 procedure and 1 type IIIBA. 2 cases had vascular end-to-end anastomosis with ischemia time of 100min. In 4 cases, osteosynthesis with plates was performed, 1 had Rush nail fixation, all with postoperative cast immobilization. We had complications in 3 cases: 1 sciatic neuropraxia(requiring emergent nerve decompression), 1 suture dehiscence(resolved with debridement and skin closure), 1 limb ischemia(amputation on the 3rd day post-rotationplasty). Our median time to get the prosthesis was 170days (60-420). 2 patients died at 64 and 108months post-surgery. The functional score(Kidscreen-10) was applied to 3 patients (median 48(38-48)) and we had a median grade of satisfaction rated as 3(1-4)

Conclusions: Our series is different from those classically described in the pediatric population, as it presents a greater number of adolescent patients. Although having important complications, our final results were good. Rotationplasty should be considered as an option, both as initial reconstructive surgery or salvage surgery in patients with malignant bone tumors of the femur

286 Mid-term follow up evaluation of custom-made prostheses after pelvic resection for bone tumours: experience of a single centre

Spazzoli B., Gemini GM., Frisoni T., Cevolani L., Focaccia M., Palmas M., Laranga R., Donati DM.
Orthopaedic Oncology Unit, IRCCS Istituto Ortopedico Rizzoli, Bologna, Italy

Introduction: Limb salvage procedure for pelvic bone tumours remains the most challenging surgery, because of the complex anatomical structures involved. During years, reconstruction of bone defect after resection was performed with several method of reconstruction including allografts and different prosthetic replacement ending with high complication rates, like infection, fracture of the graft, or loosening as major problems. Pelvic bone resections are classified according to the system of Enneking and Dunham: P1, ilium; P2, peri acetabulum; P3, pubic rami; P4, sacrum. More recently, there has been a strong interest in custom-made prostheses, particularly after developments of additive manufacturing, also known as 3D-printing. Custom-made implant could achieve a more anatomical reconstruction and a better match with patient's residual bone. We present our series of 3D printed custom-made implants for pelvic bone tumours.

Methods: 21 patients underwent pelvic resection from 2013 to 2022, mean age was 38 years old (12 – 69); mean follow up 45,4 months (2 – 109). The mean surgical time was 250 minutes (180 – 800). Histological diagnosis was Ewing sarcoma in 5 cases, chondrosarcoma in 12, Osteosarcoma in 3 and in one osteoblastoma. Wide margins were obtained in all patients. Four cases had P4 resection, the remaining resections include all the periacetabular region, in 6 cases associated with ileum (P1) and in 11 cases associated with rami area (P3).

Results: No intraoperative complications occurred. Mean MSTS score at 1 year after surgery was 80% (50% - 100%). A total of nine cases underwent surgical debridement for infection, the most within one month after surgery. Overall implant survival at 36 months after surgery was 86%, three cases indeed, required implant removal for infection; among three, one was a P4 with vertebral instrumentation. Local recurrence occurred in four cases, three had a hindquarter amputation (14%) and one had palliation therapy. Implant failure, considering implant removal both for infection and for local recurrence, occurred in 6 cases (28%).

Conclusions: Personalized implants provide optimal anatomical reconstruction shortened surgical time, providing, in successful cases, excellent functional results. Infection remains the major complication as observed in other methods of pelvic reconstruction. A number of unexpected local recurrences occurred beside wide margins have been achieved in all cases. Sacro-iliac joint resections, especially when vertebral instrumentation is added, required higher surgical times and consequently, higher infection rate.

287 Do proximal femur megaprosthesis reoperation risk and functional scores differ between non-oncological and oncological conditions?

Tran G.[1,2], Waast D.[1], Nich C.[1,3], Pere M.[4], Varenne Y.[1], Odri G.[7], Briand S.[8,9], Berchoud J. [1], Gouin F.[6], Crenn V.[1,2]
[1] Nantes Université, CHU Nantes, Clinique Chirurgicale Orthopédique et Traumatologique, Nantes, France; [2] CRCI2NA (Centre de Recherche en Cancérologie et Immunologie Nantes-Angers), INSERM UMR 1307, CNRS UMR 6075-Team 9 CHILD (CHromatin and Transcriptional Deregulation in Pediatric Bone Sarcoma), Nantes Université, Nantes, France; [3] INSERM, UMRS 1229, Regenerative Medicine and Skeleton (RMeS), ONIRIS, Nantes, France; [4] Plateforme de Méthodologie et Biostatistique, CHU de Nantes, France; [6] Département de chirurgie, Centre Léon Bérard, Lyon, France; [7] Service de Chirurgie orthopédique et traumatologique, Hôpital Lariboisière AP-HP, Paris, France; [8] Service de Chirurgie Orthopédique et traumatologique, chirurgie du rachis, Hôpital Bicêtre AP-HP, Le Kremelin Bicêtre, France; [9] Université Paris-Saclay, Paris, France

Introduction: Proximal femur megaprostheses (PFMPs) are used to manage large bone defects in non-oncological and oncological conditions, but little is known about reoperation risk and functional score comparison between these groups based on appropriate statistical analysis for femur megaprostheses.

Questions: Do the cumulative incidences of reoperation, complication rate and functional results of PFMPs differ between non-oncological indications (NOI) and oncological indications (OI)?

Methods: Between January 2005 and December 2020, a total of 109 implants were included in this retrospective monocentric cohort study involving METS modular system implants (Stryker, USA) in a sarcoma centre (Nantes, France). They were 109 (57.6%) PFMPs (NOI, n=52; OI, n=67). The mean follow-up for the cohort was 47.9 ± 42.6 months. Competing risk analysis based on the Fine and Gray model was used to estimate the cumulative incidence of reoperation and complication with death as a competing event and MSTS was assessed with patients' medical records.

Results: The PFMPs cumulative incidences of revision for NOI versus OI were 25.5% and 33.5% versus 29.2% and 32.7% at five and ten years, there was no significant difference (HR=0.90, 95%CI (0.42 - 1.95), p=0.7914. NOI appears to be more prone to complications, although there was no significant difference (HR=1.5, 95% CI (0.80 – 2.80), p=0.204). The MSTS score was significantly better at ten years in the OI (78.2% ± 19.5) group than the NOI group (48.3% ± 10.9) (p=0.012).

Conclusion: In an expert sarcoma centre, NOI seems to get a similar non-negligible reoperation risk, with higher complication rates and lower functional results.

290 Ewings Sarcoma of the head and neck region: Long term outcomes of patients treated with a homogenous treatment protocol

Nehal K. [1], Krishnan A. [1], Manjali J. [1], Parambil B. [2], Chinnaswamy G. [2], Prasad M. [2], Prabhash K. [3], Qureshi S. [3], Pantavaidya G. [3], Ramadwar M. [4], Laskar S. [1]
[1]Department of Radiation Oncology, [2]Department of Medical Oncology, [3]Department of Surgery, [4]Department of Pathology, Tata Memorial Hospital, Mumbai, India

Objective: To evaluate disease profile, treatment response, long term outcomes, patterns of failure and prognostic factors for patients of non-metastatic Ewings sarcoma (ES) of the head and neck region treated with curative intent with a homogenous treatment protocol.

Materials and methods: From January 2010 to December 2019, 87 patients with histologically proven ES in the age group of 2 months – 42 Yrs (Median 15 Yrs) were retrospectively evaluated. Prognostic factors like age at diagnosis, sex, skeletal/ extra-skeletal origin, primary site (PNS/non PNS), tumor size, nodes, performance status, hematological & biochemical parameters (hemoglobin, total leucocyte count, lactate dehydrogenase, alkaline phosphatase and albumin, Neutrophil Lymphocyte Ratio NLR, Platelet Lymphocyte Ratio PLR, response to chemotherapy (CTh) and type of local treatment were evaluated.

Results: Out of total 87, 54 (62.1%) were males and 32 (36.8%) patients had extra-skeletal disease with a mean tumor size of 5cms. All patients received multimodality treatment in the form of EFT 2001 systemic CTh and local treatment comprising of surgery (Sx) or radiation therapy (RTh) or both. RTh alone was offered in cases where Sx was either not feasible or was deemed to be associated with significant morbidity. After a median follow-up of 58 months, the 5-year local control (LC), event free survival (EFS) and overall survival (OS) were 83.4%, 72.4% and 87.5% respectively. At last follow up, 64 (73.6%) patients were alive & disease free. Nine patients had local relapse only, 8 had distant metastases only, while 5 had both local relapse & distant metastases. Two patients died of treatment related toxicities. On univariate analysis patients undergoing Sx+RTh had statistically significant superior LC, but similar EFS & OS compared to RTh alone. On univariate analysis, metastatic disease at presentation, nodal involvement, anaemia, raised platelet-to-lymphocyte ratio, partial response to chemotherapy and RT were significant prognostic factors for event-free survival and overall survival, while AJCC 8th edition T stage, raised PLR, and local treatment modality were significant for local control in our study.

Conclusion: Multimodality treatment using a combination of CTh, Sx & RTh results in optimal disease control with acceptable toxicities. Radiotherapy alone gives outcome similar to combined surgery and adjuvant radiotherapy although local control is poor.

293 Dual time point [18F]FDG PET/CT can differentiate benign from malignant musculoskeletal tumors and identifies accurately grade 3 sarcomas

d'Abadie P.[1], Gheysens O.[1], Lhommel R.[1], Kirchgesner T.[2], de Roo A-K.[3], Schubert T.[4]
[1] Department of nuclear medicine, [2] Departement of radiology, [3] Department of pathology, [4]Department of ortopaedic surgery, Ciiniques Universitaires Saint Luc, Institut Roi Albert II, Brussels, Belgium

Introduction: 18F-FDG-PET/CT can be used for the work-up of musculoskeletal tumors (MST) but differentiating malignant from benign tumors and grading malignant MST remain controversial. The aim of this study is to evaluate if dual time point PET/CT imaging can predict malignant MST.

Material and methods: Prospective single center trial. Patients with undetermined MST underwent PET/CT imaging at 1h (t1, classical imaging time) and 3h (t2) post [18F]FDG injection. Delta SUV max (SUVmax t2 - SUVmax t1)/SUVmax t1) x 100) was calculated for each tumor. The diagnostic performance of this parameter was measured using ROC curves for predicting malignant tumors and grade 3 sarcomas.

Results: 96 tumors (32 benign and 64 malignant tumors) were included. Delta SUV max was significantly higher in malignant MST compared to benign MST (mean: + 18% versus – 2.5%, p <0.001). Delta SUVmax > 16% predicts tumor malignancy with a sensibility (Se) of 66% and a specificity (Sp) of 81%. The area under the ROC curve (AUC) was 0.76. With the same delta SUV max cutoff, grade 3 sarcomas (n=35) were predicted with a Se of 94% and a Sp of 67% (AUC: 0.84).

*Conclusio*n: Dual time point [18F]FDG PET/CT identifies malignant MST tumors with high specificity and grade 3 sarcomas with high sensibility.

298 Challenges following lower limb amputation in children

Burkhard L., Gleichauf S., Ghandour M., Deisenhofer J., Alimusaj M., Renkawitz T., Putz C., Horsch A.
Department of Orthopaedics, Heidelberg University Hospital, Heidelberg, Germany

Backround: Children and adolescents encompass a very special population that requires distinguished care. Despite its rarity, the question regarding the patterns, indications, and complications of lower limb amputations in clinical practice remains unanswered. Therefore, we conducted this retrospective cohort study to address this question.

Methods: Between 2010 and 2020, the charts of children and adolescents who underwent lower limb amputation at our institution were reviewed. The analyzed dataset included two main domains. The first contained data on the patterns of lower limb amputation (i.e., number, indications, and level of amputation), while the second included data on the occurrence of subsequent complications and the need for revision surgery (i.e., indications). Descriptive statistics in the form of means (standard deviations) and numbers (percentages) were provided for continuous and categorical variables.

Results: Twenty-two patients undergoing lower limb amputation were examined, of which the majority were males (63.6%) and had a mean age of 12 (5.1) years. Tumor was the most common indication for amputation (72.7%) with transfemoral amputation being the most frequently approached level of amputation (68.2%). Complications occurred in 10 (45.45%) patients, mostly due to stump impalement or bony overgrowth. Importantly, 52.9% of patients experienced stump impalement. Among those who required revision surgery (45.45%), 90% of cases required bony revision while only 10% needed soft tissue revision.

Conclusions: Lower limb amputation in pediatrics is rarely encountered, mainly secondary to bone tumors, especially at the thigh level. Postoperative complications are common often due to bony overgrowth. These cases frequently require revision surgery.

299 The effect of omentum autograft in segmental bone defects of femur, which recycled with liquid nitrogen in rabbits

Şencan K. [1], Aycan OE. [2]
[1]Department of Orthopaedics and Traumatology, Kızıltepe Devlet Hastanesi, Mardin, Turkey; [2]Department of Musculoskeletal Oncology, Baltalimanı Bone Diseases Training and Research Hospital, İstanbul, Turkey

Objective : For this Recycling with liquid nitrogen therapy is one of the most frequently used methods in biological reconstructions. The incorporation and union process of the segmental bone recovered with this method takes quite a long time. Therefore, in our study; We sought to evaluate the histological and radiological effects of omental tissue, which has a positive effect on bone healing and high regeneration and neovascularization capacity, on the union of the segment recovered with liquid nitrogen application.

Materials and Methods: A total of 15 rabbits of the New Zealand breed, averaging 4 months old and weighing 2450-2700 g, were included in the study. Rabbits were randomly divided into 3 groups of 5 each. A 10 mm segment was resected in the left femur of the rabbits in all groups. This segment was kept in liquid nitrogen for 20 minutes, at room temperature for 10 minutes, and in physiological saline for 15 minutes. In the control group, this segment was reimplanted. In the fibula group, a 10mm-long non-vascularized fibula was resected from the ipsilateral extremity and placed in the femoral medulla, and the segment was reimplanted. In the omentum group, non-vascularized omental tissue taken from the abdomen was wrapped around the re-implanted segment after liquid nitrogen application. A 2.3 mm 8-hole universal small bone plate and 1 Kirscher wire were used for fixation in all groups. Sacrification was performed at the end of the 8th week. The femurs of the subjects were examined histologically and radiologically (radiography and computed tomography). Lane&Sandhu classification was used for the evaluations.

Results: Week 8 roentgenography scores differ statistically between the control group and the omentum group. For direct roentgenography week 8 scores, the mean of the control group (=3.2) was statistically significantly lower than the mean of the omentum group (=8) ($p<0.05$). Although the omentum group showed an arithmetically higher union score than the other groups in histological evaluations, no statistically significant difference was found. ($p>0.05$) Osteoblastic differentiation was observed in the histological evaluations of the omental tissue.

Conclusion: The rate of union of devitalized bone tissue by application with liquid nitrogen can be accelerated by reconstructing it with omental tissue. Omental tissue shows osteoblastic differentiation over time.

300 Curopsy and steroid injection in proximal humerus unicameral bone cysts: How many times should we repeat?

Aycan OE., Polat B., Çaha ME., Arslan MC.
Musculoskeletal Oncology, Baltalimanı Bone Diseases Training and Research Hospital, İstanbul, Turkey

Introduction: Unicameral bone cysts (UBC) often constitute 3% of primary bone lesions, and are the most common cause of pathological fractures in pediatric age group. Our aim is to reveal the radiological parameters that predict the risk of UBC related proximal humeral fractures in pediatric patients, to evaluate the effect of fractures on cyst regression, and the effect of steroid injection on cyst regression, recurrence and refracture rates.

Methods: 198 patients aged 5-15 years who were treated with the diagnosis of proximal humeral BCC in our clinic between July 2012 and September 2021 were evaluated retrospectively. 110 patients with a follow-up of less than 1 year, and methods other than the combination of curopsy+steroid (CSI) were excluded. A total of 88 patients (72M/16F) with persistent cystic lesions were included. The mean age was 10.2 Apart from the epidemiological data, initial complaint, maximum cyst length, the width of physeal plate, cyst ratio, cyst index and the distance between cyst and physeal plate were measured on x-ray. Cyst volume on MRI were also noted. Initial curopsy, recurrent curopsies and the amount of steroid used were evaluated. The radiological evaluation of the lesion according to the Neer classification after initial CSI, radiological changes with repeated CSI, total number of CSI were also noted. The mean follow-up time and the radiological evaluation at the last follow-up according to the Neer classification were determined.

Results: The mean follow-up time was 46.3 months (12-189). Pathological fracture was found to be the first reason on admission in 80.6% of the patients. The mean cyst volume was 23800mm3. Repeated CSI were performed with an average of every 4 months. After a mean 1.6 CSI, 100% of the lesions which preoperatively evaluated as B/C according to the Neer classification were evaluated as A at the last follow-up. Lower cyst ratio was found to be related with healing ($p=0.025$) Overall regression was found to be related with the initial regression ratio following the first procedure ($p<0.001$) The final MSTS was 29.6

Conclusion: The initial response to first procedure determines the prognosis of the cyst. Although the number of patients presenting with pathological fractures is high, CSI provides an effective, inexpensive and reliable treatment for consolidation, supported by repeated procedures when necessary.

301 Complication profiles and stem sparing revisions of tumor endoprostheses around the knee

Alparslan B., Aycan OE., Arslan MC.
Musculoskeletal Oncology, Baltalimanı Bone Diseases Training and Research Hospital, İstanbul, Turkey

Introduction: Resection and reconstruction with tumor endoprothesis is widely used method for tumors that located in knee region. Altough limb salvage procedure have reliable outcomes, the patients may encounter with various complications as Hendersen et al described. In this study we sought to evaluate the complication profiles and effectiveness of stem sparing revisions.

Methods: We retrospectively reviewed 106 patients who operated due to benign, malignant and metastatic tumor located at knee region and performed reconstruction with tumor endoprosthesis between 2011-2019. The demographic data, histopathologic diagnosis, soft tissue reconstruction methods (gastocnemius rotation flap (GRF), prolen mesh (PM), patellar tendon reattachment on endoprosthesis (PTR)), complication profiles according to Henderson, MSTS scores, final functional status, oncologic status and survival both patients and implants were evaluated in final 80 patients. Results of survival analyzes were noted.

Results: Mean age was 31.05. Mean follow-up time was 46.1 months. 64% of patients have malign tumor and 56.3% of patients' histopathologic diagnosis was osteosarcoma. Mean MSTS score was 21.6. According to Henderson complication profile our complication ratios were type 1: %23.5 ,type 2: %13.7, type 3: %23.5, type 4: %21.5, type 5: %17.6. In patients who performed soft tissue reconstruction first stem survival, flexion degree, extension lag were better (p: 0.000, p: 0.046, p: 0.021). According to subgroup analyzes of soft tissue reconstruction, PTR had a significant effect on first stem survival compare to without reconstruction groups (p: 0.000). PTR was significantly better effect on first stem survival compare to GRF an PM (p: 0.001, p: 0.001). PM was significantly better on extension lag degree compare to without reconstruction groups (p: 0.023). In soft tissue reconstruction group complication ratio and type 1 complication ratio was lower (p: 0.027 and p:0.002). Five years patient survival was 59.0%, endoprosthesis survival was %72.0.

Conclusion: Tumoral resection endoprosthesis are effective and providing good functional extremity to patients. However because of wide resection, lack of soft tissue support around prosthesis and hinge mechanism of prosthesis, various complications are seen at follow-up. Soft tissue reconstructions had lower complication ratios. Soft tissue reattachment with PM had better outcomes compared to other soft tissue reconstruction methods.

302 Operative treatment of aneurysmal bone cysts in pelvic region, Single center experience

Alparslan B., Arslan MC., Aycan OE.
Musculoskeletal Oncology, Baltalimanı Bone Diseases Training and Research Hospital, İstanbul, Turkey

Introduction: Aneurysmal bone cysts are commonly located at metaphyses of long bones. Pelvic involvement of aneurysmal bone cyst may be challenging by means of diagnosis and management. The lesions may even become complicated due to neurovascular involvement. We sought to evaluate the management and results of primary aneurysmal bone cysts of pelvic involvement.

Method: We retrospectively reviewed 26 patients, who were histopathologically confirmed as primary aneurysmal bone cyst in pelvis and sacral region between 2000-2016 in our institution. Four patients with less than 2 years follow-up and two patients who received treatment by arterial embolisation were excluded. A total of 20 patients were evaluated regarding demographic data, presenting complaints, involvement of pelvic brim, cyst volumes and applied surgical methods (en bloc resection, curretage, cementation, grafting, phenol application and preoperative arterial embolisation). Postoperative complications, recurrences and functional results according to MSTS were also noted.

Results: The mean age was 22.55 (9-56) and median follow-up time 64.5 months. All patients had pain at presentation and swelling was the most common secondary complaint. The mean cyst volume was 4361.16 mm3 (400-14400). Seven lesions were located at iliac wing, 7 lesions were in pubis, 4 lesions were sacral and 2 lesions were acetabular. An additional arterial embolism was performed in 4 patients. Resection was the most common treatment method (n=7). Other treatment methods in our series were curettage-grafting (n=6), curettage-cementation (n=5) and curettage only (n=2) with the aid of high speed burr. Phenol (n=6) and cauterisation (n=6) were local adjuvant methods in our series. Recurrence was the most common complication that encountered in 2 patients (%10) followed by hip arthritis (n=1) and obturatory nerve injury (n=1). The mean MSTS was 26.4.

Discussion: Aneurysmal bone cysts are rarely encountered in pelvis and present with pain. Intralesional curretage represents good outcomes by additional use of local adjuvants (phenol or PMMA). En bloc resection should be meticulously performed in ABC of pubis or sacral involvements particularly.

304 Polipropylene mesh use in orthopaedic oncology: Is infection a myth?

Aycan OE., Navat A., Arslan MC.
Musculoskeletal Oncology, Baltalimanı Bone Diseases Training and Research Hospital, İstanbul, Turkey

Soft tissue reconstructions following bone and soft tissue tumor resections are challenging interventions in terms of restoration of anatomical and functional integrity. Polypropylene mesh (PPM) is the gold standard in surgical repair of inguinal hernias which can be used in orthopedic oncological reconstructions and tumor type endoprostheses to aid attachment of muscles. We sought to evaluate complications and results of PPM reconstruction following tumor resections.

In our study, 104 patients who underwent surgery for bone and soft tissue tumors who applied PPM between 2010 and 2020 were retrospectively reviewed. Thirty-four patients were excluded due to insufficient follow-up. 70 patients were evaluated, the mean age was 45.8 years and the mean follow-up time was 41.4 months. 42 patients had primary or recurrent sarcoma, 10 patients had benign aggressive tumor, 8 patient had bone metastasis and a patient had chordoma. PPM was applied in 13 patients to support joint stability. PPM was applied to lower extremity in 38 patients, upper extremity in 14 patients, pelvis and acetabulum in 5 patients, scapula and patella in one patient each, shoulder, knee and hip arthroplasty revision in 11 patients and vertebrae in one patient. When categorized according to the purpose of use, to aid soft tissue balance around the prosthesis in 42 patients, to replace bone reconstruction in 19 patients, patella and extensor mechanism reconstruction in 1 patient, rotator cuff reconstruction in 2 patients, ligament reconstruction around the elbow in 1 patient and gluteus medius reconstruction in 1 patient.

The application of PPM increased the surgical time by an average of 36.6 minutes (15-60 minutes), the mean intraoperative bleeding was 639.4 mL (100-1900), and the mean postoperative bleeding was 572.5 mL (100-1500). 58 (82.9%) patients were complication free in the postoperative period. Superficial infection was encountered in 5 patients and deep infection in 2 patients (10%), dead space occurred in 1 (1.4%) patient, and DVT in 1 (1.4%) patient and prosthetic loosening was detected in 1 (1.4%) patient. No dislocation was detected in patients who used PPM in their revision due to joint instability.

We conclude that PPM is a mechanically and biologically reliable reconstructive tool in orthopedic oncology. Although the reconstruction with PPM increases operation time by 15-60 minutes, infection rates in our series were no different from the overall reconstruction.

305 Allograft prosthetic composites in growing children: our experience

Ratto N., Pellegrino P., Boux E., Boffano M., Albertini U., Marone S. , Ferro A. , Piana R.
Orthopaedic Oncology Unit, Città della Salute e della Scienza, Torino, Italy

Introduction : Allograft prosthetic composites (APCs) are used in orthopaedic oncology and in general orthopaedics with specific indications. The possibility to reattach muscles and tendons to human structures gives the possibility of a potential functional recovery. Growing children need a long term and durable reconstruction. The aim of the study is to analyze a case series from a reference centre looking for specific indications, complications and possible technical improvements.

Methods: In the period 2013-2021 20 young patients below 16 years old (age range 4-16) have been treated for bone sarcomas (12 osteosarcomas, 8 Ewing sarcomas) with a limb salvage reconstruction using APCs after tumor resection. Follow up range 1,5-10 years. All patients received preop and postoperative chemotherapy with standard protocol and none received radiotherapy. Anatomic sites were: proximal humerus (5), proximal femur (3), distal femur (5), and proximal tibia (7). Complications, follow up and functional results have been evaluated.

Results: No infection occurred. Four reconstruction failures occurred: 1 traumatic tibial allograft fracture, 1 atraumatic distal femur allograft fracture, 2 broken plates and screws due to non union and allograft mobilization (proximal femur and proximal humerus). Two patients died of disease and 1 of cardiac complications chemotherapy related. Two local recurrences happened 1 in a distal femur and 1 in a proximal tibia. MSTS scores confirmed good long term results with an average score of 26.6 (range 29-19) with no decrease over time.

Discussion: APCs are reliable and long term surviving reconstruction for young oncologic patients. Functional results do not get worse with the growing age. Compared to conventional prosthesis a period of postoperative no weight-bearing or immobilization is mandatory. The use of an additional free fibular graft is still debated because it increases surgical time and morbidity with no clear advantages in term of allograft long term survival. Often the challenge is for young patients to restrain themselves from high load and torsional efforts. Pediatric reconstruction database will represent the future for a patient specific (and not surgeon specific) approach.

306 Improved accuracy and delay in bone tumor diagnosis within an expert sarcoma network: A nationwide study

Crenn V. [1,2], Lataste F.[1], Cassagnau E.[3], Galmiche L. [3], Le Nail L-R.[4], Mickaël Ropars M.[5], Berchoud J.[1], Blay J-Y.[6], de Pinieux G.[7], Gouin F.[8]
[1]Nantes Université, CHU Nantes, Clinique Chirurgicale Orthopédique et Traumatologique, Nantes, France; [2]CRCI2NA (Centre de Recherche en Cancérologie et Immunologie Nantes-Angers), INSERM UMR 1307, CNRS UMR 6075-Team 9 CHILD (CHromatin and Transcriptional Deregulation in Pediatric Bone Sarcoma), Nantes Université, Nantes, France; [3]Nantes Université, CHU Nantes, Service d'anatomopathologie, Nantes, France; [4]Department of Orthopaedic Surgery, CHU de Tours, Faculté de Médecine, Université de Tours, Tours, France; [5]Department of Orthopaedic Surgery, CHU de Rennes, Faculté de Médecine, Université de Rennes, Rennes, France; [6]Departement d'Oncologie médicale, Centre Léon Bérard, Lyon, France; [7]Department of Pathology, CHU de Tours, Faculté de Médecine, Université de Tours, Tours, France; [8]Département de Chirurgie, Centre Léon Bérard, Lyon, France

Background: Primary bone tumors (PBT) constitute a set of rare and varied lesions. Pathologic diagnosis can be challenging: discrepancies have been analyzed for soft tissue sarcomas but there have been no specific studies for bone lesions.

Materials and Methods: Our two-year study on the national prospective French sarcoma network database aimed to answer the following questions: What is the rate of major diagnostic discrepancy (MD) concerning PBT? Does a first histological analysis performed within the network decrease the MD rate and the final diagnostic delay? What is the role of the expert pathologist systematic review on diagnosis variation and readjustment? Are there specific factors affecting diagnostic MD rates?

Results: 1,075 patients were included from 2018 to 2019. A major discrepancy rate of 23.9% was observed among the cohort, with 49 (6.9%) MD in an initial analysis within the network and 207 (57.3%) outside the network ($p < 0.001$); concerning the final diagnostic delay, we observed a mean of 2.8 weeks (± 4.9) within the network vs. 6.5 weeks (±9.1) outside the network ($p < 0.001$). Systematic review by an expert pathologist allowed diagnosis readjustment in 75% of cases; 68.4% of all diagnostic variations occurred preoperatively. Only 34 patients (3.2%) get a post-operative MD based on the tumor specimen resection final analysis. Non-cancerous cartilage lesions were the most at risk for MD, accounting for 117 of all patients (45.7%).

Conclusion: The competence of expert pathologists reduces post-operative diagnostic MD and the final diagnostic delay within the network. Organized networks for rare pathologies such as musculoskeletal bone tumors are mandatory; we recommend treatment in a referral center as soon as a diagnosis of a PBT is suspected and a biopsy is warranted.

307 What is the role of chest imaging in atypical lipomatous tumours?

Boffano M., Ratto N., Pellegrino P., Ferro A. Boux E., Marone S., Albertini U., Piana R.
Orthopaedic Oncology Unit, Città della Salute e della Scienza, Torino, Italy

Introduction: Atypical lipomatous tumours (ALTs) are locally aggressive mesenchymal neoplasms. Previously they were considered low grade soft tissue sarcomas and therefore an oncologic staging with at least chest Xray or CT was indicated if not a chest follow up after surgery. The utility of chest Imaging in ALTs is still debated.

Methods: In the period 2017-2021 in a single reference centre 109 patients were treated for ALTs (medium age 63ys, age range 27-91, 58F:51M, all MDM2+).

The management of preoperative staging and postoperative chest follow up was studied.

Follow up and diagnosis of metastatic lesions were evaluated

Results: Patients were classified in 3 groups: no chest Imaging either at the diagnosis or during follow-up (16 patients); preoperative chest Xray for anesthesiology purposes (8); preoperative staging (12; 1 PET/CT, 10 chest/abdomen CT, 1 chest Xray) and no follow-up; preoperative staging (73; 40 chest CT and 33 chest Xray) and chest Xray follow-up for 3 years.

No metastatic lesion from ALTs was identified preoperatively or during follow-up. Occasionally during staging one 1cm renal clear cell carcinoma and one 1.3cm lung adenocarcinoma were diagnosed and successfully surgically treated by other specialists.

Discussion: Chest Imaging is unuseful in ALTs. It causes unnecessary costs, radiation exposure, lack of time and potential patient's distress. Sometimes patients are staged before histologic diagnosis only because of a big mass. The role of oncologic screening (liquid biopsy, low radiation exposure Imaging) in the general population with or without risk factors is challenging. Multidisciplinary and international consensus for a shared protocol are advisable.

308 Primary bone lymphoma in pediatric age

Tuzzato G.[1], Spinnato P.[1], Vara G.[2], Ostetto F. [1], Donati DM. [1], Bianchi G. [1]
[1]Unit of 3rd Orthopaedic and Traumatologic Clinic Prevalently Oncologic, IRCCS Istituto Ortopedico Rizzoli, Bologna, Italy; [2]Department of Radiology, IRCSS Azienda Ospedaliero Universitaria di Bologna, Bologna, Italy

Primary Bone Lymphoma (PBL) is a rare oncological entity that may initially present paucisymptomatic with local pain and mild systemic symptoms, up to manifesting itself with pathological fractures and large palpable masses. The term primary bone lymphoma indicates the finding of bone involvement without other organ sites for at least six months. Although some radiological features raise suspicion about this tumor form, there are no pathognomonic radiological findings, and the diagnosis is likely to be delayed for a long time. The most critical radiological feature is soft tissue involvement associated with a preserved cortical layer, much more than expected for an infiltrating lesion. Although the radiological features of PBL have been discussed in the literature by various authors, there are rare data concerning pediatric involvement. This paper aims to depict all the possible imaging features of PBL in the pediatric age.

309 Fluorescence guided surgery in bone and soft tissue tumors: A systematic review of clinical and animal studies

Okay E.[1], Gonzalez MR.[2], Sodhi A.[2], Werenski JO.[2], Ozkan K.[1], Lozano-Calderón AS.[2]
[1]Department of Orthopedic Surgery, Istanbul Goztepe Prof.Dr.Suleyman Yalcin City Hospital, Istanbul, Turkey; [2]Department of Orthopedic Surgery, Massachusetts General Hospital, Harvard Medical School. Boston, MA, USA

Background & Objectives: Obtaining negative surgical margins is the fundamental goal in surgicaloncology procedures given the impact in reduction oflocal recurrence rates. An ideal method for intraoperative margin assessment would replace the limited, intraoperative margin, frozen pathology evaluation. Near-infrared imaging using fluorescent dye is performed in oncological surgeries from other disciplines like general surgery and neurosurgery. Its application in orthopedic oncology is a newly emerging technique. This systematic review aims to evaluate current evidence and quantify the risk of bias in the existing literature, including animal and clinical studies.

Methods: Our reviews for clinical and animal studies are registered with PROSPERO. We searched the literature up to December 17, 2022. PubMed, Cochrane, Embase, Wos core collection, Scopus, and Ovid databases were searched using Title & Abstract, keywords, Topic, emtrees, and meshterms. The search terms related to "Indocyanine Green", "Fluorescein," "Fluorescent," "fluorescent dyes," "agents, fluorescence," "agents, luminescent," "fluoresceins," "neoplasm," "sarcoma," "tumor," and "tumor" are used. Studies included were those using fluorescent dye in extremity-located tumors for margin assessment. The search of these online databases had no formal language restriction and no publication year restriction. Two reviewers screened the title and abstract for each result from the databases relevant studies. The deduplication and screening process was done using Covidence online software. Two reviewers evaluated animal studies using SYRCLE's RoB tool and CAMARADES checklist. Two reviewers evaluated clinical studies according to Joanna Briggs Institute's critical appraisal tools.

Results: A total of 34 studies (7 clinical studies, 27 animal studies) were included. Clinical studies are limited to case reports, case series, and case-control studies. There was a high risk of bias with all types of bias: selection, performance, detection, attrition, and reporting. Clinical studies were retrospective, with small sample sizes and a lack of randomization. The studies showed the utility of targeted and nontargeted dyes. However, there is limited reported data regarding diagnostic accuracy tests and margin positivity.

Conclusion: Future studies are warranted to develop a standard protocol for fluorophore-guided sarcoma surgery using NIRF imaging. Other techniques, such as fluorescence lifetime imaging, could improve diagnostic accuracy for targeted and nontargeted dyes.

310 Non-ossifying fibroma fracture risk: How long and how should we follow?

Doğan B., Sobayapan AM., Arslan MC., Aycan OE.
Musculoskeletal Oncology, Baltalimanı Bone Diseases Training and Research Hospital, İstanbul, Turkey

Objective: The aim of this study was to evaluate the radiological features of the non-ossifying fibroma (NOF), to describe the timing of consolidation regarding Ritschl stage, to determine the fracture risk and identify follow-up.

Material and Method: The clinical and radiologic data of 151 consecutive NOF patients who were operated or followed up for a minimum of 3 years, between July 2012 and September 2020 were evaluated retrospectively. A total of 104 patients (66M/38F) with a mean age of 11.3 were included. Besides epidemiological data, presenting symptom, the Ritschl stage at diagnosis, cortical thinning, cortical expansion, lesions distance from the physeal plate and measurements of cortical involvement at presentation were noted. The timing of Ritschl stage changes at follow-ups and presence of pathological fracture were also noted. Fracture risk score defined by Ritschl were calculated.

Results: The most common localization in our series was tibia(51.9%) and femur(41.3%). The mean follow-up time was 62.7 months. 14.4% lesions were multiple. 73.1% of the patients were asymptomatic and pathological fracture was the presenting symptom in 9.6% patients. 50.1% of the lesions were at stage A at initial diagnosis and 51.9% were stage D at last follow-up. Cortical thinning was evident in 35.6% and cortical expansion in 14.4% of the patients. The observed mean time to change from stage A to B was 17.3 months(n=32), stage B to C in 24.7 months(n=68), stage C to D in 27.5 months(n=44). Overall mean time to change from stage A to D was 51.2 months(n=22). There was no change in 5 patients within 47.2 months follow-up in our series. 17.3% of the patients were calculated as high risk for fracture and 8 out of 18 high risk patients had fracture.

Conclusion: The non-ossifying fibroma follows a characteristic radiomorphological course with variable duration of each stage. Stage B lesions were found to be at an increased risk of fracture similar to literature. Follow-up, with imaging at least twice a year is recommended at adolescent patients until the lesion reaches stage C or D. Overall, patients can be followed up for at least 4 years.

311 Evaluation of the long term functional outcome and quality of life after rotationplasty in the management of primary malignant bone tumours about the knee in children

Wafa H. [1], Moke L. [1], Ebeid W. [2]
[1]Department of Orthopaedic Surgery, University Hospital Leuven, Belgium;
[2]Department of Orthopaedic Surgery, Cairo University, Egypt

Background and Objectives: Rotationplasty, described as segmental resection or intercalary amputation, is a valid modified limb-salvage technique in children with primary bone sarcomas about the knee joint. The use of expandable prostheses has gained increasing popularity at the expense of rotationplasty owing to concerns regarding the appearance of the limb and its impact on the overall development and psychological well-being of these patients. We aimed to highlight the long term functional outcome and quality of life in these patients through adulthood.

Methods: Ten skeletally immature patients with primary malignant bone tumours about the knee joint who underwent rotationplasty procedure and were alive with no evidence of disease at the time of their last followup were included in this study. There were five males and five females with a mean age of 10.4 years (range, 9-16 years) at the time of surgery. Nine patients had osteosarcoma while the remaining patient had a diagnosis of Ewing's sarcoma. The functional outcome was evaluated using the Musculoskeletal Tumour Society Score (MSTS) while the quality of life was assessed using the standard version of the core quality-of-life questionnaire (QLQ-C30) of the European Organization for Research and Treatment of Cancer (EORTC).

Results: The mean MSTS functional score was 83% (range, 73-100%) and the mean score of the global health status (QoL) was 91.7 points (range, 75-100 points). The mean score for physical functioning was 81.0±13.6 points while the mean score for role functioning was 88.1±20.9 points. Patients did not think that their physical condition or the treatment they received had interfered with their family life or social activities with a mean score for social functioning of 91.7±13.9 points. 0nly one patient was hesitant about recommending the rotationplasty procedure to others.

Conclusion: Rotationplasty remains a very valid technique in the management of children with primary bone sarcomas about the knee joint with excellent long term functional results and a high quality of life in this group of patients.

312 Enhancing massive bone allografts outcomes: a large animal model study

Evrard R.[1,2], Manon J.[1,2], Darius T.[1,2], Cornu O.[1,2], Lengelé B.[1,2], Schubert T.[1,2]
[1]Institut de Recherche Expérimentale et Clinique (IREC), UCLouvain, Brussels, Belgium; [2]Cliniques Universitaires Saint-Luc (CUSL), Brussels, Belgium

Introduction: In order to achieve limb salvage, large tumor resection surgeries are always followed by a crucial orthopedic reconstruction. To do so, massive bone allografts allow to preserve a good bone stock and achieve anatomic reconstruction. However, their postoperative complication rate is still very high. By removing immunogenic tissue, our total bone perfusion-decellularization protocol was able to create massive bone allografts with better osseointegration properties.

Methods: We processed bone allografts with our perfusion-decellularization protocol. Three porcine femurs were cut into 2,5cm long intercalary massive bone allograft. The same cut was performed on the 3 contralateral femurs.

A critical size bone defect of 2,5cm was performed on each femur of 3 minipigs. One leg received a decellularized allograft (DA) and the other received a conventional “fresh frozen” allograft (CA).

Fortnightly, imaging, weighing, blood sample and fluorochrome injections were performed. After 3 months, the allografts were retrieved and analysed through histology, immunohistochemistry (IHC) and fluorescent microscopy.

Results: Fluorescent microscopy showed that the ossification front, always dependent from a central vessel, penetrates deeper into the DA.

Histology (Alcian blue and Hematoxylin/Eosin) showed higher quantities of bone remodelling and cellular colonization inside and around the DA. Larger areas of osteoclasts taking on the graft were also more highlighted in the DA than in the CA after 3 months postoperative. On the other hand, CA showed denser areas of inflammatory cells populations (i.e. PMN) around it compared to the DA.

IHC (Osteocalcin) correlated these results with larger amount of osteocalcin in the DA following the ossification front inside and outside the graft, dependent on a neo-vessel.

Alpha-SMA IHC wasn’t contributive.

Conclusion: Our original perfusion-decellularization protocol can create massive bone allografts with better biological properties of bone integration and remodeling.

313 Impact of the COVID-19 pandemic on sarcoma patients: results from the London Sarcoma Service (LSS)

Wood M., Hasan Y., Bayliss L., Strauss S.
Division of Orthopaedic Oncology & Specialist Hip and Knee Unit (DOOSHAK), Royal National Orthopaedic Hospital, Stanmore, United Kingdom

Background & Objectives: In 2020, the COVID-19 pandemic became a public health emergency and has affected every aspect of the healthcare sector. There is emerging evidence that the pandemic was associated with a delay in cancer diagnosis and treatment. However, the impact on sarcoma patients and the survival rates remains widely unknown.

Methods: We retrospectively reviewed all the patients (n = 664) who were referred to the London Sarcoma Service (LSS) between February 2018 and December 2022. In this study, we aimed to compare the results from the LSS before and after the pandemic. We investigated the time from first symptoms to referral, diagnosis and treatment, survival rates and surgical outcomes (including limb salvage or amputation, pelvic resection or amputation and palliative care).

Results: We identified a total of 174 patients in the pre-COVID group and 177 in the post-COVID group. The mean time from first symptoms to referral was 7.34 months post-COVID (range 0-148 months) compared to 6.68 months pre-COVID (range 0-120 months) (p=0.656). The mean time from referral to first treatment was 48.51 days post-COVID (range 11-273 days) compared to 61.26 days pre-COVID (range 8-553 days) (p=0.067). There was a higher amputation rate for patients with limb sarcomas in the post-COVID group: 18.57% compared to 13.39% pre-COVID. There was no significant difference in the survival rates at 6, 12 and 18 months between the pre- and post-COVID groups.

Conclusion: the COVID-19 pandemic was not associated with any statistically significant delay in time to presentation but was associated with a significant delay from referral to treatment for sarcoma patients. There was a higher amputation rate for patients with limb sarcomas in the post-COVID group, but overall survival rates remained unchanged at 18 months post-operatively.

314 Limb survival after tibial massive bone allograft

Evrard R.[1,2], Manon J.[1,2], Cornu O.[1,2], Schubert T.[1,2]
[1]Institut de Recherche Expérimentale et Clinique (IREC), UCLouvain, Brussels, Belgium; [2]Cliniques Universitaires Saint-Luc (CUSL), Brussels, Belgium

Introduction: In order to reconstruct large bone defects, massive bone allografts are an interesting alternative to endoprostheses. In cases of major bone loss in the tibia, the usefulness and advantages of massive allografts are again being discussed. We conducted a retrospective study of all types of massive tibial allografts performed at our centre to evaluate the overall survival of these reconstructed limbs.

Methods: We reviewed the cases of 125 patients who received one (or more) massive tibial allografts between 1987 and 2022. All types of massive allograft (inlay, diaphyseal, metaphyseal, APC, osteochondral) were evaluated as well as all types of indication for grafting (non-union, sepsis, tumour, deformity, arthrodesis and metal implant failure). The main outcome being the survival of the operated limb in the short and long term, classical survival curves, descriptive statistics and correlation studies on secondary outcomes were performed.

Results: Of our 125 patients, 86 are men and 39 are women. The mean age at the surgery was 40.9 ± 19.2 years, the mean postoperative follow-up was 8.65 ± 7.2 years and the mean follow-up to the first revision surgery was 6.3 ± 6.0 years. 60 patients (48%) had no revision surgery and no allograft retrieval.

The limb survival curve showed a survival rate >70% at 30 years of follow-up. The majority of reconstruction failures occur in the first 5 years postoperatively. However, our data suffers from a large amount of censoring due to a lack of follow-up beyond 5 years (n=40), which makes our long-term survival data less accurate.

There was no statistical correlation between the type of allograft or age and the limb survival (Spearman Correlation =0.16 and -0.3, respectively). There was no statistical correlation between the number of surgeries and the type of allograft (Cramer's V =0.22). However, there is a statistical correlation between the number of redo and the limb survival (Spearman = 0.44; p-value <0.001).

Conclusions: This very broad inclusion method probably leads to a homogeneity bias but will help to identify variables influencing the main outcome in a future analysis by a statistical logistic regression model. It goes without saying that the success of allograft reconstruction surgery depends on many factors such as surgical skills or the type of indication. However, our study shows an interesting overall short- and long-term survival of operated limbs (>70%).

316 Management of a complex Winkelmann B2 rotationplasty for a high-grade osteosarcoma of the hip: A case report

Evrard R.[1,2], Lacroix V. [1,2], Docquier P-L. [1,2], Schubert T.[1,2]
[1]Institut de Recherche Expérimentale et Clinique (IREC), UCLouvain, Brussels, Belgium; [2]Cliniques Universitaires Saint-Luc (CUSL), Brussels, Belgium

Background: In orthopaedic oncology, rotationplasties are mostly performed on young patients with very large tumours of the lower limbs. In the era of limb-salvage surgery, rotationplasty avoids the adverse effects of amputations (e.g. failure of stump closure) or disarticulations (e.g. issues with the adaptability and longevity of external devices). Indeed, the preservation of the foot as a physiological pressure point allows for an easier and painless fitting of the prosthesis. Winkelmann et al. were the first to describe these rotationplasties around the hip. Type B2, which involve a large part of the pelvis and femur and result in osteosynthesis from the distal femur to the iliac wing, are poorly described in the current literature.

Case description: We report a case of type B2 rotationplasty in a 16-year-old male patient with osteosarcoma of the proximal femur and pelvis. The patient was diagnosed of a Ewing sarcoma in November 2021 in another country where he benefitted from a chemotherapy. The patient was subsequently sent to us for the surgical procedure. He was suffering from a bacterial pneumonia when arriving our institution. Our work-up confirmed the diagnosis of a high-grade osteosarcoma of 157mm long axis instead of a Ewing sarcoma. The major vascular and nervous structures were free of disease.

Treatment and outcome: The patient underwent an extensive “en-bloc” resection of the entire tumour. The resection margins were safe. The pelvic cuts were performed with a Gigli saw while the femur was cut with a conventional oscillating saw. The superficial femoral artery was preserved ad integrum and pushed back into the lesser pelvis before closure. Over a 5-month follow-up, the patient suffered 3 postoperative complications which were the subject of surgical procedure: a wound dehiscence (bacterial infection due to active pneumonia), a vascular compression (perivascular inflammatory magma) and a single pulmonary metastasis resected by thoracoscopy.

Conclusion: Our patient is currently free of disease, he pursues revalidation but is ambulant with two crutches. The rotationplasty allowed our young patient to avoid a hip disarticulation which would have caused him significant comorbidities both in the immediate postoperative period and throughout his life with difficulties in fitting external devices. While the procedure is relatively straightforward, it remains more complex and prone to perioperative complications than the classic VanNes rotationplasty.

318 Does reconstruction after internal P2 hemipelvectomy affect oncologic and functional outcome?

Lehner B., Bollmann J., Geisbüsch A., Renkawitz T., Beckmann NA.
Orthopedic university clinic, Heidelberg university hospital, Heidelberg, Germany

Background & Objectives: Internal hemipelvectomies (IH) are complex surgical procedures mainly performed in patients with musculoskeletal tumors. It is unclear whether patients benefit from reconstruction (REKO) after undergoing IH involving the acetabulum (P2 hemipelvectomy). The aim of this study was to investigate and compare oncologic outcome and functionality in patients with and without REKO.

Methods: This retrospective cross-sectional study includes 45 patients who underwent IH, including acetabulum, for a musculoskeletal tumor (44% chondro-, 18% Ewing-, 7% osteosarcoma, 13% metastasis, 18% other) at our hospital between 1995 and 2019.

Twenty-seven patients received a REKO (19 endoprosthetic, 7 biologic, 1 osteosynthetic; 16 men, 11 women; mean age at surgery: 44.4 years) and 18 patients remained without a REKO (= Girdlestone situation (GS)) (10 men, 8 women; mean age at surgery: 45.3 years). Overall survival was evaluated using Kaplan-Meier analysis and resection margin (R0 vs. R1/R2/RX), local recurrence and complication rates using the chi-square test. In survivors, functional outcome was assessed using MSTS Score, Toronto Extremity Salvage Score (TESS), and Oxford Hip Score (OHS) and was evaluated using the Mann-Whitney U test.

Results: 44% (12/27) after having received a REKO, and 39% (7/18) without having received a REKO were alive at the time of study. There was no significant difference in overall survival between the two groups (median survival [95%-CI]: REKO: 5.1 years [1.2; 9.0]; GS: 2.5 years [0.0; 8.6]; p=0.858). Patients who received REKO showed more frequent R0 resection (REKO: 77% (20/26), GS: 61% (11/18), p=0.323) and less frequent local recurrence (REKO: 33% (9/27), GS: 53% (9/17), p=0.225). There was no difference in complication rate (REKO: 52% (14/27), GS: 56% (10/18), p=1.000). Survivors (Mean follow-up: REKO: 12.5 years, GS: 13.0 years) showed no clinically relevant difference in postoperative functionality (Mean MSTS, TESS and OHS: REKO: 13 (44%), 65% and 29 (60%), GS: 13 (44%), 70% and 35 (72%), p-values: 0.732, 1.000 and 0.157, respectively).

Conclusion: After internal P2 hemipelvectomy, patients with reconstruction did not show better overall survival or functionality despite higher R0 resection rates and lower local recurrence rates.

319 Fibrinolysis shutdown and elevated D-dimer levels have high prognostic capacity for postoperative thromboembolic complications in patients with bone tumors

Tsantes AG.[1], Loukopoulou I.[1], Papadopoulos DV.[2], Trikoupis IG.[3], Sokou R.[1], Tsante KA.[1], Piovani D.[4,5], Papagelopoulos P.[3], Bonovas S.[4,5], Tsantes AE.[1]
[1]Laboratory of Haematology and Blood Bank Unit, "Attiko" Hospital, School of Medicine, National and Kapodistrian University of Athens, Athens, Greece; [2]2nd Academic Department of Orthopaedics, School of Medicine, Konstandopoulio General Hospital, National & Kapodistrian University of Athens, Athens, Greece; [3]First Department of Orthopaedics, National and Kapodistrian University of Athens, School of Medicine, Athens, Greece; [4] Department of Biomedical Sciences, Humanitas University, Pieve Emanuele, Milan, Italy; [5] IRCCS Humanitas Research Hospital, Rozzano, Milan, Italy

Background: Surgical resection of malignant bone tumors is associated with a high risk of venous thromboembolism (VTE). The purpose of this study was to evaluate the association between rotational thromboelastometry (ROTEM) parameters and VTE following oncologic resections, and to evaluate their prognostic capacity for this complication.

Methods: A prospective observational study was conducted including 113 patients who underwent surgical resection of malignant bone tumors. ROTEM analysis and conventional coagulation studies were performed preoperatively and on the 2nd postoperative day, while patients were followed for the development of VTE. Logistic regression was used to assess the association between ROTEM parameters and occurrence of VTE. The area under the receiver operating characteristic curve (AUC), sensitivity and specificity were calculated as measures of discrimination and predictive accuracy.

Results: Fourteen patients (12.4%) developed symptomatic VTE. Development of VTE was associated with shortened INTEM CFT (Odds Ratio [OR]= 0.90, 95% Confidence Interval [CI]= 0.84−0.96, p=0.004), higher INTEM A10 (OR=1.21, 95% CI=1.07−1.36, p=0.002), higher INTEM MCF (OR=1.22, 95% CI= 1.08−1.37, p=0.001) and higher INTEM LI60 (OR=2.10, 95%CI=1.38−3.21, p=0.001). An INTEM LI60 value indicative of fibrinolysis shutdown (≥98%) had the best predictive accuracy for VTE (AUC=0.887, 95% CI= 0.824−0.951, sensitivity =100%, specificity=67.0%), higher than that of D-dimer levels (p=0.028).

Conclusions: ROTEM parameters were promising predictors of symptomatic VTE. Fibrinolysis shutdown as reflected by ROTEM LI60 and high D-dimer levels can aid the identification of highriskpatients. Future studies should evaluate whether the addition of ROTEM findings to an expanded risk-assessing model can improve the predictive capacity and provide better guidance in thromboprophylaxis.

320 Analysis of the results of pelvic sarcoma treatment

Polatova D., Alexander S., Davletov R., Asamedinov N., Nurjabov A., Nasirov S.
Oncology and medical radiology, Tashkent State Dental Institute, Tashkent, Uzbekistan

Background: improving the results of treatment of pelvic sarcomas through the introduction of organ-preserving operations.

Methods: National Cancer Research Center of the Ministry of Health of the Republic of Uzbekistan. and National Medical Research Center of Oncology. N.N. Blokhin (Russian Federation) in the period from 1994 to 2019, including 69 patients with sarcomas of the pelvic bones. Depending on the method of surgical intervention, the patients were divided into 2 groups: group I (n = 43) - patients who underwent organ-preserving surgery, and group II (n = 26) - patients who underwent traumatic operations. Postoperative complications, functional outcomes, recurrence-free and overall survival are analyzed.

Results: In our study, functionally unsatisfactory results were observed after mutilation operations, compared with organ-preserving ones. Also, low indicators of the emotional sphere were observed among patients after mutilation operations. This was due to loss of motor activity and phantom pains. An analysis of the cumulative overall survival showed an increase in survival in group I compared with group II (p=0.0035). The 3- and 5-year cumulative disease-free survival rates were 73% and 58%, respectively.

Conclusions: In conclusion, a multimodal, personal approach to the patient, considering individual and anatomical features, oncological balance and functionality, and the desire to save money can give good results. Today, many studies cover internal organs, blood vessels and nerve bundles, and due to their size, the use of traumatic surgical interventions is allowed only for unresectable tumour processes. In recent years, visualization of preoperative conditions, and modern multimodal treatment regimens allow the use of organ-sparing operations.

321 Genetic phenotype in osteosarcoma patients

Polatova DSh.[1,2] , Abdikarimov KhG.[1], Davletov RR. [1], Sultonov BB. [1], Savkin AV.[2], Nasirov SK.[3], Asamedinov NK.[2], Nurzhabov AI. [2]
[1]Oncology and medical radiology, [2]Tashkent State Dental Institute, [3]Tashkent Medical Academy, Tashkent Medical Academy, Tashkent, Venezuela

Target: to study the influence of the genetic phenotype of the tumor on the prognosis of osteosarcoma.

Material and methods: The study included 221 patients with osteogenic sarcoma. The number of men was 133, women - 88. The age of patients was from 1 to 35 years. Localization of the tumor is as follows: 102 patients have a tumor. was in the femur, in 83 patients in the tibia, in 16 patients in the fibula, in 11 patients in the radius, in 6 (2.7%) patients in the ilium and in the 5-inch humerus. In all cases, treatment was carried out according to the protocol and standard of care. Genetic markers of tumors (P53; Ki67; BcL2, chromosome aberration) were studied by immunohistochemistry . The combination of these genes such as P53+/Ri67+/Bcl2- and more than 5% chromosomal aberration is considered a negative combination and the combination of P53-/Ri67-/Bcl2+ and less than 5% chromosomal aberration as positive. Patient survival was studied by the Kaplan-Meier method depending on the combination of genetic markers.

Results: The 3- and 5-year survival of patients with osteosarcoma who had a positive combination of genetic markers (40.0% and 0%) were lower than in patients with negative P53- / Ri67- / Bcl2 + and chromosomal aberrations. <5% (± 90.0 2.9% and 40.0 ± 4.2%) (P < 0.05). 3- and 5-year metastasis-free survival in an unfavorable combination of P53 + / Ri67 + / Bcl2 + genes and chromosome aberrations was (> 5%) - 70.0 ± 3.4% and 10.0 ± 3.2%, in while with a positive phenotype - 90.0 ± 3.4% and 50.0 ± 4.3% (<0.05). In the analysis, 3- and 5-year survival without recurrence in the negative phenotype was - 60.0 ± 4.9% and 10.0 ±.4%, while in the positive - 90.03 ± 3.2% and 50.0 ± 4.2% (p<0.05).

Conclusion: The study showed that the prognosis was poor in terms of positive P53+/Ki67+ expression and chromosomal aberrations of more than 5%. The management of osteosarcoma can be modified by combining these markers.

322 The hypercoagulable profile of patients with bone tumors: A pilot observational study using rotational thromboelastometry

Tsantes AG.[1], Loukopoulou I.[1], Papadopoulos DV.[2], Trikoupis IG.[3], Roustemis AG.[3], Goumenos S.[3], Piovani D.[4,5], Papagelopoulos PJ.[3], Bonovas S.[4,5], Tsantes AE.[1]
[1]Laboratory of Haematology and Blood Bank Unit, "Attiko" Hospital, School of Medicine, National and Kapodistrian University of Athens, Athens, Greece; [2]Department of Orthopaedic Surgery, Geisinger Medical Center, Danville, PA, USA; [3]First Department of Orthopaedics, School of Medicine, National and Kapodistrian University of Athens, Athens, Greece; [4]Department of Biomedical Sciences, Humanitas University, Milan, Italy; [5]IRCCS Humanitas Research Hospital, Rozzano, Milan, Italy

Introduction: A detailed evaluation of the malignancy-associated coagulopathy (MAC) in surgical patients with bone tumors may allow for more effective thromboprophylactic measures.
The purpose of this study was to assess the perioperative hemostatic changes in patients with bone tumors, using rotational thromboelastometry (ROTEM).

Methods: An observational study was performed, including 50 patients with bone tumors who underwent oncologic resection and 30 healthy controls, matched for age and gender. The preoperative and postoperative laboratory evaluation of coagulation in both groups included conventional coagulation tests and a ROTEM analysis. The results of the conventional coagulation tests and the ROTEM analysis were compared between the two groups.

Results: The results of the conventional coagulation tests were comparable between the tumor patients and the healthy controls. However, compared to the healthy adults, the tumor patients had lower CT ($p < 0.001$) and CFT ($p < 0.001$) values suggesting a rapid induction of the coagulation cascade, elevated A10 ($p < 0.001$) and MCF ($p < 0.001$) values indicating a higher clot strength and platelet activation, and elevated LI60 ($p < 0.001$) values indicating hypofibrinolysis in patients with bone tumors. The multiple linear regression analysis (controlling for potential confounding factors) confirmed the independent association of bone tumors with these hemostatic changes.

Conclusions: Our results support the advantageous use of a ROTEM in patients with bone tumors over conventional coagulation tests because the qualitative changes in the hemostatic profile of these patients that can be detected by a ROTEM analysis cannot be identified by conventional tests. The ROTEM results indicate that the hypercoagulable state in patients with bone tumors is caused by the malignancy associated activation of the coagulation cascade, platelet activation, and hypofibrinolysis.

323 Study of customised cutting guides in the resection of primary pelvic bone tumours

Fragnaud H., Biscaccianti V., Vidal L., Varenne Y., Lataste F., Hascoet J-Y., Crenn V.
[1]Clinique Chirurgicale Orthopédique et Traumatologique, Nantes Université, CHU Nantes, Nantes, France

Background: Customised cutting guides (CCG) are a technical aid that makes removing primary pelvic bone tumors safer and more reliable. Although the effectiveness of the devices is unanimous, their conception and design remain varied and heterogeneous, with no defined consensus. Two main designs can be observed in the literature, the "block" type CCG, and the "patch" type CCG, and an evaluation of their respective performances seems necessary.

Hypothesis: The thinner, patch-type CCG design would better respect the planning and resection margins of the tumor.

Method: We conducted an experimental study on five anatomical subjects by simulating six virtual tumors in three zones (zone I, zone II, zone I-IV). This was done to evaluate and compare the impact of the CCG design on performance in terms of resection margins (deviation from the planned margin (EMP) and maximum deviation from the scheduled margin (EMaxMP)) and intraoperative ergonomics in bone oncology conditions.

Results: The patchCCG performed significantly better than the block CCG on the criteria of EMP with median data of 1.0mm versus 2.3mm (p=0.019) and EMaxMP (2.6mm versus 4.1mm; p=0.002). In addition, the patch design was significantly more ergonomic than the block design, 92% versus 84% (p=0.031).

Conclusion: We have demonstrated that the design of a custom-made cutting guide can impact its performance in terms of accuracy and ergonomics. The patch-type CCG thus seem more suitable for bone tumor resections in the pelvis.

324 Staged revision of infection with adjustable spacers after megaprosthesis implantation in primary sarcoma patients

Sirin E., Sofulu O., Baysal O., Akgulle AH., Erol B.
Department of Orthopaedic Surgery and Traumatology, Marmara University School of Medicine, Istanbul, Turkey

Background: While periprosthetic joint infection has always been a significant concern for orthopaedic surgeons, the rate of infection is five to ten times higher after tumor prosthesis implantation. With the growing use of mega-implants, the number of these infections has also increased. We aimed to investigate the results of our patients with a primary malignant musculoskeletal tumor, who underwent two-stage revision surgery for an infected mega-prosthesis. We also presented the required soft tissue reconstruction procedures after the second stage.

Methods: The study included 32 primary bone and soft tissue sarcoma patients who underwent a two-stage revision procedure for infection. After a rigorous bone and soft tissue debridement procedure at the first stage, antibiotic-loaded bone cement was wrapped around a cloverleaf type intramedullary nail and inserted into the forming gap. After a minimum of 6 weeks of antibiotic therapy, depending on patients' clinical signs and serum infection markers, the reimplantation stage was undertaken.

Results: The mean oncologic follow-up period was 28 months (range: 5-96 months). During this period, 11 patients died because of non-infection related causes, 12 patients were alive with their disease, whereas 9 patients were totally free of their oncologic condition. The infection was eradicated in all survivors except one patient, where a high-level transfemoral amputation became necessary.

Conclusion: Antibiotic loaded size-adjusted megaspacers can efficiently function in megaprosthesis infections treated with staged revision procedures during implant-free interval. They provide proper soft tissue balance and enable partial mobility for patients, and limb length discrepancy can also be avoided.

325 Neoadjuvant radiotherapy in extremity Ewing sarcoma may facilitate increased rates of limb salvage

Anthony C.[1], Etaiwi M. [1], Morris G. [1], Jeys L.[1,2], Kurisunkal V. [1]
[1]Oncology Department, The Royal Orthopaedic Hospital, Birmingham, UK;
[2]Faculty of Health Sciences, Aston University, Birmingham, UK

Radiotherapy is a useful adjunct in Ewing sarcoma although comes with its own morbidity. We assessed the role of neoadjuvant radiotherapy in patients with extremity disease undergoing surgery at our unit. Decisions are made case by case at MDT for poor response, anticipated close margins, fracture or large soft-tissue component.

97 patients were retrospectively identified between 2012 and 2023. Mean follow up was 38 months (3-125). 33 received neoadjuvant radiotherapy, 12 received adjuvant radiotherapy, and 52 received no local radiotherapy. Between 2012-2017 and 2017-2023 there was a significant increase in the use of neoadjuvant radiotherapy in limb salvage surgery (18% vs 66% P<0.0001). Amputation rate was 29% vs 16% respectively for these periods (p=0.15)

There was no significant difference in local recurrence (100% neoadjuvant, 100% adjuvant, and 96% no radiotherapy), metastasis free survival (79%, 83%, and 90%), or overall survival (94%, 83%, and 83%). Local recurrence in limb salvage without radiotherapy was 7%. Good response to neoadjuvant chemotherapy (necrosis >90%) was 88% with neoadjuvant radiotherapy vs 72% without (p=0.12). Higher rates of close margins (<2mm) were found with neoadjuvant radiotherapy (36% vs 14% p=0.03). No significant difference in wound complications (30% neoadjuvant, 25% adjuvant, 13% no radiotherapy p=0.16) or return to theatre (18%, 17%, 6% p=0.18) was observed.

Neoadjuvant radiotherapy is increasingly utilised in extremity Ewings. This allows the planning of closer margins and may facilitate increased rates of limb salvage without an increase in local recurrence. It is likely however, that there is an increase incidence of wound complications.

326 A novel immune cell signature for predicting pleomorphic sarcoma prognosis

Petroni G.[1], Scolari F.[2], Campanacci DA.[2], Scoccianti G.[2], Palchetti I.[3], Gambale E.[1], Caliman E.[1], Boddi A.[2], Antonuzzo A.[1], Pillozzi S.[1]
[1]Department of Experimental and Clinical Medicinel, University of Florence, Florence, Italy; [2]Orthopaedic Oncology, AOUC - Azienda Ospedaliero-Universitaria Careggi, Firenze, Italy; [3]Dept. of Chemistry, University of Florence, Firenze, Italy

Background: Relation between immune status within Pleomorphic Sarcomas (PS) microenvironment and clinical outcome has been recently addressed, but still needs further investigation. Patients with PS have different immune microenvironment characteristics and, therefore, have different responses to immunotherapy; hence, studying the immunological characteristics of PS tissues may contribute to improving immunotherapy efficiency.
Dendritic cells (DC), being the most potent antigen presenting cells (APCs), are of great interest in the study of potential prognostic or immunotherapeutic factors.

Methods: PS tissue samples were obtained from 12 patients enrolled at the Careggi University Hospital, Florence (RESEARCH study). We performed an immunologic profiling analysis using the Human Immunology V2 Panel on the nano String Counter platform. The prognostic value of immune-cell signatures on Disease Free
Survival (DFS) was assessed through a log-rank test.

Results: Differential expression analysis of immune-related genes revealed heterogeneity of genes representative of certain immune populations (B-cells, CD8 T cells, Cytotoxic cells, Exhausted CD8, Macrophages, Neutrophils, NK cells, T-cells, Th1 cells and Treg) between samples. DC related genes also shown heterogeneity between samples, however patients characterized by an increased DC phenotype showed a significant higher median DFS compared with patients with a low DC phenotype.

Conclusions: In the present study, we explored genes associated with immune cell infiltration and we found that PS patients with an increased DC phenotype showed a better prognosis.

327 How to manage intraarticular knee masses; Building an algorithm from a retrospective point of view

Sirin E., Sofulu O., Sağlam F., Kutuk E., Akgulle AH., Erol B.
Marmara University School of Medicine - Department of Orthopaedic Surgery and Traumatology, Istanbul, Turkey

Background: Intraarticular masses of the knee joint are usually encountered as incidental findings on imaging studies, which are usually asymptomatic and benign, however the probability of a highly malignant sarcoma should never be taken out of consideration. As there is no certain approach guideline for these lesions, we tried to build a management strategy considering the fact that malignant tumors, particularly synovial sarcoma can also arise in this region.

Methods: A total of 43 patients were included in the study. Preoperative biopsy was performed only for three patients, who had definitely a malignant appearance on magnetic resonance imaging with increased contrast enhancement. Two patients were referred for unplanned resection of intraarticular synovial sarcoma. For the remaining 38 patients, a direct marginal excisional surgery via arthrotomy was applied. Attention was paid to leave a synovial layer on the excised specimen and also not to section the tumor tissue in pieces.

Results: The pathologic diagnosis was tenosynovial giant cell tumor (n=23), synovial hemangioma (n=6), synovial chondromatosis (n=3), intraarticular ganglion cyst (n=3) and intraarticular osteochondroma (n=3). The diagnosis of the remaining five patients was synovial sarcoma, who eventually underwent an extraarticular joint resection procedure.

Conclusion: While heterogenous lesions with a definitive malignant image on MRI warrant a preoperative closed biopsy, totally benign appearing masses without contrast enhancement and intermediate suspicious lesions with only peripheral contrast enhancement should be preferably managed by intraarticular marginal excision without a biopsy, taking care to get the specimen en-bloc and leaving a peripheral rim of synovial tissue on the mass if ever possible.

328 Gap Nail in the management of pediatric bone tumor pathology

Puertas JP., Valcárcel A., Valero G., Salcedo C., Ondoño A., Escudero A., García Paños JP., Maestre D., Ortega A., Castillo A.
Cirugía Ortopédica y Traumatología, Hospital Universitario Virgen de la Arrixaca. Murcia, Murcia, Spain

Objectives: The Gap Nail, whose indication arises as a fixation material for patients with short stature and bone fragility (osteogenesis imperfecta), is a suitable material for use in the management of benign and malignant tumor pathology of bone tumors in children. In tumor pathology, there are no specific nailing designs for reconstruction after tumor resection.

Material and Method: We present a retrospective study of a series of 7 cases, in which the method of stabilization of the surgery is the Gap Nail, specific for children . The follow-up was performed for a mean of 29.42 months (2017-2021). Four of the patients underwent surgery due to previous osteosynthesis failure.

Results: In the present review only one complication of the stabilization method studied was detected, i.e. only one of the nails that was implanted, had to be replaced. Functionality, according to the MSTS scale, was scored with an average of 28.42 of 30 points.

Conclusions: In the management of reconstructive surgery of pediatric bone tumors, bone transplant stabilization using the Gap Nail appears to offer better biomechanical stability than plate osteosynthesis.

329 Characterization of miRNA-mRNA network in soft tissue sarcoma

Pillozzi S.[1], Scolari F. [2], Scoccianti G. [2], Caliman E. 1, Palomba A.[2], Scanferla R.[2], Gambale E.[1], Fancelli S.[1], Antonuzzo L. [1], Campanacci DA.[2]
[1]Department of Experimental and Clinical Medicinel, University of Florence, Florence, Italy; [2]Orthopaedic Oncology, AOUC - Azienda Ospedaliero-Universitaria Careggi, Firenze, Italy

Background: Soft tissue sarcomas (STS) are a heterogeneous and complex group of tumors with significant metastatic potential. We focused our analysis on miRNA-mRNA networks, in order to identify potential biomarkers and therapeutic targets for these malignancies.

Methods: We performed miRNA profiling on tissue and plasma samples obtained from 12 patients enrolled at the Careggi University Hospital, Florence (RESEARCH study) using the nCounter Human v3 miRNA Expression Assays Panel on the NanoString nCounter platform. In order to identify differentially expressed miRNAs in relapsed vs non-relapsed patients, miRNA counts were normalized and compared with a reduced model likelihood test.. Prognostic value of miRNAs was evaluated by ROC analysis.

Results: Differential expression analysis revealed that 4 miRNAs involved in FOXO pathway (miR-21-5p, miR-15a-5p, miR-221-5p and miR-205-5p) showed higher expression in relapsing patients (adjusted p-value <0.05, Fold Change >2). ROC analysis on this panel revealed that the combination of hsa-miR-21-5p, hsa-miR-15a-5p and hsa-miR-221-3p displayed good predictors of relapse (AU-ROC = 0.933) in STS. Validated targets of these miRNAs (FOXO, PTEN and PI3KR1) also showed high prognostic values of relapse (AU-ROC = 0.72 – 0.81).

Conclusions: Our data indicate that a network of mRNA-miRNAs is differentially regulated in tissue samples of who will experience relapse vs not relapsing STS patients. The combination of 4 miRNAs and 3 target genes could potentially serve as biomarker for predicting tumor relapse of STS patients.

330 Osteoarticular allograft rescue of the proximal femur for post-traumatic fracture

Puertas JP., Valcárcel A., Salcedo C., Sánchez Archidona J., Clavel L., Valero G., Ondoño A., Escudero A.
Cirugía Ortopédica y Traumatología, Hospital Universitario Virgen de la Arrixaca, Murcia, Murcia, Spain

Introduction: Technical difficulties involved in the localization of the proximal femur in children; after allograft extraction and implantation of a customized growth megaprosthesis.

Material and Method: A 7-year-old girl diagnosed with osteosarcoma of the proximal femur and treated according to oncology protocol and subsequent tumor resection. Reconstruction of the proximal femur was performed by means of an ostearticular allograft. And stabilization with Gap Nail (diameter 7.2 and length 260).

Results: During the evolution of the patient, he suffered a trauma, resulting in a subcapital fracture of the allograft, at nine months. In view of this situation, a reconstruction by means of the implantation of a customized megaprosthesis (Implancast-Mutars) was considered.

Conclusions: Reconstruction after tumor resection of the proximal femur in pediatric age is difficult. One of the most appropriate options is the implantation of a customized growth megaprosthesis to avoid the complications of biological options such as vascularized fibula or osteoarticular allografts.

331 3D Virtual Reality Planning and Browser-Assisted musculoskeletal tumor surgery

Valcárcel A., Puertas JP., Salcedo C., García Paños JP., Valero G., García J., Ondoño A., Escudero A.
Cirugía Ortopédica y Traumatología, Hospital Universitario Virgen de la Arrixaca. Murcia, Murcia, Spain

Introduction: Virtual reality planning is performed prior to surgery and provides more information to the surgeon of the anatomical area to be operated on. This is especially important in complex anatomical locations such as the scapula and pelvis.

Browser Assisted Surgery uses virtual planning during surgery and helps the surgeon to have 3D orientation in the operative act which together with 3D cutting guides increases precision and safety in surgery of musculoskeletal tumors.

Objective: We present our experience in virtual planning and resection of complex musculoskeletal tumors assisted with navigation system and 3D cutting guides.

Material and Method: We present 6 patients with musculoskeletal tumors planned with virtual reality prior to surgery and in whose surgery we used the navigation system (VegaOneStep Navigation System. IngenieriaQx. Spain). The anatomical location was in two cases the pelvis (Osteosarcoma and S. Ewing), two the scapula (Kaposiform hemangioendothelioma and chondrosarcoma), one the knee and one the foot (extra skeletal osteosarcoma). In 3 of them we used 3D printed cutting guides to increase the precision of the resection.

Results: In all 6 cases the resection was achieved R0 resection according to the planned margins correlating the planned resection piece virtually with the anatomical piece.In 1 case allowed orientation in the implantation of pelvic anchor prosthesis.

Conclusions: Planning with virtual reality and computer-aided navigation together with 3D printed cutting guides provide great support in decision making and surgical precision in musculoskeletal tumors.

332 Are PSI Jigs in sarcoma resections safe? The Early Birmingham experience

Sison JD., Almashahedi M., Jison J., Kurisunkal V.
Department Oncology, Royal Orthopaedic Hospital, Birmingham, UK

Patient – Specific Instruments (PSI) jigs can provide dead-on accurate resections to obtain safe margins which could be the single most important controllable surgeon factor in sarcoma surgeries. These cutting guides have emerged from the improving technology of Bespoke implants which commonly uses these guides to precisely and accurately obtain planned resections. There is currently limited literature regarding the reliability and overall safety of these jigs. The objective of this study will be to determine whether these custom jigs can deliver the actual planned margins of resection.

This is an ongoing retrospective study of all patients who underwent resection of bone malignancy of the extremities and the pelvis using a custom-made resection jig between 2019 and 2023, statistical analysis will be used to compare the planned margins (A) to the final margins achieved (B) to determine if there are any significant differences, and finally to conclude on how accurate the resections were. Patient demographics and other pertinent data will also be analyzed to determine if these will have statistically significant relevance to the overall outcome of the treatment, i.e., time between planning scan and the actual surgery, the PSI manufacturer, neoadjuvant or adjuvant treatment received, tumour necrosis, staging, presence of pathologic fracture on presentation, surgical complications and recurrences.

We have completed the systematic search and are now in the process of extracting the relevant information. The preliminary results so far have been interesting but the final and completed outcome will be presented at the conference.

333 Intercalary reconstruction with vascularized fibula after resection for primary bone tumors of the tibia

Campanacci DA.[1], Scanferla R.[1], Marsico M.[1], Muratori F.[1], Scoccianti G.[1], Beltrami G.[2], Innocenti M.[3], Capanna R.[4]
[1]Orthopedic Oncology Unit, Careggi University Hospital, Firenze, Italy; [2] Pediatric Orthopedic Unit, Meyer University Hospital, Firenze, Italy; [3]Plastic Surgery, Istituto Ortopedico Rizzoli, Bologna, Italy; [4]Orthopedic Clinic, Pisa, Italy

Background & Objectives: Reconstruction with vascularized fibula grafts (VFG) after intercalary resection for sarcoma may provide early union, spontaneous healing potential after fracture and the ability to hypertrophy under mechanical stress, even in compromised soft tissue area due to chemo and/or radiation therapy. The association of VFG and massive allograft combines the primary mechanical stability of the graft with biological potential of the vascularized fibula. The purpose of this study was to review long term results of VFG reconstruction after intercalary resection of the tibia for primary bone sarcomas.

Methods: Fifty-seven patients treated in our Unit for primary bone tumors with intercalary resection of the tibial diaphysis and reconstruction with VFG were included. The mean age at the surgery was 21.6 (5 - 68) years.

Results: Mean Follow-Up was 186 (24 - 417) months. Mean tibial resection length was 15.1 (7 - 27) cm, while mean fibular resection length was 18.7 (10 - 29) cm. In 46 cases VFG was associated with massive allograft and in 5 cases with allogenic cortical bone struts, in 5 cases it was used alone, while in one case it was combined with a recycled autoclaved autograft. Forty complications that required surgery were assessed in 32 patients (56%) (10 nonunions, 7 fractures, 6 local recurrences, 5 wound problems, 4 deep infections, 1 recurrent hemorrhage, 1 screw-related pain, 1 plate-related pain, 1 acute vein thrombosis of VFG pedicle, 1 Achille's tendon retraction, 1 varus deformity of proximal tibia, 1 knee osteoarthritis and 1 hypometria); Complication-free survival was 52% at 5 years, 44% at 10 and 15 years and 41% at 20 years. VFG removal due to complication was needed in five cases, with a VFG removal-free survival of 93% at 5 years and 91% at 10, 15 and 20 years. At last clinical control mean MSTS score was 29.3/30 (23 - 30).

Conclusion: VFG combined with massive allograft represents an effective reconstructive option after tibial intercalary resection for primary bone tumors, while VFG alone had a high risk of fracture. Despite the high rate of mechanical complications in the first years, the combination between VFG and massive allograft represents a long-term durable reconstructive option with excellent functional results.

334 Extra-corporally irradiated autografts for reconstruction of peri-acetabular Ewing's sarcoma after neo-adjuvant proton beam therapy

Keintzel M., Panotopoulos J., Hobusch G., Windhager R.
Department of Orthopedics and Trauma Surgery, Medical University of Vienna, Vienna, Austria

Background: The purpose of this study was to evaluate our first results of extra-corporally irradiated autografts for pelvic reconstruction after peri-acetabular tumor resections for Ewing's sarcoma after pre-operative proton beam therapy in parallel to standard neo-adjuvant chemotherapy.

Methods: This case series includes 7 consecutive patients who underwent en-bloc resection of their peri-acetabular lesion with pelvic reconstruction by re-implantation of the extra-corporally irradiated bone segment, , after undergoing standard neo-adjuvant chemotherapy as well as additional pre-operative proton beam irradiation. Four patients were male. Mean age at diagnosis was 13 years (6 to 18), mean follow-up was 23 months (6 to 45). Six patients were metastasis-free at the time of surgery. The average maximum diameter at time of surgery was 8.2cm. After pre-operative proton beam irradiation of the full tumor bed in parallel to concomitant neo-adjuvant chemotherapy, all patients underwent wide tumor resection of the residual post-chemotherapeutic tumor volume. To reconstruct the peri-acetabular defect, intraoperative radiation of the resected specimen was performed with a total dose of 90gy from two sides. The irradiated autograft was replanted to reconstruct original pelvic anatomy and fixated by ORIF principles. Consecutively, patients underwent standard adjuvant chemotherapy.

Results: One patient died of pulmonary metastasis, whereas 6 patients were free of distant metastases, no local recurrence has been observed. No intraoperative complications occurred. One patient developed pseudarthrosis. One patient showed progressive acetabular necrosis under complete oncologic remission, and all hardware has been removed along with the autograft. One patient underwent secondary implantation of a tri-polar acetabular cup reconstruction for secondary arthritis. In one case, wound necrosis occurred followed by revision (split skin graft and valvuloplasty). Four patients showed leg length discrepancy of the operated side of 1.5cm. All patients with retained autografts were fully ambulatory without further walking aid devices.

Conclusion: Our early outcomes suggest that the use of extra-corporally irradiated autografts may successfully work for peri-acetabular reconstructions in selected patients with Ewing's sarcoma even after pre-operative proton beam irradiation of the full tumor field as a viable alternative to pelvic endoprostheses.

335 The role of margins of resection in chondrosarcoma

Traub F., De Jager T., Farah G., Sachsenmaier S.
Department of Orthopedics and Traumatology, University Medical Center of the Johannes Gutenberg University Mainz, Mainz, Germany

Introduction: Chondrosarcoma (CS) is a common primary malignant bone tumor. Apart from surgery, additional systemic or radiologic therapies have not shown significant improvement in survival. The purpose of this study was to investigate the association between surgical excision margins and local recurrence-free survival (LRFS) and the role of local recurrence (LR) on disease-specific survival (DSS) in CS of the extremities and pelvis.

Material and methods: We performed a retrospective review of a prospectively collected database between 2007 and 2025 to identify patients who underwent surgery for a chondrogenic tumor. 702 chondrogenic tumors were identified. The final analysis included 109 atypical chondrogenic tumors and 203 chondrosarcomas.

Results: Most atypical chondrogenic tumors were treated by curettage and high-speed burring of the tumor cavity. Recurrence was documented in 19 patients (17%), and in 12 patients the tumor was graded as full chondrosarcoma.

Positive resection margins were divided into R0 with > 5mm distance, 1mm-4.9mm, 0.1-0.9mm. R1 with a positive margin < 1mm2, R1 up to <1cm2.

LR developed in 20% of cases. Pelvic location, pathologic fracture, margin, and grade were significant factors for LR after univariate analysis. In multivariate analysis, surgical margin, central location, and grading were found to be negative factors for LR.

However, if the redefined resection margins are used, it can be seen that the LR and DSS differ significantly. For the DSS, only the grading but not the LR could be shown to reach significant levels in the multivariate analysis. On competing risk analysis, LR was statistically significant for DSS in grade 2 and 3 tumors.

Conclusion: Surgical margins determine LR in all CS grades, but LR affects DSS only in grade 2 and grade 3 tumors. Narrow margins are acceptable in G1 tumors.

336 Should periprosthetic pseudotumors be treated like soft tissue sarcomas?

Pellegrino P.[1], Boffano M.[1], Ratto N.[1], Boux E.[1], Albertini U.[1], Marone S.[1], Ferro A.[1], Aprato A.[2], Masse' A.[2], Piana R.[1]
[1]Orthopaedic Oncology Unit, Città della Salute e della Scienza, Torino, Italy;
[2]Orthopaedic and Traumatology, University of Torino, Torino, Italy

Background: Pseudotumors around total hip (THA) and total knee arthroplasties are mass-forming tissue reactions caused by metal-on-metal or other bearing surfaces wear. The pathophysiology is still not completely known and the surgical management is debated. They are often treated by orthopaedic oncologists and revision arthroplasty or prosthesis explantation is associated with pseudotumor removal with oncologic criteria. The aim of the study is to analyze indications and complications in a case series from a reference centre.

Methods: In the period 2016-2022 48 patients have been treated in a reference centre for bone and soft tissue sarcomas. Hip:Knee 45:3, Medium age was 74 (age range 54-86). Bearings in THA were MoM (29), metal on poly (6), ceramic on poly (7), ceramic on ceramic (2) and ceramic on metal (1). Surgical indications and complications were analyzed

Results: One stage revision arthroplasty with pseudotumor was performed in 21 cases, two stage procedure (prosthesis and pseudotumor removal followed by delayed reimplantation) in 8 cases, pseudotumor removal alone with prosthesis retention in 12 cases, only biopsy with no further treatments (7). Several complications were observed: pseudotumor recurrence (13), bleeding and anemia (5), wound healing complication (4), infection (2), DVT (3), dislocation (2), death due to related complications (1).

Conclusions: The surgical management of pseudotumor is often challenging and complications are frequent if not guaranteed. Preoperative embolization is unuseful in our experience. Arterial stop flow can have its role to prevent massive bleeding. Clinical research should be focused to identify causes and to prevent pseudotumor development in order to reduce massive surgical procedures with poor and unrewarding clinical results.

338 Early outcomes of immediate reconstruction following sarcoma resection including major vessels in a single sarcoma referral center: A descriptive study

Lhuaire M.[1,2,3], Biau D.[4], Habibi K.[1], Garrido I.[1], Prive S.[1], Khoshim K. [1], Anract P.[4], Lantieri L.[1], Julia P. [5]
[1]Department of Plastic, Reconstructive and aesthetic surgery, Hôpital Européen Georges Pompidou, APHP, Université Paris Cité, Paris, France; [2]Department of Imaging research, Cardiovascular research Center of Paris – Inserm UMR970, Hôpital Européen Georges Pompidou, Paris, France; [3]Department of Anatomy and Organogenesis of Saints-Pères, Faculté de Médecine Paris-Descartes, Université Paris Cité, Paris, France; [4]Department of Orthopedics, Oncology et Traumatologic Surgery, Hôpital Cochin, APHP, Université Paris Cité, Paris, France; [5]Department of Vascular Surgery, Hôpital Européen Georges Pompidou, APHP, Université Paris Cité, Paris, France

Background and Objectives: The limb-preservation approach to sarcoma surgery intends to preserve quality of life with aiming for a clear-margin resection even if major vessels were invaded by cancer [1,2]. In these complex cases, vascular reconstruction is mandatory and free flap coverage necessary to prevent wound healing complications, however very few series reported surgical outcomes. The aim of this descriptive study was to describe early post-operative outcomes and complication rate in immediate reconstruction following sarcoma resection including major vessels associated to vessel reconstruction and free flap coverage for soft tissue defect in a single sarcoma referral center.

Methods: This is a retrospective descriptive study of a single sarcoma referral center between December 2019 and February 2023 which included a consecutive cohort that underwent resection of an extremity soft tissue or bone sarcomas including major vessels resection, reconstruction and immediate flap coverage (free or pedicled). Demographic characteristics, post-operative course and complications outcomes were described.

Results: Among the 8 patients included, every patients underwent immediate vascular reconstructions and flap coverage (7 free flaps, 1 pedicled flap). The rate of complete resection (R0) was of 100% (n = 8). The most frequent complication was lymphocele (75% ; n=6), followed by operative site infection (62,5% ; n=5), followed by hematoma (37,5% ; n=3), venous graft thrombosis (37,5 % ; n=3), False aneurysm rupture (25% ; n=2) ; arterial graft thrombosis (12,5% ; n = 1) ; there were no Flap failure and no secondary amputation. Overall complication rate requiring repeat surgical intervention was 75% (n=6). No death was recorded during the early postoperative period and all patient presented wound healing.

Conclusion: Immediate vascular reconstruction and free flap defect coverage following limb sarcoma resection is feasible and a reproducible technique with satisfying vascular graft patency and wound healing outcomes despite a high rate of early postoperative complication.

341 Long-term outcomes of osteoarthritis after a rotationplasty

Krebbekx GGJ., Smithuis FF., Kerkhoffs GMMJ., Bramer JAM., Schaap GR., Verspoor FGM.
Department of Orthopeadic surgery, Amsterdam University Medical Centers, Amsterdam, The Netherlands

Background: Long-term quality of life after rotationplasty might be influenced by osteoarthritis (OA). This study aims to objectify the consequences of hip, knee, and ankle osteoarthritis years after rotationplasty.

Method: All patients after rotationplasty between 1980 and 2002 at the Amsterdam University Medical Center were evaluated at the outpatient clinic. Pain was scored within the AOFAS and Harris-hip questionnaire. OA was objectified by plain radiographs of the pelvis, and AP mortise plus lateral radiographs of the (pseudo) knee, and contralateral ankle The radiographs were evaluated by a musculoskeletal radiologist, and an orthopedic surgeon, on individual radiographic features (osteophyte and joint space narrowing) and the Kellgren-Lawrence grading.

Results: Thirty patients, median 33(IQR 29-35) years after rotationplasty, and aged median 47(IQR 43-51) years, were included.

Three patients reported pain at one or both hip(s), none of which had signs of OA on radiographs. Total of 43% of patients had moderate to definite findings of OA at the ipsilateral hip(rotationplasty leg). Only 6.7% of the contralateral hip had definite findings of OA. One patient had a total hip replacement.

Six patients reported now and then mild pain at the ankle of which half showed definite findings of OA. None had severe pain. The (pseudo)knee compared to the contralateral ankle had 56.7% versus 16.7% moderate to definite findings of OA, respectively.

Conclusion: This long-term follow-up study showed OA of hips, knee, and ankle(s) years after rotationplasty. OA was most prominent at the (pseudo)knee and ipsilateral hip, although not related to patient-reported pain outcome measures.

342 Results of navigated extended costo-transversectomies by a muscle sparing technique for musculoskeletal tumors of the thoracic spine

Keintzel M., Hanna M. , Panotopoulos J., Hobusch G., Windhager R., Funovics, P.
Department of Orthopedics and Trauma Surgery, Medical University of Vienna, Vienna, Austria

Background: The aim of this case series was to evaluate the oncological, surgical, and functional outcomes of intra-operative CT-guided navigated extended costo-transversectomies by a muscle sparing technique for musculoskeletal tumors of the thoracic spine

Methods: This case series included 11 consecutive patients who underwent extended costo-transversectomy using a muscle sparing technique at our department between 2014 and 2023. In all cases the muscle-sparing approach allowed complete salvage of the paravertebral musculature, allowing both, restoration of an active locomotive system and a viable soft tissue cover of the implants used for spondylodesis. Pre- and post-operative clinical records, operative reports, oncological follow-up, complications and functional outcomes were reviewed.

Results: Five patients were male, seven were female. The mean age at initial diagnosis was 44 years (14 to 82 years). The average maximum diameters of the tumor were 5.6cm by 4.7cm by 2.9cm. Histologically, there were three undifferentiated soft tissue sarcomas, two Ewing's sarcomas, two myxofibrosarcomas, one chondrosarcoma, one myxoid liposarcoma, one solitary metastasis of an adenocarcinoma, and one osteochondroma with progressing spinal stenosis. Resection was performed under intra-operative CT-based guidance in five patients and under conventional image guidance in three. No intra-operative complications occurred. Final clinical outcomes during last follow-up were available in ten of the 11 patients. The mean follow-up was 14 months (5-38 months). Within this period five of the 11 patients returned to normal baseline function, three patients were dependent on walking aids. Two patients died in the course of follow-up of the underlying disease. In one case, spinal ischemia with post-operative paraplegic symptoms occurred, which, however, recovered completely. Adjuvant therapy was performed according to the respective histological entity and staging findings. No local recurrence in case of a malignant tumor has been detected.

Conclusion: Our results suggest that patients with appropriate indication could greatly benefit from a muscle sparing costo-transversectomy, especially in terms of functional outcomes.

343 How accurately can lipoma and atypical lipomatous tumors be differentiated based on images alone?

Traub F.[1], Wilde L.[2], Bogumil A.[3], Boesmueller H.[4], Notohamiprodjo M.[5], Kreitner KF. [6]
[1]Department of Orthopaedic and Traumatology, University Medical Center Mainz, Germany; [2]Department of Orthopaedics, University Medical Center Tuebingen, Germany; [3]Department of Pathology, University Mainz, Germany; [4]Department of Pathology, University Medical Center Tuebingen, Germany; [5]Department of Radiology University Medical Center Tuebingen, Germany; [6]Department of Radiology University Medical Center Mainz, Germany

Background: Differentiating atypical lipomatous tumors from lipomas can be a diagnostic dilemma.

Methods: To determine the accuracy, interrater reliability, and relationship of stranding, nodularity, and size in MRI differentiation of lipomas and atypical lipomatous tumors, MRI scans of 100 patients with large (>5 cm), deep, pathologically proven lipomas or atypical lipomatous tumors were reviewed by 6 observers with subspecialty blinded to diagnosis. Observers indicated whether the extent of stranding, nodulation, and size of each tumor suggested a benign or aggressive diagnosis and made a diagnosis of lipoma or atypical lipomatous tumor. The accuracy, reliability, and ratio of strand formation, nodule formation, and size to diagnosis were calculated for all samples.

Seventy-two percent of the investigators' MRI diagnoses agreed with the final pathology diagnosis (95% CI 65-73%).

All specimens were analyzed for MDM2 expression and the pathologist was expected to make his diagnosis beforehand. Radiologically, lipomas were correctly diagnosed in 63% of cases (95% CI 58-69%) and ALT in 75% of cases (95% CI 69-80%).Based on the histomorphological imaging, the pathologists were able to make the correct diagnosis in 82% of the cases (95% CI 73-85%). The expression of MDM2 was used as a distinguishing feature. It should be noted that the investigators in both groups tended to misdiagnose ALT.

Assessment of the relationship between stranding, nodularity, and size and correct diagnosis showed that the presence of each of these features was associated with a lower likelihood of a pathologic lipoma diagnosis ($P < 0.01$). The same applies to cellular atypia and core irregularities.

While the diagnosis of a lipoma or ALT cannot be made with 100% certainty from imaging alone, experienced examiners have a high level of correct predictability.

344 Pretherapeutic laboratory parameters as a predictor on overall survival in ewing sarcoma

Keintzel M., Funovics P., Mannsbart C., Hobusch G., Windhager R., Panotopoulos J.
Department of Orthopedics and Trauma Surgery, Medical University of Vienna, Vienna, Austria

Introduction: The aim of the study was to identify pretreatment serum markers as prognostic factors for the overall survival (OS) of patients with Ewing sarcoma.

Patients and methods: We retrospectively reviewed 68 patients with histologically confirmed Ewing sarcomas treated at our department from 1997 to 2022. The normal value of CRP was defined as below 1 mg/dL. No previous interventions on the sarcoma have been performed. Laboratory data was obtained prior to the histological assessment/surgical intervention. The excluding criteria for this study was lack of laboratory parameters between 1 and 14 days prior to a histological assessment of the tumor site or surgical intervention.

Kaplan-Meier estimation, uni- and multivariable Cox proportional hazard model were performed to evaluate the association between serum markers such as the C-reactive protein and OS. Statistically significant values were calculated with a p-value < 0.05. Sensibility and specificity based on the optimal identified cut point were calculated along the 95% interval.

Results: In our study´s population, 30 patients were male while 22 were female (58% male, 42% female). The median age at diagnosis was 17 years, with patients between the age of 1 and 68 years at the time of diagnosis. The mean age at diagnosis was 19,28 years.

38 of the patients showed CRP levels above 1mg/dL. 38 patients had CRP levels below 1mg/dL. With an overall mean of 2,443 mg/dL.

In the first univariable analysis of our dataset, CRP was strongly associated with OS (HR 1.35; 95%CI 1,001-1,185; $p = 0.046$).

Conclusion : CRP and possibly other inflammatory parameters could be exploited for the clinical prediction of Ewing sarcomas in the future.

345 Cemented versus uncemented tumor endoprostheses at the knee: a systematic review and meta-analysis

Park C. [1], Kadkoy Y. [1], Ippolito J.[2], Thomson J. [1], Beebe K.[1], Benevenia J. [1]
[1]Department of Orthopaedic Surgery, Rutgers New Jersey Medical School, Newark, NJ, USA; [2]Department of Orthopaedic Surgery, University of Chicago, Chicago, IL, USA

Background: Outcomes following endoprosthetic reconstruction (EPR) at the knee have been widely published in the literature, but method of stem fixation, cemented versus cementless, has been widely debated with still no currently agreed upon superior technique.

Methods: A primary literature search was performed in PubMed following PRISMA 2020 guidelines. We identified 772 studies related to reconstruction of the lower extremity with an endoprosthesis at the knee. After review of manuscripts, 44 studies met inclusion criteria. Data from these studies were collected and to calculate proportions and comparisons.

Results: Uncemented EPRs were associated with a higher rate of mechanical failure [(7.9%) 95% CI, 5.6-11.1 versus (4.6%) 95% CI, 3.4-6.2; p=0.02, figure 1], but had statistically comparable rates of aseptic loosening [(5.9%) 95% CI 3.7-9.2 versus (8.9%) 95% CI 6.9-11.4; p=0.11] and infection [(9.5%) 95% CI 7.0-12.7 versus (6.6%) 95% CI 4.9-8.9; p=0.10] versus cemented EPRs. Utilizing four studies with comparison data, use of hydroxyapatite collars was associated with lower aseptic loosening [OR, 0.96; 95% CI, 0.23-0.04, P<0.001). Egger's regression test (p<0.001) and ranked correlation test (p=0.022) revealed significant funnel plot asymmetry and is suggestive of publication bias.

Conclusion: These findings indicate that cemented endoprostheses at the knee are associated with lower rates of mechanical failure, while aseptic loosening and implant survival rates are comparable among cemented and uncemented implants. Hydroxyapatite coated collars appear to reduce risk of aseptic loosening substantially. Despite these findings, they are based exclusively upon Level IV evidence. Future prospective large multi-center trials are needed to further elucidate the impact of various implant characteristics.

346 Predictors of functional results in patients undergoing synovial sarcoma surgery

Machado P., Peiró A., Trullols L., Fa M., García-Fontes L., Mata JM., Bagué S., Lopez Pousa A., Majerkakova K., Gracia I.
Pau Machado, COT, Hopsital de la Santa Cree I Sant Pau, Barcelona, Spain

Background & Objectives: Functional outcomes are important for oncologic patients undergoing limb surgery. The aim of this study is to identify predictors of postoperative function in musculoskeletal oncology patients that underwent synovial sarcoma surgery.

Methods: We retrospectively reviewed 102 consecutive cases of synovial sarcoma treated in our musculoskeletal tumor unit between 1983 - 2016.

A descriptive study was performed and all risk factors that could contribute to a difference in functional outcomes were analysed. The functional outcomes were measured with Musculoskeletal Tumor Society-Score (MSTS)

Results: The follwing risk factors related to functional results were statiscally significant: age ($p=0.036$), staging ($p<0.001$), surgical technique ($p<0.001$), tumour size ($p= 0.014$), tumour volume ($p= 0.03$), chemotherapy treatment ($p<0.001$), complete combined treatment by surgery, radiotherapy and chemotherapy ($p<0.001$), absence of local recurrence ($p<0.001$) and absence of dissemination ($p<0.001$).

The following variables did not show statistical significance: sex, general location and by segments, histological variant, degree of anatomopathological differentiation, association with radiotherapy treatment, and diagnostic and therapeutic times.

Conclusions: younger patients, patients undergoing limb salvage compared to amputation, patients with smaller tumour, those treated with chemotherapy or combined treatment, and patients without recurrences or dissemination, presented better functional results after undergoing synovial sarcoma surgery.

347 Biomechanical analysis comparing different reconstruction methods of large segmental defects at the femurBiomechanical analysis comparing different reconstruction methods of large segmental defects at the femur

Park C.[1], Kadkoy Y. [1], Schneider G. [1], Ippolito, J.[2], Helbig, T. [1], Lopez J. [1], Paglia D. [1], Benevenia J. [1]
[1]Department of Orthopaedic Surgery, Rutgers New Jersey Medical School, Newark, NJ, USA; [2]Department of Orthopaedic Surgery, University of Chicago, Chicago, IL, USA

Background: Different methods (intercalary allograft plating versus intramedullary (IM) fixation) to reconstruct large intercalary femoral defects have varying limitations from weightbearing restrictions to mechanical failure. Additionally, the advent of newer IM fixation methods such as photodynamic bone stabilization systems (PBSS) aims to improve existing modalities. Few studies exist comparing biomechanical properties of these different reconstruction methods.

Methods: Utilizing 15-paired human cadaveric femora with uniform 7-cm segmental defects, one of each pair was reconstructed via bulk allograft with a double plate construct (ADP) (15). Remaining femora were repaired with either intramedullary endoprosthesis (OsteoBridge™ IDSF) (5), IM nail and a single plate (5) or PBSS with a single plate (5). Matched pair femurs were tested by cyclical medial-lateral and anterior-posterior bending (300-800N), cyclical axial compression (300-800N), cyclical torsion (-6Nm to +6Nm), and internal rotation to failure.

Results: In anterior-posterior bending, IDSF displaced a smaller distance over 100 cycles of creep (p=0.037) and had higher elastic stiffness (p=0.002) than ADP. The only significant finding in medial-lateral bending was ADP had a smaller change in displacement per cycle than PBSS (p=0.032). No differences were detected in axial compression between all groups. During cyclic torsion, IDSF had smaller angular displacement than the ADP (p=0.03). Also, in failure in torsion testing, IDSF had higher torsional rigidity (p=0.005) and smaller angular displacement (p=0.03) than ADP. ADP had higher torsional rigidity than the IM group (p=0.027), but not the PBSS group.

Conclusion: Preliminary data suggests intercalary endoprosthetic reconstruction provides superior stability in bending and torsion than the DP reconstruction. Also, PBSS seems to have more torsional stability than the IM nail. These methods of fixation may be useful for younger patient population where allograft incorporation is advantageous.

348 Does subchondral bone grafting minimize degenerative changes and fracture risk in Giant Cell Tumor treatment of the extremities?

Park C.[1], Kadkoy Y. [1], Ippolito J.[2], Guinand L. [1], Thomson J. [1], Beebe K. [1], Patterson F.[3], Benevenia J.[1]
[1]Department of Orthopaedic Surgery, Rutgers New Jersey Medical School, Newark, NJ, USA; [2]Department of Orthopaedic Surgery, University of Chicago, Chicago, IL, USA; [3]Department of Orthopaedic Surgery, Hackensack University Medical Center, Hackensack, NJ, USA

Background: Giant Cell Tumor of bone (GCT) has a proclivity for periarticular involvement and when feasible, joint-sparing treatment of intralesional curettage with adjuvant therapy and polymethylmethacrylate cement (PMMA) for defect filling is preferred. Addition of material with similar stiffness to subchondral bone such as allograft may diminish articular stress while protecting from heat damage during PMMA polymerization.

Methods: This study retrospectively reviewed 50 patients treated for GCT at a single institution from 1996-2020. One author routinely utilized subchondral bone grafting (SBG) technique, while two authors did not. No variation in technique of curettage and adjuvant therapy between surgeons existed. Patient's demographic information and clinical outcomes were collected for analysis.

Results: Patients (54% female) had a mean age of 32.9±13.7 and mean follow-up of 72.0±65.6 months. Demographic characteristics were statistically similar between the two methods ($p>0.05$). Twenty-one (42%) patients experienced at least one complication. Twelve (24%) suffered local recurrence at a median of 29 months. Ten non-oncologic complications were seen in the PMMA alone group (6 with fracture, 4 with arthritis) and one non-oncologic complication in the SBG group (arthritis). SBG was associated with significantly lower risk of non-oncologic complications [HR 0.15; 95% CI 0.04-0.51] and fracture [HR 0.15; 95% CI 0.03-0.74]. Mean MSTS scores were not significantly different between the groups; however, eleven patients ultimately underwent conversion to an endoprosthesis and had significantly lower mean MSTS score than the SBG and PMMA groups ($p<0.001$).

Conclusions: Subchondral bone grafting following curettage may decrease risk for non-oncologic complications of fracture and arthritis, delaying need for revision surgery in patients with GCT.

349 Total femoral replacement following prior oncologic or arthroplasty reconstruction is associated with increased risk for infection and limb-salvage failure

Ippolito J.[1], Park C.[2], Kadkoy Y.[2], Schneider G.[2], Patterson F.[3], Beebe K.[2], Benevenia J.[2]
[1]Department of Orthopaedic Surgery, University of Chicago, Chicago, IL; [2]Department of Orthopaedic Surgery, Rutgers New Jersey Medical School, Newark, NJ; [3]Department of Orthopaedic Surgery, Hackensack University Medical Center, Hackensack, NJ, USA

Background: Total femoral replacement (TFR) with an endoprosthesis is indicated with tumors involving most of the femur or combined ipsilateral total hip and knee arthroplasty failure(s). While TFR is typically used following oncologic resection, its use for non-oncologic complications is increasingly common, but reserved for last resort in limb salvage due to associated high complication rates.

Methods: We performed a retrospective cohort study of 22 patients who received total femur endoprostheses for oncologic and revision arthroplasty indications from 2000-2020. Data including demographics and clinical characteristics were collected for reporting. Chi-square and fisher's exact were used for statistical analysis.

Results: Mean age of patients undergoing TFR was 51±24.6 years. Indications included primary reconstruction following oncologic resection (9), revision of prior arthroplasty infection (7), or revision after mechanical failure (6). Sixteen patients (73%) experienced complications. Non-oncologic failure modes as classified by Henderson were as follows: Three (13.6%) soft tissue, three (13.6%) mechanical failures, and ten (45.5%) infections. At last follow-up, six suffered hip disarticulation, one died with an antibiotic spacer, and four required single-stage revision for infection. Patients with infectious indications were at increased risk for failure compared with those who underwent primary TFR following oncologic resection (71% vs 17%; p=0.048). TFRs have very high failure rates with a 46% infection rate and overall complication rate of 73%, in this series. Patients with TFR for revision of prior failed reconstruction or infection had increased risk for limb-salvage failure.

Conclusion: This series demonstrates increased failure risk if undergoing TFR for infectious causes. Patient counseling in these cases may be beneficial due to the increased risk of limb-salvage failure.

350 The electronic Toronto extremity salvage Score (eTESS)- an institutional interventional study to improve the patients´ response rate

Hobusch GM., Trost C., Keintzel M., Funovics PT., Panatopoulos J., Windhager R.
Department of Orthopedics and Trauma Surgery, Medical University of Vienna, Vienna, Austria

Background & Objectives: The Toronto Extremity Savage core (TESS) as a Patient-reported outcome (PRO) measure is an essential sources of clinical information for patients and stakeholders in sarcoma care. To follow up sarcoma patients we have been using an electronic TESS (eTESS) via Email/SMS over Research, Documentation and Analysis (RDA) Platform since 2019. Although the eTESS might bridge areal distances between sarcoma patients and the hospital, the response rates seem low. Therefore, we ask the question: Is the implementation of a standardized eTESS educational information brochure before start of treatment capable to improve response rate of sarcoma patients?

Patients and methods: A total of 232 patients with histologically verified sarcomas of the upper or lower extremity who have undergone an extremity-preserving sarcoma resection procedure between 2019 and 2023 at the Medical University of Vienna, Department of Orthopedics and Trauma Surgery, Division of Orthopedics were included in this study.

The eTESS was sent out to all participating patients by mobile phone, and/or email.

As of March 2022, patients undergoing surgery for sarcoma of the extremity, additionally received a standard information brochure at the time of admission that specifically informed them about the receipt of the TESS via SMS and/or email and the importance of ePRO as such.
This allowed the participants to be divided into 2 groups, one with and one without the intervention of an additional information sheet.

Results: The overall response rate was 39.6% (92/232) of the patients. 41.2% (75/182) on the lower extremity (LE) and 36% (18/50) on the upper extremity (UE) questionaire. For patients who did not receive a standard educational information brochure, the response rate was 34.7% (57/164). 36.9% (48/130) in LE-patients and 26.4% (9/34) in UE-patients, whereas for those patients who already received the information sheet before receiving the EPROS, the overall response rate increased to 52.9% (36/68). 51.9% (27/52) in LE-patients, 56.25% (9/16) in UE patients. (p- value = 0.01 [chi-square test]).

Conclusion: The implementation of a standardized educational information brochure upfront to the sarcoma treatment might improve the involvement of the patients and might positively stimulate their response behavior. However, reasons for non-responding need to be clarified more detailed.

352 Outcome of reconstruction with irradiated tumour bone in paediatric malignant one tumours

Paul M.[1], Sugath S.[1], Nair M.[2], Binitha R[2], Guruprasad C.S.[2], Prasanth V.R.[2], Aswin kumar[3], Jayasree K.[4], Preethi Sara George[5], Augustine P.[1], Thankamony P.[2]
[1]Department of Surgical Oncology, [2]Department of Paediatric Oncology, [3]Department of Radiation Oncology ,[4]Department of Pathology,[5]Department of Epidemiology and Biostatistics, Regional Cancer Centre thiruvananthapuram, Thiruvananthapuram, India

Background & Objectives: Tumor bone sterilized with extracorporeal irradiation is a method of bone reconstruction after wide excision. Here we report the outcome of reconstruction with irradiated tumour bone in paediatric malignant bone tumour.

Methods: This is a retrospective audit of 53 paediatric patients who were operated between 01/01/2011 to 31/12/2021. We analyzed the oncological, surgical and functional outcomes of these patients. During the initial period we used intramedullary placement of non vascularised fibula for reinforcing irradiated tumour bone. But considering the donor site morbidity of fibula graft harvesting we changed to bone cement. In a subgroup analysis we compared both groups to assess whether there is any difference in surgical outcome between fibula grafting and bone cement.

Results: Mean age was 9.1 years.There were 23 male patients (43.4%). 36 patients (67.9%) had osteosarcoma and remaining patients were ewing's sarcoma. Mean duration of surgery was 346 minutes. Mean resection length was 16.1 cms. 12 patients (22.6%) experienced immediate post op complications - skin flap necrosis was the most common (4 patients, 7.5%). 25 patients (47.2%) experienced long term complications (most common - malunion leading to shortening and deformity - 12 patients, 22.6%). Mean time for union at metaphyseal end was 9 months and for diaphyseal end was 20.8 months. Both osteotomies were united in 31 patients. Among the remaining 22 patients, 10 patients achieved union with additional procedures.There were 14 patients in the fibula graft group and 39 patients in the bone cement group. There was no significant difference in union rate (p =0.16), immediate post op complications (p =0.485)or long term post op complications (p =0.172) between fibula and bone cement .Mean Musculoskeletal Tumor society score (MSTS) score was 27. Median follow up period was 64.3 months. 86.8% patients have a minimum of 3 year follow up. The 3 year overall survival was 84.4% and 3 year DFS was 72.6%.Six patients (11.3%) developed local recurrence (soft tissue -5, bone recurrence -1) and mean time to local recurrence was 20 months. 13 patients developed distant metastasis and the mean time to distant recurrence was 27 months.

Conclusion: Reconstruction with irradiated tumour bone is an oncologically safe procedure with acceptable morbidity and functional outcome. The use of bone cement to reinforce irradiated bone is as effective as non vascularised fibula graft.

356 Extended distal femur resection: Megaprosthesis with bone allograft augmentation *vs* total femur prosthesis

Bruschi A., Cevolani L., Minerba A., Falzetti L., Pasini S., Donati DM.
Orthopaedic Oncology Unit, IRCCS Istituto Ortopedico Rizzoli, Bologna, Italy

Background and Objectives: In case of extended distal femoral resection with more than 70% of femur resected, proximal femoral bone can be too short to host a prosthetic stem. In this case the choice is to sacrifice the whole bone using a total femur reconstruction. On the other hand, proximal femur can be saved and a femoral stem used with the help of a cylindrical allograft (allograft-prosthesis composite, APC). However, literature provides very few data on this topic. Therefore, the aim of this study is to compare APC and TFP in terms of failures, complications and MSTS score in patients underwent extended distal femoral resection for primary bone tumour.

Questions/Purposes (1) Which reconstruction provides better implant survival between APC and TFP after extended distal femur resection? (2) Which reconstruction provides less complications between APC and TFP after extended distal femur resection? (3) Which reconstruction provides better functional outcome between APC and TFP after extended distal femur resection?

Methods: We conducted a retrospective monocentric comparative study and we divided 33 patients into two groups: Group 1 (APC, 16 patients) and Group 2 (TFP, 17 patients). We compared implant failures rate, complication rate and MSTS score evaluation in the two groups.

Results: Implant survival rate is 85% for both groups at 5 years (60 months) of follow-up, while it's 72% for Group 1 and to 55% for Group 2 at 100 months (C.I. 95%, p: 0,84). Complication rate at 5 years is 25% for both groups, while at 100 months it increases to 75% in Group 2 and it's steady at 25% in Group 1 (C.I. 95%, p=0,39). MSTS score at 2 years of follow-up is 25 +/- 5 for Group 1 and 19 +/- 7 for Group 2. (C.I. 95%, p=0,02). MSTS score at 5 years of follow-up is 27 +/- 2 for Group 1 and 22 +/- 6 for Group 2. (C.I. 95%, p=0,047).

Conclusions: Despite being technically demanding, our analysis indicates that APC reconstruction should be preferred to TFP when proximal femur can be spared by resection, even with a short segment. This provides better implant survival, less complications and a higher functional outcome is expected by saving the hip joint.

Level of Evidence III

359 Patient specific instrumentation versus surgical navigation: Which one provides better oncological and functional results in bone tumour resection? A systematic review

Bruschi A.[1], Di Bella C.[2], Donati DM.[1]
[1]Orthopaedic Oncology Unit, IRCCS Istituto Ortopedico Rizzoli, Bologna, Italy;
[2]Department of Orthopaedics, St Vincent's Hospital Melbourne, Fitzroy, VIC, Australia

Background & Objectives : When performing a bone tumour resection, patient specific instrumentation (PSI) and intraoperative surgical navigation (SN) can significantly help in achieving wide surgical margins while sparing as much bone as possible. The aim of the present paper is to systematically review the literature to compare the two techniques on oncological and functional results. Features as preoperative time for surgical planning, surgical intraoperative time, intraoperative complications and learning curve are also investigated.

Methods: 1613 papers were identified and 95 of them matched criteria for PRISMA inclusion and eligibility.

Results: PSI and SN showed similar results in margins, bone cut accuracy, local recurrence and functional reconstruction scores for both long bones and pelvis, both achieving better results compared to standard resections. A planned margin of at least 5 mm from the tumour appeared to be safe for both PSI and SN, in both long bones and pelvis, while not providing any benefit on soft tissue margin. A little higher accuracy and shorter intraoperative times were reported as advantages of PSI over SN. However, long osteotomies, homogenous bone topology and restricted working spaces affect more PSI than SN. In urgent cases, SN might be more indicated, to avoid PSI planning and production time.

Conclusion: Overall, this review demonstrates that both surgical navigation and patient specific instrumentation are valid options to improve margins accuracy in bone for tumor resection and allow for a reliable reconstruction if required.

EMSOS

35th ANNUAL MEETING

BRUSSELS | 2023