

ABSTRACTS

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Thursday 04/04/2019

Basic Science

OP-001 / 08:20

Cell death mechanisms are regulated by hyperbaric oxygen therapy following experimental spinal cord injury

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Level V

Introduction and Objective The most effective treatment in spinal cord injuries is the prevention of secondary injury that commences with the crush. The regeneration mechanisms and the prevention of apoptotic cell death are the most important aims of treatment in this injury. In this experimental animal study, the effects of hyperbaric oxygen therapy (HBO) on the prevention of apoptotic cascades and motor neuron protective effects of these treatments through their antioxidant mechanisms were evaluated in a model of spinal cord injury.

Materials and Methods Twenty-eight Sprague Dawley rats were divided into four groups (HBO, Metilprednizolon as positive control, trauma and sham). Spinal cord injury was examined in all rats except for sham group, after the extradural compression was performed at T4-T10 vertebra by Yasargil aneurysm clip. HBO therapy was given in the first hour of trauma and it continued during 7 days. Functional evaluation of rats was assessed daily by using Basso-Beattie-Bresnahan (BBB) locomotor scale. Superoxide dismutase (SOD), glutathione peroxidase (GPx) and catalase enzymes activities were

measured in the spinal cord samples of rats that were sacrificed at the end of acute and subacute period which was the 8th day of trauma. The measurement of bax, bcl-2 and caspase-3 were conducted by western blot method in order to reveal apoptosis.

Results The increase in the activities of SOD, GPx and scores of functional evaluation by HBO was significant ($p < 0.05$). Besides, HBO led to upregulate the Level of caspase-3 and bax; therefore, it increased apoptosis through mitochondrial pathway ($p < 0.05$).

Conclusions As a conclusion, HBO treatment was found to be beneficial in the removal of reactive oxygen species and neurologic recovery. However, HBO-induced apoptosis mechanism needs to be revealed by future studies.

Thursday 04/04/2019

Basic Science

OP-002 / 08:25

Behavior of intramedullary implants across the distal femoral growth plate: preliminary results from a sheep model

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Level II

Introduction and Objective The purpose of this investigation is to study the superior migration of an intramedullary implant across the distal femoral growth plate. In the developing world, retrograde intramedullary nailing offers a potential treatment option in light of limitations such as lack of power

equipment and intraoperative fluoroscopy. Preliminary data suggest that these nails may migrate superiorly past the growth plate over time, with unclear consequences.

Materials and Methods SIGN Fracture Care intramedullary implants were inserted retrograde into the distal femurs of ten 3-month old sheep (10 surgical limbs, 10 contralateral control limbs, for a total of 20 limbs) and secured to the metaphysis with inter-locking screws. After 5 months, sheep were euthanized and radiographically and histologically assessed.

Results At the time of abstract submission, four sheep had been sacrificed and undergone final analysis. Growth plate violations were 3.7%, 3.8%, 4.9%, and 5.1%. The four implants demonstrated an average migration of 18.8mm (SD 2.4), and were 7.1mm (SD 2.1) superior to the distal femoral growth plate. Compared to the contralateral control limb, the surgical limbs were on average 10.3 mm shorter. Histological analysis on demonstrated bone growth across the distal femoral physis.

Conclusions Our preliminary results demonstrate that over a 5-month period, the implants migrated an average distance of 18.8mm across the distal femoral growth plate. The study also demonstrated a growth disturbance of 1.03 cm, possibly due to osseous penetration across the growth plate. These results suggest that retrograde femoral nailing should be used with caution in the open physis, and likely requires either epiphyseal locking to avoid migration or early removal of the nail with fat grafting.

Thursday 04/04/2019

Basic Science

OP-003 / 08:30

The results of cartilage damage treatment using growth plate chondrocytes on the growing animal model

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Level I

Introduction and Objective Due to the specific structure and highly specialized function, treatment of articular cartilage damage is a major clinical problem. Moreover, its avascular character results in low regenerative capacity. The aim was to compare the results of treatment of cartilage damage treated using scaffold, bone marrow, and growth plate chondrocytes.

Materials and Methods The study group consisted of 10 pigs at the age of 12 weeks. A bone marrow biopsy was performed from the posterior iliac spine. We divided the scaffolds into two groups. First one consisted scaffold with bone marrow and growth plate chondrocytes. Second group contended only of scaffolds with bone marrow without chondrocytes. The samples from pig's knee according to ICRS classifications was evaluated after 12 weeks from the day of surgery.

Results Macroscopic evaluation according to ICRS classification, in the group of pigs treated with scaffolds without cells, all animals showed nearly normal morphology with an average of 9.66/ 12 points. In the group of pigs treated with scaffolds incubated with the cells, all animals similarly showed nearly normal morphology with an average of 10.44/ 12 points. Based on microscopic evaluation, one very good result and eight good results were obtained in the group of pigs treated with scaffolds without cells, with an average of 70.44%; in the group of pigs treated with the scaffolds incubated with the cells, 5 very good results and 4 good results were obtained with an average of 79.61%.

Conclusions 1. Treatment of joint cartilage damage with the use of additional growth cartilage chondrocytes improves the quality of joint cartilage healing process. 2. Chondrocyte clustering is a manifestation of the cartilage repair process starting from the side of the stimulated subchondral bone.

Thursday 04/04/2019

Basic Science

OP-004 / 08:35

Can real time monitoring with a controlled advancement drill decrease plunge depth?

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Level III

Introduction and Objective To reduce the risk of neurovascular injury from plunging, drills have been developed that provide controlled drill bit advancement and real-time visual monitoring of bone penetration. The purpose of this study was to investigate whether a drill with real-time resistance monitoring can decrease plunge depth by users with varying levels of experience.

Materials and Methods Sixty-six subjects (20 attending orthopedic surgeons, 20 orthopedic surgery residents, and 26 medical students) drilled three holes with a conventional drill (CD) and three holes using a controlled-advancement "intelligent drill" (ID) in a bi-cortical sawbone block set on ballistic gel. The depth of drill bit penetration into the gel was measured for each hole using digital calipers.

Results All subjects plunged less with the ID than with the CD (0.9 mm vs. 4.2 mm, $p < 0.001$). This was consistent within each group: attending surgeons (0.9 mm vs. 3.2 mm, $p = 0.02$), residents (1.0 mm vs. 3.0 mm, $p < 0.001$), and students (0.7 mm vs. 6.0 mm, $p < 0.001$). Results were also stratified based upon plunge depth: 0 to 2 mm, 2 to 5 mm, and >5 mm. Using the ID, subjects were more likely to plunge less than 2 mm (97% plunged 0-2 mm, 3% plunged 2-5 mm), whereas subjects were more likely to plunge deeper with the CD (27% plunged 0-2 mm, 45% plunged 2-5 mm,

27% plunged >5 mm). Attendings and residents plunged less than students with the CD (p=0.02). There was no statistically significant difference in plunge depth between groups using the ID.

Conclusions A controlled advancement drill can significantly decrease plunge depth for both surgically experienced and inexperienced subjects. While inexperienced subjects performed worse with the CD than those with experience, there was no difference in performance with the ID.

Thursday 04/04/2019

Basic Science

OP-005 / 08:53

Linkage analysis in a national series of patients affected by non syndromic severe clubfoot

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Level I

Introduction and Objective The genetic of clubfoot is right now not understood. The few performed studies are focused on transcription and regular factors such as PITX1, TBX4, HOXC13, UTX, CHD1, RIPPLY2.

Materials and Methods In 2015, Pediatric Orthopedists and Genetists of our Hospital started a project on the genetics of clubfoot with the major national Italian Hospital (San Raffaele, Rizzoli; Giovanni XXIII, Buzzi, Gaslini) and started with a deeply clinical characterization of patients. Patients were selected to have: a) non syndromic clubfoot, b) maximum clinical severity (Manes-Costa = 3; Pirani >5; Dimeglio >15). A clinical database was created. More than 150 DNA patients, and in particular families with more affected subjects were collected and a national DNA repository was created, An informed consent was collected for each patient and SNP array analysis was performed. We performed a high throughput genotyping using ILLUMINA arrays, and all the data were subsequently analyzed using parametric and non parametric linkage analysis with MERLIN.

Results In 2017: 1) we created a clinical database of more than 150 patients affected by severe non syndromic clubfoot; 2) we collected their DNA; 3) we performed a High Density SNP array of all, focusing the analysis on families with more than one affected person, 4) we demonstrated areas shared by all families different from those already known.

Conclusions Since the low informativity of the families analyzed, we were not able to detect one common region, but we identified some regions shared by all patients excluding the rest of the genome.

Thursday 04/04/2019

Basic Science

OP-006 / 08:58

The effect of relaxin on primary fibroblast-like cells isolated from clubfoot tissue

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Level II

Introduction and Objective Idiopathic *pes equinovarus* (clubfoot) is one of the fibroproliferative disorders. Treatment by serial manipulation and long-term casting is now the first and successful method of choice. This is not the case with relapsed clubfeet, however, where the application of antifibrotic substances already used in treatment of certain other fibrotic diseases, could be employed. The potential effect of these substances on fibrotic tissue of clubfoot has yet to be researched in depth. The aim of our study was to examine in vitro effect of relaxin on clubfoot primary fibroblast like cells. Relaxin is a peptide hormone from insulin family, which is involved in extracellular matrix remodeling.

Materials and Methods Primary cells were isolated from tissue excised during the surgery of a relapsed clubfeet. These cells were cultured in DMEM media and treated with TGFβ1 (2-10ng/ml) or TGFβ1 solution with relaxin (10 and 150 ng/ml). The effects on cell proliferation, collagen synthesis, α-smooth muscle actin and βcatenin expression were determined by real-time quantitative PCR, flow cytometry and immunocytochemistry.

Results TGFβ1 increased the cell proliferation and stimulated their differentiation into myofibroblasts, as determined by α-smooth muscle actin (aSMA) production. The increased expression of βcatenin was observed. However, simultaneous exposure to relaxin caused the inhibition of TGFβ1 stimulatory effect on cell proliferation and βcatenin expression in both tested concentration, while minimal effect on collagen synthesis and aSMA differentiation was observed.

Conclusions Our results are the first step in the search for substances which can be applied directly into the stiff fibrotic tissue occurring in the clubfoot deformity, that could improve and expedite the outcome of currently practiced non-invasive methods.

Thursday 04/04/2019

Basic Science

OP-007 / 09:03

Safety potential of physéal biopsy in a rabbit model

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Level I

Introduction and Objective Our purpose was to evaluate the safety of obtaining a biopsy of the physis in a pediatric/juvenile animal model, demonstrating that this can be accomplished without causing adverse growth sequelae.

Materials and Methods We employed a rabbit model, according to IACUC protocol. A 2.4 mm Jam-Shedi needle was used to obtain biopsy specimens of the medial distal femoral and proximal tibial physes on, 8-week old New Zealand rabbits. The contralateral limb served as a control. Biopsies were conducted under fluoroscopic guidance. At 8 (n=5) and 16 (n=5) weeks following the biopsies, animals were euthanized. Micro-CT was employed to assess structural abnormalities resulting from biopsy and to obtain an estimated percentage of the physis biopsied. Polymethylmethacrylate (PMMA) embedded bone samples were sectioned coronally and analyzed using a scanning electron microscope (SEM) equipped with a backscatter detector (BSE).

Results No iatrogenic deformities were noted. The micro-CT analysis demonstrated the absence of any significant bowing when compared the contralateral limb to the biopsied limb (Figure 1A). Less than $\leq 1.5\%$ of the total physis was biopsied for the femurs the tibiae had $\leq 2.3\%$.

Conclusions This small animal model revealed that a 2.4mm biopsy of the physis was well-tolerated. Micro-CT analysis demonstrated no apparent growth deformities to the long bone for both the 8 or 16-week animals. The bone healing/bridging response observed in the micro-CT and BSE imaging appeared normal and suggested that a small region of bone bridging in the physis may not adversely affect growth. The diagnostic and therapeutic information that could be gleaned from one or serial biopsy samples could be invaluable in decision making and clinical management (e.g. Blount's, skeletal dysplasias, metabolic conditions).

Thursday 04/04/2019

Basic Science

OP-008 / 09:08

Dynamic three-dimensional reconstruction of thoracic cage and abdomen in children and adolescents with scoliosis: results of optical reflective motion analysis assessment

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Level III

Introduction and Objective In patients with scoliosis or in those with posterior spinal instrumented fusion (PSF), the movements of neither the thoracic cage (ThC) nor the abdomen (ABD) during quiet/deep breathing have been well defined. The purpose of this study was to evaluate kinematic variations in the ThC and ABD during quiet/deep breathing by optical reflective motion analysis (ORMA) in children with scoliosis.

Materials and Methods Six healthy children (Gr. A), 7 patients with untreated scoliosis $>50^\circ$ (Gr. B) and 8 patients with scoliosis treated by PSF (Gr. C). After anthropometric measurements were obtained, the movements of subjects during quiet/deep breathing were measured with a 10-camera 3D ORMA system (82 markers) with the subjects in a standard standing position.

Results No significant differences were observed in sex, age, weight, height or arm span ($p>0.05$). Significant differences were observed in the chest perimeter, Cobb angle and body mass index ($p<0.05$). Gr. B showed decreased ThC expansion (-52.4% to -58.3%) and relatively increased ABD motion compared to Grs. A and C ($p<0.001$). However, ABD expansion remained lower in Gr. B than in Grs. A and C (-32.8% and -5.7%). PSF does not completely eliminate transverse plane kinematics, although a greater reduction was observed at instrumented (-60.8%) than non-instrumented levels (-35.1% ; $p<0.05$).

Conclusions Patients with severe scoliosis had poorer and less effective kinematics of the ThC and ABD, abnormal breathing curves and a predominance of ABD breathing over ThC movements. Operated subjects had better and more effective kinematics of the ThC and ABD, breathing curves closer to normal and ThC expansion more efficient than ABD movements. PSF does not completely eliminate transverse plane kinematics of ThC, although a greater reduction was observed at instrumented levels.

Thursday 04/04/2019

Sports Medicine

OP-009 / 09:26

The influence of general physical health and socioemotional status on the outcomes following meniscus repair procedure in patients under 18 years

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Level III

Introduction and Objective The impact of HQoL on the outcomes of procedures has received increased attention. The main goals of this study are to assess the functional and anatomic healing outcomes following meniscus repair procedure and evaluate possible impact of general physical and socio-emotional status on the postoperative results.

Materials and Methods The cohort of 31 patients were included. 14 boys and 14 girls (n=28) were followed up at a mean of 23 months. Median age was 15 years. Postoperative MRI analysis was done in 22 cases (79%) at the last follow-up (minimum 11 months) and in 2 cases by repeated arthroscopy. All patients completed Pedi-IKDC functional questionnaire pre- and postoperatively. General physical and socioemotional status was estimated through the Pediatric QoL Inventory (PedsQL 4.0 Generic Core) at the first meeting preoperatively.

Results The mean pedi-IKDC score improved from 38.9 to 83.5 ($P < 0.001$). MRI images were assessed as Grade III (unhealed) – 8 cases, grade II (partly healed) - 7 cases and normal MRI was seen in also 7 cases. 2 cases were defined as unhealed by repeated arthroscopy. There were significantly more patients evaluated themselves higher in MRI Grade III than in Grade II group regarding total PedsQL score ($P = 0.016$), emotional ($P = 0.012$) and social ($P = 0.023$) domains. The postoperative pedi-IKDC score correlated with total PedsQL score (0.488, $P = 0.008$), physical (0.479 $P = 0.01$) and emotional (0.389 $P = 0.041$) domains. The linear regression indicated the postoperative pedi-IKDC dependence on the total PedsQL score ($r^2 = 0.276$ $P = 0.04$) and physical functioning domain ($r^2 = 0.589$ $P = 0.01$).

Conclusions The self-reported QoL does not reflect postoperative MRI results. Conversely self-reported QoL status, especially physical functioning, could be a predictor on postoperative self-reported functional results.

Thursday 04/04/2019

Sports Medicine

OP-010 / 09:31

Prevalence of ramp meniscal lesions associated with ACL injury in children and adolescents

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Level IV

Introduction and Objective Posterior meniscocapsular tears of medial meniscus have been called 'Ramp' or 'hidden' lesions. This lesion appears to be more frequent in children than in adults. The aim of this study was to define the prevalence of ramp lesions associated with ACL rupture children and adolescents.

Materials and Methods We analysed retrospectively videos of arthroscopic ACL reconstructions recorded for the purpose of

the current study. Systematic search of ramp lesions was carried out. The arthroscope was passed through the intercondylar space to visualize posteromedial compartment. A needle was introduced posteromedially to probe and stretch the meniscocapsular junction, so as to unveil a ramp lesion. Surgical procedures were performed by two senior surgeons. Videos were blindly analysed by a third surgeon.

Results 50 videos from 50 consecutive patients were analysed. They were 32 boys and 18 girls. Patients were between 12 and 18 years old. 14 ramp lesions (28%) were found in 8 boys and 6 girls. There was no difference between left or right knee. In another 3 knees, the meniscocapsular junction was remodeled without true lesion.

Conclusions Our results are consistent with recent literature. Prevalence of Ramp lesion is very high in the pediatric population. These lesions are often undiagnosed by MRI. A cadaveric study had shown that anteroposterior and rotation laxity increase with Ramps even if the ACL is reconstructed. Systematic exploration of posteromedial compartment by intercondylar view is advocated. Untreated Ramp lesions may account for poor surgical outcomes of ACL reconstruction.

Thursday 04/04/2019

Sports Medicine

OP-011 / 09:36

An all-inside arthroscopic posterior cruciate ligament (PCL) reconstruction technique for children

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Level IV

Introduction and Objective Intraligamentous rupture of the PCL is uncommon in pediatrics and only 4 surgical treatment have been described so far. Non-surgical management is usually advocated due to the potential risk of growth disturbance. Nonetheless, poor long-term outcomes have been reported with anterior knee pain, instability and meniscal lesion. The purpose of this work was to report the results of surgically treated isolated intraligamentous PCL rupture.

Materials and Methods Three skeletally immature patients underwent PCL reconstruction in our service between 2009 and 2013. Respective age at surgery was 11, 7 and 8 years. Surgical indication was considered only after a failure of conservative treatment of several months. We performed in all three cases an all-inside arthroscopic technique using an autologous semitendinosus-gracilis graft. Outcomes were evaluated through the IKDC score, a quantitative gait analysis (QGA) and a laximetry. Adverse effects on growth were evaluated. Mean follow-up was 6 years (4.5-9).

Results At last visit, all three patients were asymptomatic of their operated knee. All had returned to sports at prior level. QGA showed no more discrepancies. Posterior laxity was also

resolved. The IKDC score increased by a mean of 26.7 points between pre-operative phase and last follow-up. No growth disturbance was reported besides one hypergrowth resulting in a 15mm leg-length discrepancy.

Conclusions The clear majority of children's PCL lesion consist of bony or periosteal tibial avulsion. Intraligamentous rupture is exceptional. After a failure of conservative treatment, a case-by-case assessment for surgical indication must be carried out in a specialized team. This surgical technique used is reproducible and showed a good mid-term reliability. Patients should be monitored until skeletal maturity has been reached.

Thursday 04/04/2019

Sports Medicine

OP-012 / 09:51

Clinical outcome after arthroscopic debridement and microfracture for osteochondritis dissecans of the capitellum

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Level IV

Introduction and Objective Arthroscopic debridement and microfracture are considered the primary surgical treatment of capitellar osteochondritis dissecans (OCD). The objective of this study was to evaluate clinical outcomes of this technique in a large patient cohort.

Materials and Methods Seventy-one consecutive patients (75 elbows) with capitellar OCD who underwent arthroscopic debridement and microfracture were included. The mean age was 16±3.3 years and the mean follow-up was 3.5±1.9 years. Clinical elbow outcome (pain, function, and social-psychological effect) was assessed using the Oxford Elbow Score (OES) at final follow-up. Range of motion and return to sports were recorded. Multivariable linear regression analysis was performed to determine predictors of postoperative OES.

Results The mean postoperative OES was 40.8±8.0. An open capitellar physis was a predictor of better elbow outcome (5.8-point increase; P=.025), as well as loose body removal/grade 4-5 lesions (6.9-point increase; P=.0020) and shorter duration of preoperative symptoms (1.4-point increase per year; P=.029). Flexion improved from 134° to 139° (P<.001); extension deficit improved from 8° to 3° (P<.001). Pronation (P=.47) and supination did not improve (P=.065). Thirty-seven patients (55%) returned to their primary sport at the same level, and 5 patients (7%) returned to a lower level. Seventeen patients (25%) did not return to sport due

to elbow-related symptoms, and 10 patients (13%) did not return due to non-elbow-related reasons.

Conclusions Arthroscopic debridement and microfracture for capitellar OCD provide good clinical results, especially in patients with open growth plate, loose body removal, and shorter duration of symptoms. However, only 62% of patients in this study returned to sports.

Thursday 04/04/2019

Sports Medicine

OP-013/ 09:56

Long term results of surgical treatment of juvenile osteochondritis dissecans of the knee by arthroscopic fixation with bioabsorbable implants

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Level IV

Introduction and Objective The aim of this study was to assess the long term results of operative management of osteochondritis dissecans (OCD) lesions in skeletally immature knees by arthroscopic internal fixation using bioabsorbable implants.

Materials and Methods A series of 24 patients (26 knees) with juvenile OCD of the knee, who were followed for a minimum of five years after surgical treatment by arthroscopic fixation with bioabsorbable implants, were included in the study. All subjects were skeletally immature at the time of surgery and had MRI-confirmed knee OCD lesions which either were found to be unstable or had failed conservative treatment for at least six months. Each lesion was fixed *in situ* with commercially available bioabsorbable (96L/4D PLA) implants during knee arthroscopy. Postoperatively, protective weight bearing was maintained for six weeks. Outcome evaluation was based on the statistical analysis of the differences between the pre- and postoperative values (at the last follow-up visit) in the Hughston rating scale and pedi-IKDC subjective form.

Results The mean Hughston score increased from 1.3±0.5 preoperatively to 3.6±0.6 at the time of the last follow-up, whereas the mean pedi-IKDC score raised from 66.6±4.9 to 85.8±6.3 correspondingly. In both cases the differences were found to be statistically significant (p<0.001). Furthermore, there was a negative correlation between the change in the Hughston score and the age of the patient (r=-0.518), as well as between the change in the pedi-IKDC score and the size of the lesion (r=-0.407).

Conclusions This study has demonstrated satisfactory long term results of arthroscopic fixation of OCD lesions in skeletally immature knees with use of bioabsorbable implants. The aforementioned technique appears to be a safe and effective means of managing juvenile OCD of the knee.

Thursday 04/04/2019

Sports Medicine

OP-014 / 10:01

Level of sports competition is associated with increased yearly incidence of back pain in 3,891 American children and adolescents

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Level II

Introduction and Objective The purpose of this study was to examine sports related back pain and its associations with Level of competition in a cohort of American children and adolescents.

Materials and Methods Demographic, back pain and sports participation data were collected in a representative, epidemiological survey of American adolescents between 10 and 18 years old. Chi-squared analyses were performed to investigate the relationship between Level of competition in sports and the incidence of back pain at any time in the previous year.

Results A total of 3,891 participants were included for analyses in this study. Overall, 33.7% (n=1,311) of included participants experienced back pain within the last year. Yearly incidence of back pain was significantly associated with participation in several sports, including rowing/crew (17 of 23, 73.9%), volleyball (87 of 184, 47.3%), softball (46 of 101, 45.5%), cheerleading (133 of 294, 45.2%), and weight lifting (63 of 145, 43.4%) (p<.05 for all compared to population). For participants competing in one or more of the sports significantly associated with back pain, increased yearly incidence of back pain was associated with increasing Level of competition, such that those who participated at the junior varsity level (81 of 162, 50.0%), varsity Level (108 of 218, 49.5%), on travel teams (57 of 118, 48.3%), and in national or international competition (37 of 79, 46.8%), experienced significantly greater yearly incidence of back pain compared to those who played on their local team (90 of 245, 36.7%) or recreationally (118 of 368, 32.1%) (p<.001).

Conclusions The current epidemiologic study establishes baseline incidence of back pain in children and its association with specific sports and increasing Level of competition.

Thursday 04/04/2019

DDH

OP-015 / 10:46

Comparison between the Pavlik Harness and the Tübingen splint for the treatment of developmental dysplasia of the hip in infants

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Level III

Introduction and Objective The main objective of this study was to evaluate the clinical and radiological outcomes of patients younger than 6 months of age with DDH managed by Pavlik Harness (PH) or Tübingen Hip Flexion Splint (TS).

Materials and Methods The records of 83 consecutive infants aged 62±59 days, diagnosed with DDH from 01/2015 to 12/2017, were retrospectively reviewed. Inclusion criteria for patients carrying the diagnosis of DDH were as follows: a) age between 21 days and 180 days at the time of diagnosis; b) Ultrasound examination based on Graf grade system; c) treatment by PH or TS. The exclusion criteria were as follows: incomplete clinical and radiological data, presence of genetic or neuromuscular disease, and/or follow-up less than 12months. All patients underwent hip ultrasound every 7 days during the first 3 weeks of treatment and subsequently every 3 to 4 weeks until completion of treatment. If no signs of improvement were found after 3 weeks of treatment, the abduction brace was discontinued. Statistical analysis was performed.

Results The study included a total of 83 patients with Graf grade IIc to IV DDH (8 males [9.6%] and 75 females [90.4%]). Average follow-up time was 24 ± 5 months. 27 hips were graded as Graf IIc (29.6%), 9as grade D (9.9%), 32as grade III (35.2%) and 23 hips as grade IV (25.3%). Average age at initial treatment was 62 ± 59 days (range, 1-180). There were 46 patients (51 hips) in the PH group and 37 patients (40 hips) in the TS group (p>0.05). TS showed 87% and 61% success rate in Graf III and Graf IV hips, respectively. Success rate was significantly lower in Graf III (79%) and Graf IV hips (24%) treated by PH (p<0.05).

Conclusions TS should be preferred treatment option for patients with severe forms of DDH (Graf grade III and IV) younger than 6 months of age.

Thursday 04/04/2019

DDH

OP-016 / 10:51

The complication rate for treatment of developmental dysplasia of the hip with the Pavlik Harness

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Level IV

Introduction and Objective to determine the complication rate for the Pavlik harness in the treatment of developmental dysplasia of the hip (DDH), and identify risk factors for presenting a complication.

Materials and Methods a retrospective review of 307 patients with DDH treated with a Pavlik harness (mean age at start of treatment = 3.1 months), minimum follow-up of two years. The presence of femoral nerve palsy, dermatitis, posterior fixed subluxation of the hip and avascular necrosis (AVN) were determined. Risk analysis was carried out to identify factors for presenting these complications.

Results The overall complication rate was 13% (40 of the 307 patients). Three patients developed a femoral nerve palsy, all resolved within 6 days after removing the harness (rate = 0.98%). 19 cases of dermatitis were found (rate = 6.2%) and 18 cases of AVN were found (rate = 5.8%), of the 18 cases with AVN, 14 were classified as Salter & Thompson type I and 4 as type II; AVN was observed between 2 and 18 months after treatment had been started. The mean age for the 3 cases with femoral nerve palsy was 5.6 months, the mean age for the group that presented dermatitis was 4.3, the mean age for the group that presented AVN was 5.1 months, the mean age for all patients with a complication was 5.1 months compared with 3.1 months for the cohort without a complication. All of the cases with a femoral nerve palsy were dislocated at rest at the start of treatment, 15 of the cases that presented AVN were dislocated at rest and 3 were unstable. None of with stable dysplasia presented any complication other than dermatitis.

Conclusions the Pavlik harness is a safe treatment method with a very low rate of complications. Independent risk factors for presenting a complication were being over 4 months of age at the start of treatment and having a dislocated hip.

Thursday 04/04/2019

DDH

OP-017 / 10:56

Predictors of avascular necrosis of the femoral head following closed or open reduction in the treatment of developmental dysplasia of the hip

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Level II

Introduction and Objective Avascular necrosis (AVN) is a potential complication of treatment for DDH. AVN most commonly occurs following operative management (closed [CR] or open reduction [OR]); however, little high-Level evidence exists on risk factors. The purpose of this prospective multi-centre study was to identify predictors of AVN following operatively-managed DDH.

Materials and Methods CR/OR-treated DDH patients were identified from a multi-centre prospective database. At ≥ 1 yr

follow-up, AVN was determined from AP pelvis radiographs via assessment and consensus discussion between 3 paediatric orthopaedic surgeons. Demographics, clinical and radiographic data were assessed for potential predictors.

Results In total 139 hips (125 patients) underwent CR/OR at median age 10.4mos (range 0.7-27.9). There were 37 cases of AVN (26.6%) at median 23mos post-surgery. Univariate logistic regression analysis identified sex, diagnosis and surgery age, pre-surgery IHDI grade and time from diagnosis to surgery as potential predictors. Male sex (OR2.21[0.87,5.72]), IHDI grade IV, and older age at diagnosis (7.4vs.9.5mos) and surgery (10.2vs.13.6mos) were associated with AVN development, as was time from diagnosis to surgery (2.9vs.5.5mos). No association was found with surgery type (CRvs.OR), pre-surgery acetabular index or side.

Conclusions Early outcomes suggest AVN is an important operative complication, occurring at comparable rates after CR or OR. Male patients may be more susceptible, and potential predictive factors of older age and length of time from diagnosis to surgery emphasize importance of early detection and treatment to minimize complications and optimize outcomes. Longer-term follow-up and larger numbers will be required to confirm these findings.

Thursday 04/04/2019

DDH

OP-018 / 11:11

Is closed reduction for DDH avoidable?

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Level II

Introduction and Objective The performance of a regional surveillance program for developmental dysplasia of the hip (DDH) has been monitored since 2010. The aim was to measure performance and allow continuous quality improvement.

Materials and Methods All infants treated for DDH in the region had demographic data prospectively logged from 2010. Radiological records and treatment data were interrogated to identify referral source, time to review, interventions and complications. We report on the birth cohort from 2010 to 2016 (172,819 live births).

Results There was an increase in ultrasound capacity rising from 3,434 infants scanned in 2010 (13% of live births) to 6,638 in 2016 (23% of live births). There was a modest increase in the overall treatment rate from 10.8 to 14.6 per 1,000 live births. There was a four-fold decrease in the number of closed reductions performed, from 1.54 to 0.37 per 1,000 live births. There was a reduction in the rate of very late (> 1 year) presentation of subluxed or dislocated hips from 0.41 to 0.28 per 1,000 live births. Over the time there was a significant reduction in the number of pelvic X-rays performed on infants less than one year of age, from 6,754 in 2010 to 2,969 in 2016.

Conclusions Monitoring performance has increased ultrasound capability and led to a reduction in operative procedures. The reduction in pelvic X-rays in infants has exceeded the increase in ultrasonic examinations. Even in the last 2 years of the study period only 1 of the 20 children having closed reductions were seen before 6 weeks of age, indicating scope for further improvement. The improvements to date have been achieved with limited extra resources. We believe that performance monitoring should be an integral component of surveillance. The rate of closed reduction may be a useful indicator of overall performance.

Thursday 04/04/2019

DDH

OP-019 / 11:16

Effect of age on radiographic outcomes of patients aged 6 to 24 months with developmental dysplasia of the hip treated by closed reduction

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Level III

Introduction and Objective This study aimed to evaluate the effect of age on rates of redislocation, avascular necrosis of the femoral head (AVN), and final radiographic outcomes in patients with developmental dysplasia of the hip (DDH) treated with closed reduction (CR).

Materials and Methods We included 308 hips (276 patients; aged: 15.3±4.4 months) with DDH treated by CR. Patients were divided into 3 groups according to age (<12 months, 12-18 months, 18-24 months). Tönnis grade, rate of redislocation, rate of AVN, acetabular index, center-edge angle, Severin radiographic grade and risk of surgery were evaluated on plain radiographs.

Results Overall, redislocation occurred in 17 (5.5%) and AVN occurred in 36 (11.7%) out of 308 hips. The rate of redislocation and AVN were similar among the three age groups in all Tönnis grades. However, the redislocation rate significantly increased with Tönnis grade. Overall, 246 hips (79.9%) had satisfactory final outcomes, 62 hips (20.1%) had unsatisfactory outcome; no significant difference was observed among the three age groups. A total of 103 out of 308 hips (33.4%) were found to be at risk for secondary surgery. The surgical risk (25%) in patients younger than 12 months was lower than that of older patients (12-18 months: 34.4%; 18-24 months: 37.9%); however, the difference was not statistically significant. Logistic regression analysis also confirmed that age was not a risk factor for redislocation, AVN or poor radiographic outcome.

Conclusions Age has no significant impact on redislocation or AVN in patients with late-detected DDH treated with CR. However, older patients may have a higher risk developing residual acetabular dysplasia requiring surgery. Under this condition, secondary pelvic surgery provides favorable outcomes in most patients, without the need to opening the joint.

Thursday 04/04/2019

DDH

OP-020 / 11:21

Acetabular indices in children at risk of developmental dysplasia of the hip: time for new references?

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Level III

Introduction and Objective Values for acetabular indices (AI) were defined in normal children over forty years ago and are still used to diagnose DDH. These values have not previously been defined for children 'at risk' of DDH. Our aim was to define a range of normal and dysplastic values of AIs in this population.

Materials and Methods At our centre, all patients born with risk factors for DDH (breech presentation, family history, asymmetric skin creases and abnormal examination without dislocated or dislocatable) hips are screened using plain radiography at 6 months and followed up if abnormality is identified. These patients were identified retrospectively over a 9 year period. Serial AIs were measured on all pelvic radiographs. Patients with acetabular dysplasia requiring any intervention, syndromic diagnoses or inadequate radiographs were excluded.

Results A total of 1076 AIs were measured from 538 radiographs in 387 children. All patients were treated with observation alone and discharged from follow-up once the AI was deemed normal. In girls, the values for mean AI (both hips) and for severe dysplasia (+2 standard deviations) were: 25.0/35.1 at 6 months, 22.7/32.5 at 1 year, 23.2/32.8 at 2 years, 22.6/30.9 at 3 years, 21.4/29.8 at 4 years and 23.3/33.1 at 5 years of age. The mean AI was higher at any age in girls and in the left hip.

Conclusions Our results provide new reference ranges for AIs in children carrying risk factors for DDH at birth as opposed to general population data. Compared to current reference values, our values suggest that higher AIs may be tolerated potentially reducing the need for intervention as none of our patients developed hip instability or persistent dysplasia.

Thursday 04/04/2019

DDH

OP-021 / 11:36

Factors affecting the outcome of open reduction for developmental dysplasia of the hip performed over the age of 18 months

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Level III

Introduction and Objective To determine predictors of redislocation, subluxation and osteonecrosis following open reduction when performed over the age of 18 months.

Materials and Methods We performed a case control study of 156 consecutive patients (184 hips) undergoing open reductions >18 months at two tertiary referral centres. Median age at reduction was 26 months (IQR, 21-45). We reviewed case notes to ascertain all relevant clinical variables. With a median age of 10 years (IQR 2-18) at followup, two blinded assessors graded all radiographs for re-dislocation, subluxation and osteonecrosis using established indices. We graded skeletally mature hips by according to Severin. We defined 'adverse outcome' as cases that developed either a re-dislocation, subluxation or osteonecrosis of grades II-IV. We used mixed effects models to examine which patient-related factors and factors of patient history could predict an adverse outcome (and controlled the analysis for baseline osteonecrosis risk).

Results We identified 8 re-dislocations, 33 subluxations and 51 hips with osteonecrosis grade II-IV. We classified 127/143 hips (75%) as Severin class I/II, 43/143 hips (25%) as class III/IV, and none as class V. Age at reduction (OR=1.05; 95% CI 1.01-1.08; p=0.003) and having had one more failed attempts of reduction of any type (OR=5.55; 95% CI 1.48-20.85, p=0.017) were associated with adverse outcome.

Conclusions For every month of age over 18 at index procedure, a 5% increase in adverse outcome was seen. Clinicians can reduce the risk for re-dislocation, subluxation and osteonecrosis by avoiding multiple attempts to relocate a hip and by early specialist referral.

Thursday 04/04/2019

DDH

OP-022 / 11:41

Dega transiliac osteotomy in the developmental dislocation of the hip: long-time outcome in patients treated when older than 5 years

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Level III

Introduction and Objective The series of hips underwent the open reduction, proximal femoral and Dega transiliac osteotomy for the developmental dislocation of the hip (Tönnis grade III and IV) at the age equal or greater than 5 (mean 6,9±1,8) between 1969 and 1987. The aim of this study was to review the outcome of treatment into middle age.

Materials and Methods We located and reviewed cases of 50 patient (68 hips). Patients were assessed after a median observation period of 39,0 years (± 5,6 years) by WOMAC, Harris Hip Score (HHS), clinical and radiological examination. 20 patients (28 hips) underwent total hip replacement (THR) – group 1. In group 2 radiographs of 40 hips in 30 patients were analyzed by Kellgren and Lawrence (K&L) score, the minimal joint space width and hip dysplasia indices.

Results In group 1 the average time between the initial surgery and THR was 32,3 years (±6,7), average WOMAC and HHS scores were 17,9 (±17,9) and 80,6 (±16,3) respectively. In the group 2 the average WOMAC and HHS scores were 27,2 (±16,6) and 74,1 (±15,5) respectively. 13 hips have been assessed as K&L grade 2, 11 as grade 3 and 16 as grade 4. Minimal joint space width was on average 1,2 mm (±1,1). Average CEA and Sharp angle were 49,7 (±12,6) and 32,6 (±6,2) respectively. 25 % of hips in group 2 were painless.

Conclusions The surgical method achieves 58,8 % survival rate at 39 years in population of patient treated at the mean age of 6,9. Unfortunately 67,5 % of hips in group 2 have a poor prognosis because of apparent osteoarthritis (K&L grade III and IV) and pain.

Thursday 04/04/2019

DDH

OP-023 / 11:46

Significance of asymmetry of groin/thigh creases in developmental dysplasia of the hip revisited; a myth or a fact?

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Level III

Introduction and Objective The aim of this study is to assess whether or not asymmetry of groin/thigh creases (AGTC) that has been underestimated in the literature as well as in several newborn hip screening programs, is a significant clinical finding in developmental hip dysplasia (DDH) and can be introduced as a risk factor to newborn hip screening programs.

Materials and Methods Control group (CG) was composed of 1000 consecutive healthy babies (526 girls and 474 boys) whose hip ultrasonography (US) was made within the first six months of life (6-180 days), and both hips were considered Graf type I (normal). Study group (SG) was composed of 246 consecutive patients (200 girls and 46 boys) whose

treatments by abduction bracing were initiated due to unilateral or bilateral US documented DDH (Graf type IIa- or worse hips) within the first six months of life (21-193 days). SG included 178 patients with bilateral or unilateral stable hips (Graf types IIa-, IIb, IIc), and 68 patients with at least one unstable hip (Graf types D, III, IV).

Results The rate of AGTC was about 6 times higher in SG (63/246; 25,6%) than in CG (44/1000; 4,4%) ($P < 0.00001$). In SG, 101 patients (41%) had at least one positive clinical finding. AGTC was seen in 63 of the patients with at least one positive clinical finding (63%) and was also the most common clinical finding. AGTC was the only clinical finding in 31 patients and 24 of them had unilateral or bilateral stable hips. AGTC was accompanied by other clinical findings in remaining 32 patients and 23 of them had at least one unstable hip.

Conclusions AGTC is a significant clinical finding in DDH and can be introduced to newborn hip screening programs as a risk factor for DDH.

Thursday 04/04/2019

Tumours

OP-024 / 12:01

Pelvic ring reconstruction with a double-barreled free vascularized fibula graft after resection of pediatric pelvic bone sarcomas

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Level IV

Introduction and Objective We aimed to analyze the outcome of pelvic ring reconstruction using a double-barreled free vascularized fibular graft (FVFG) combined with internal fixation after limb-salvage internal hemipelvectomy in children.

Materials and Methods We conducted a retrospective review of 16 children [10 male, six female; mean age 14 (11-19) years] with primary pelvic bone sarcomas who underwent pelvic ring reconstruction using a double-barreled FVFG after internal hemipelvectomy. Internal hemipelvectomy included type I (11) and type I+IV (5) resections; the fibular graft was placed in an intercalary fashion between supraacetabular region distally and remaining ilium or sacrum proximally. The stability was provided by single or double columns of transpedicular screws and spinal rod(s). Average follow-up was 52 (28-96) months.

Results Fourteen patients were alive at the time of study [no evidence of disease (10); alive with disease (4)]. Only 2 patients had died of disease after 24 months follow-up. The union of FVFG was observed proximally and distally in all patients at 12 months. Graft hypertrophy was significant in all at 12 months and continued till the end of 24 months. Average final follow-up MSTS score was 80% (60-95%). There was a slight (<2 cm) limb length discrepancy in 3 (18.7%) and

spinal asymmetry in 2 (12.5%). There were 3 (18.7%) complications [deep infection (1), hematoma (1), wound dehiscence (1)] requiring re-operation. Except for 1 transient nerve palsy, no donor site complication was observed. The disease relapsed in 6 (37.5%) patients in terms of distant metastasis.

Conclusions This reconstruction method can achieve a high rate of bone union and provide good functional outcome following resection of pediatric sacroiliac pelvic bone sarcomas. Even though complication rate is high, most of them can be managed conservatively.

Thursday 04/04/2019

Tumours

OP-025 / 12:06

Free fibula reconstruction of distal tibial osteoarticular defects after sarcoma surgery

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Level IV

Introduction and Objective Distal tibia tumor ablation results in combined bone and soft tissue defects that involves the ankle joint. We present our experience with a limb sparing surgery using vascularized fibular graft (VFG) following resection of distal tibial bone sarcomas.

Materials and Methods Between 2007 and 2016, 12 patients [average age 14 (9-21) years] with osteosarcoma and Ewing's sarcoma of the distal tibia underwent osteoarticular resection and biological reconstruction with VFG. All received preoperative and postoperative chemotherapy. The fibular graft was placed in an intercalary fashion between the remaining tibia and talus to achieve arthrodesis of the ankle joint. In 2 patients with small defect size, double-barreled VFG was used. Osteocutaneous flap was required in 3 patients. The average follow-up was 62 (28-124) months.

Results Graft union on bone ends/arthrodesis was achieved in 91.6% and 100% of the patients at 12 and 24 months follow-ups respectively. Graft hypertrophy was observed and progressively increased in 11 (91.6%) patients between 12 and 24 months. In 1 patient with delayed union fibular graft was hypertrophied between 24 and 36 months. The average final follow-up Musculoskeletal Tumor Society (MSTS) score was 76% (64-92%). Eleven patients regained almost normal ambulation within 24 months. The overall complication and re-operation rates were 41.6% and 33.3% respectively. Four patients underwent re-operation for delayed union (1), implant failure (1), skin necrosis (1) and wound problem (1). The disease relapsed in 3 (25%) patients in terms of distant metastasis, and 11 (91.6%) patients were still alive at the time of study.

Conclusions Biological reconstruction of osteoarticular distal tibial defects with VFG can achieve ankle arthrodesis to provide permanent stability with good functional results.

Thursday 04/04/2019

Tumours

OP-026 / 12:11

Intramedullary fixation of double barrel vascularised fibula grafts with subsequent femoral lengthening for reconstruction of the distal femur in osteosarcoma patients

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Level IV

Introduction and Objective The use of vascularised fibula grafts is an accepted method for reconstructing the distal femur following resection of malignant tumours. Most techniques are limited by the mismatch in the diameters of the transplanted fibula graft and the local bone as well as the resulting leg length discrepancy at maturity. We present preliminary results of a unique technique for reconstructing the distal femur utilizing a double barrel vascularised fibula graft in A-frame configuration with intramedullary nail fixation.

Materials and Methods We retrospectively included 10 patients (mean age 10 years) with an osteosarcoma of the distal femur, who underwent tumour resection with a staged reconstruction - an immediate defect reconstruction with a vascularised double barrel free fibular autograft in A-frame configuration (nail fixation) and a subsequent intramedullary leg lengthening procedure. All patients were evaluated with regards to hypertrophy/consolidation of the transplanted grafts, leg length discrepancies, complications as well as the functional/oncologic outcome.

Results The mean defect size was 15cm, the mean length of the harvested fibula graft 22cm. Consolidation was achieved in all cases, 4 patients required a bone grafting procedure. Hypertrophy at the host-graft junctions was observed in 75%. In 5 patients the solid intramedullary rod had been replaced by a lengthening nail and a successful leg lengthening procedure had been performed at the latest follow up. The overall complication rate was 40%, the mean follow-up 5 years (1-12 years).

Conclusions The shown results suggest that the used technique is a valuable alternative option for reconstruction of the distal femur. The immediate nail fixation facilitates a planned intramedullary equalization of leg length discrepancies following tumour resection.

Thursday 04/04/2019

Tumours

OP-027 / 12:25

Allograft-prosthetic composite after proximal femur bone tumor resection in paediatric age

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Level IV

Introduction and Objective Allograft-prosthesis composite (APC) of the proximal femur is one reconstructive option after bone tumor resection in children, with the advantages to restore bone stock and to provide biological reinsertion of abductor and iliopsoas muscles. The aim of the study was to evaluate functional outcome, complications and failure rate in paediatric patients treated with APC after resection of primitive malignant tumor of the proximal femur.

Materials and Methods We evaluated retrospectively 12 patients, who underwent APC reconstruction of the proximal femur under the age of 14 years. The diagnosis included 9 Ewing's sarcoma and 3 osteosarcoma. In 9 patients we used a short-stem prosthesis fully cemented into the allograft and diaphyseal host-allograft plate fixation. In 2 patients a megaprosthesis with proximal femur trochanteric allograft was employed. In 1 case, proximal femur allograft with plate fixation and resurfacing prosthesis of femoral head was used. Average resection length was 16 cm and a total femur resection was included.

Results After a mean follow-up of 60 months (16-206), 4 patients (33%) were continuously disease free, 3 (25%) showed no evidence of disease after radiotherapy or surgery of pulmonary metastases, 1 was alive with disease and 4 patients were died of disease. Five APC failed (41,6%) as a result of fracture and non-union requiring revision. Three patients experienced non-union and three patients had allograft fractures (one patient had both). Limb salvage after revision was effective in 100% of cases. The mean MSTS score was 84,5%.

Conclusions Despite possible high complication rate, APC of the proximal femur in paediatric age can provide excellent functional results preserving bone stock for future revisions with definitive implants at skeletal maturity.

Thursday 04/04/2019

Tumours

OP-028 / 12:30

Granular cells tumors in pediatric patients

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Level IV

Introduction and Objective Granular Cells Tumors (GrCTs) are tumors embryologically arising from Schwann cells. Commonly occur from the 2nd to 6th decade of life. Presentation is not well defined in the pediatric population. In adults, majority of cases occur in the head and neck area. Patients present with a painless mass and require a wide resection to ensure negative margins. The purpose of this study is to describe the features and outcomes of treatment of GrCTs in children.

Materials and Methods An IRB approved retrospective review was performed for all pediatric patients who had a histologically confirmed diagnosis of GrCT seen from 2004-2018. Frequencies and descriptive statistics are reported for demographics, clinical presentation, medical imaging, surgery, histology, treatment, and complications.

Results 18 patients were identified with a majority being female (14, 77.8%). Mean age at presentation 9.8 ± 1.17 years. Predominant ethnicities: African-American (10, 55.6%) and Caucasian (5, 27.8%). Locations included: head/neck (8, 44.5%), extremities (8, 44.5%), chest (1, 5.6%), and pelvis (1, 5.6%). Average size was 16.28 ± 2.22 mm. No pain reported in 14 patients (77.8%). 17 patients had excisional biopsy. Histological exam reported 17 benign and 1 atypical tumor. Tissue involved was: skin (18), subcutaneous tissue (18), fascia (7) and muscle (1). Complications were dehiscence (1) and transient nerve injury (1). No recurrence post-surgery at median follow up of 28.6 months.

Conclusions This is the first reported study of GrCT exclusively in the pediatric population and defines the epidemiology in this group. We report a higher than adult prevalence in the African American population. Extremity involvement is higher than reported in adults and GrCT's should be included the differential diagnoses of pediatric extremity soft tissue masses.

Thursday 04/04/2019

Tumours

OP-029 / 12:35

Treatment of simple bone cysts with bone marrow aspirate concentrate (BMAC) and equine derived demineralized bone matrix: a retrospective comparative study

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Level III

Introduction and Objective Purpose of the study is to compare the outcomes of uncomplicated simple bone cysts in patients treated with injections of autologous bone marrow concentrate (BMC) and equine derived demineralized bone matrix (EDDBM), versus methylprednisolone acetate injections.

Materials and Methods Clinical records and radiographs of 53 consecutive patients (37 females, 16 males) treated in our institute from 2006 to 2016 were retrospectively reviewed. Healing was determined by independent radiologist according to Neer score rating system modified by Cole. Patient function was assessed with use of the Activity Scale for Kids (ASK). Thirty-four cysts were located in the humerus, 13 in the femur and 6 in other localizations. Twenty-nine patients were included in Steroid Group and treated with 3 cycles of injections of methylprednisolone acetate, while 24 patients were treated with injection of autologous bone marrow concentrate and equine derived demineralized bone matrix (BMC+EDDBM Group). The two groups were comparable as for mean age, sex distribution, cysts location and their clinical presentation.

Results At a minimum follow-up of 24 months, success rate (Neer/Cole score 3 and 4) was higher in EDDBM+BMC group (83.3% vs 58.6%; $p=0.047$). Female patients reached higher healing rates in both groups ($p=0.002$). No association was found between healing and age ($p=0.839$), cyst activity ($p=0.599$), cyst localization ($p=0.099$) and clinical presentation ($p=0.207$). BMC+EDDBM group showed higher ASK score ($p=0.0007$) and less infiltration procedures.

Conclusions Treatment with BMC+EDDBM injections allows better results with a single procedure towards 3 methylprednisolone acetate injections.

Thursday 04/04/2019

Tumours

OP-030 / 12:40

Bioexpandable prosthesis after resection of malignant bone tumors in children

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Level IV

Introduction and Objective Conventional expandable endo-prostheses are an option after resection of malignant bone tumors of the lower extremities in children and adolescents

not only to bridge the defect but also to overcome limb length discrepancy. The "bioexpandable" Prosthesis is able to lengthen the bone using the method of callus distraction what offers better long term results.

Materials and Methods The prosthesis is equipped with an encapsulated electromotor which enables the device to perform bone growth in an osteotomy gap with about 1mm/day. The new bone is improving the relationship from bone to prosthesis and therewith the potential stability of the final stem. 11 patients (7m, 4f) were treated with the bioexpandable prosthesis. In 6 cases the femur and in 2 cases the tibia and in 3 cases the femur and the tibia were lengthened after resection of an osteosarcoma (7) or a Ewings-sarcoma (4). The mean age of the patients was 14 years and the mean amount of lengthening was 74mm. In 2 cases lengthening was performed in 2 steps and in 1 case it was performed in 3 steps.

Results All lengthening procedures could be finished without complications. There was no infection and no technical problem. The bone regenerate in one tibia case was poor so that bone grafting had to be performed from the iliac crest. In one case a temporarily contracture of the knee joint was observed which recovered completely after finishing lengthening. In one early case a breakage of the nail happened 2 years after lengthening just before the replacement to the final prosthesis was planned.

Conclusions The "bioexpandable" prosthesis is a new concept for limb lengthening after tumor resection in children. The latest versions of the prosthesis allow lengthening procedures via small incisions.

Thursday 04/04/2019

Trauma

OP-031 / 15:00

Metaphyseal fracture displacement is predictive of intra-articular diastasis in adolescent triplane ankle fractures

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Level II

Introduction and Objective To determine the utility of a novel and simple plain radiographic measurement as a predictor of intra-articular displacement in adolescent triplane fractures (TPFs).

Materials and Methods A retrospective review of all adolescent TPFs was performed at a Level 1 pediatric trauma center from 2003-2013. Radiographs (XR) and computed tomography (CT) scans at initial presentation were reviewed. Maximum articular diastasis (AD) and step off (SO) were measured using digital calipers on AP, mortise and lateral XR as well as on axial, coronal and sagittal CT scans. Maximal metaphyseal fracture displacement (MFD) was recorded on lateral XR. AD

and SO were compared between the two imaging modalities. Correlations between XR and CT measurements were identified.

Results 87 TPFs were identified with XR and CT scans prior to treatment. XR underestimated AD by 233% in the sagittal plane (1mm vs. 3.3mm on sagittal CT; $p<0.05$). XR underestimated AD by 24% in the coronal plane (2.3mm on AP XR vs. 2.9mm on coronal CT; $p<0.05$). XR underestimated articular SO by 184% in the coronal plane and 177% in the sagittal plane ($p<0.05$). Axial CT demonstrated significantly greater AD (4.2mm, range 0-19mm) compared to coronal (2.9mm, range 0-18.7mm) and sagittal (3.3mm, range 0-11mm) cuts ($p<0.05$). 65 patients had MFD ≥ 1 mm on lateral XR, of whom 61 had AD of >2.5 mm on CT (positive predictive value of 94%).

Conclusions Surgeons underestimate articular displacement of TPFs on XR. MFD is easily measured on XR and correlates with articular displacement. MFD ≥ 1 mm is predictive of AD above the commonly accepted threshold for operative intervention. This finding should raise suspicion for significant articular displacement that may not be appreciated on XR and should prompt consideration of a CT before proceeding with non-operative management.

Thursday 04/04/2019

Trauma

OP-032 / 15:05

The IOLE (intramedullary titanium nail osteosynthesis linked external-fixator) technique in pediatric femoral shaft fractures: validity and reliability

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Level III

Introduction and Objective Over the last 20 years, the incidence of pediatric femoral shaft fractures was increased, due to changes in the children's daily activities. The Intramedullary titanium nail Osteosynthesis Linked External-fixator (IOLE) was born to prevent rotational and lengthening mal union or non union in the treatment of pediatric femoral shaft fractures. The aim or the objective of this paper is to compare the IOLE with the two most used methods for the treatment of femoral fractures in children.

Materials and Methods From 2000 to 2016, 52 pediatric patients with femoral shaft fractures were surgically treated and enrolled in the study. The range age of the patients was

between 3 and 15 years. Twenty-two patients were treated with endomedullary titanium nails (TEN) and the other 16 with external axial or modular external fixators and 14 patients treated with IOLE technique. The IOLE technique in brief is the hybridization of titanium intramedullary nails with a modular external fixator. It is divided into three phases, the first riviene given the length of the femur with the external fixator; the second, the rotations are dominated by the elastic nails; and the third finally they are hybridized on the external fixator. Comparing the three groups, radiographic images were taken to assess the fracture reduction and consolidation.

Results At the final follow-up, there were no differences between three groups in term of significant rotation defects, angulation, growth, and/or nonunion but there was a statistical in IOLE groups for the early weight bearing.

Conclusions The IOLE technique showed to lead to healing the pediatric femoral shaft fracture of the femur but allows early weight bearing to these patients and a normal life like that.

Thursday 04/04/2019

Trauma

OP-033 / 15:10

Paediatric pelvic fractures: a retrospective review of 2 cohorts of patients

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Level IV

Introduction and Objective Paediatric pelvic fractures are uncommon and are usually the result of high velocity trauma. Being a major trauma centre in London we are in a unique position to see these injuries. The purpose of this review was to highlight current practice with regards to paediatric pelvic fractures and compare management with a similar cohort analysed 10 years ago.

Materials and Methods Our hospital notes, trauma database and radiological imaging were used to identify paediatric patients with pelvic fractures. We assessed parameters such as age, gender, fracture pattern, associated injuries, imaging and management of patients with these injuries.

Results There were 32 boys and 21 girls in our study. Mean age of the boys was 8.8 years and the girls 10.7 years. In seven children the pelvic fracture was an isolated injury and in the remaining 46 children, there were 113 additional injuries. 56% of the additional injuries was either a fracture/dislocation (37%) or a head injury (19%). Compared to our first cohort, we had a larger number of children in the second cohort.

Age, sex distribution, mechanism of injury was similar in the two groups. In this current cohort, use of CT scan imaging was more frequent, there were more unstable pelvic fracture patterns identified, ISS scores were higher and mortality was lower.

Conclusions Over the years we have seen more children with paediatric pelvic fractures in London. Compared to our first cohort of patients we have seen more severe injuries, and higher ISS scores recorded. The increased use of CT scan as part of the trauma survey may have contributed to picking up more complex fracture patterns. Despite the increase in paediatric pelvic fractures overall mortality is lower.

Thursday 04/04/2019

Trauma

OP-034 / 15:25

Importance of timing in elbow supracondylar fractures associated to neurovascular injury

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Level III

Introduction and Objective Urgent treatment for supracondylar elbow fractures (SEF) have been recommended when associated with a vascular injury, but, is unclear when fractures are associated with neurological injury. The objective is to evaluate if neurological or non-emergent vascular lesion are influenced by the time of surgery.

Materials and Methods Out of 223 consecutive Garland type 3 SEF, excluding those with a white pulseless hand. 37 presented associated neurovascular injury (NVI). In 22 occasions median or anterior interosseous nerve, in 17 absence of pulse with a pink hand, in 8 cases a radial nerve palsy, one patient presented a 3 nerves trunk lesion.

Patients with neurovascular injury were divided according to the time of surgery; in early (operated <6 hours since injury) and late (>6 hours).

Results In the early group patients with no NVI required an average of 40 minutes (mean 40) surgery, while those with associated NVI required 50 minutes (mean 40) (p>0.05). In the late group patients with no NVI required an average of 38 minutes (mean 34) of intervention, while patients with NVI required an average 92 minutes (mean 60) p=0.01. Only 6 of the 11 patients with pulseless hand treated by closed reduction in the early group recovered pulse immediately after reduction. While in 3 out of 4 pulseless hand treated late the pulse reappeared.

Conclusions Associated neurological injury is an indication for early surgery. The chances of pulse recovery after SEF reduction are not related to the time elapse since the injury.

Thursday 04/04/2019

Trauma

OP-035 / 15:30

Radial neck fractures in children: results of open reduction

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Level II

Introduction and Objective Radial neck fractures in children are rare, representing 5% of all elbow pediatric fractures. Most are minimally or non-displaced. Severely displaced or angulated radial neck fractures often have poor outcomes, even after open reduction and case series reported in literature are limited. The aim of the study is to analyze the outcomes of patients with a completely displaced and angulated fracture who underwent open reduction when closed reduction failed.

Materials and Methods Between 2000 and 2009, 195 patients with radial neck fractures were treated in our institute. 24 cases satisfied all the inclusion criteria and were evaluated clinically and radiologically at a mean follow up of 7 years. At follow up, carrying angle in full elbow extension and range of motion of the elbow and forearm were measured bilaterally. We recorded clinical results as good, fair or poor according to the range of movement and the presence of pain. Radiographic evaluation documented the size of the radial head, presence of avascular necrosis, premature physeal closure and cubitus valgus.

Results Statistical analysis showed fair and poor results are directly correlated with loss of pronation-supination ($p=0.001$); reduction of elbow flexion-extension ($p=0.001$); increase of elbow valgus angle ($p=0.002$), necrosis of the radial head ($p=0.001$), pre-mature physeal closure ($p=0.01$) and associated lesions (olecranon fracture with or without dislocation of the elbow) ($p=0.002$).

Conclusions In our cases, residual radial head deformity due to premature closure of the growth plate and avascular necrosis were correlated with a functional deficit. Outcomes were good in 55% and felt to represent a better outcome than if the fracture remained non-anatomically reduced with residual angulation and/or displacement of the radial head.

Thursday 04/04/2019

Trauma

OP-036 / 15:35

Can childhood obesity increase the risk of failure in conservative treatment of distal radius fractures?

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Level IV

Introduction and Objective Obesity is a clinical and social burden in the childhood population. The distal radius is the most common site of fracture in childhood and the conservative treatment is widely used. The major casting complication is the loss of reduction and the re-displacement of the fracture. The aim of the study is analyzing the obesity influence the loss of reduction risk in conservative treatment patients.

Materials and Methods Between January 2012 and December 2017, according to WHO BMI-for-age, 189 under 16 years patients conservatively treated for distal radius fractures were divided into three groups: normal, overweight and obese. The sample underwent a radiographic follow up at the ER department arrive, at 7 and 30 days from the treatment. The radiographic assessment was: following Mani criteria, initial translation of the fractures grade; following Alemendaroglu criteria, initial reduction quality, and Cast (CI), Padding (PI), Canterbury (Cal), Gap (GI) e Three Point (3PI) index and dislocation at 7 days Xray.

Results Group 1: 23 50–100% initial dislocations, 27 anatomical reductions of the fracture; indexes means were: CI 0,8, PI 0,2, Cal 1,0, GI 0,16, 3PI 0,9. Group 2: 42 50–100% initial dislocations, 23 anatomical reductions of the fracture; indexes means were: CI 0,9, PI 0,2, Cal 1,1, GI 0,18, 3PI 1,0. Group 3: 26 50–100% initial dislocations, 9 anatomical reductions of the fracture, indexes means were: CI 0,9, PI 0,3, Cal 1,2, GI 0,16, 3PI 0,9.

Conclusions Obesity results in a higher rate of malreduction and subsequent manipulations with closed reduction and casting. Close follow-up and early consideration for additional treatment in this patient population may help reduce the need for further manipulations.

Thursday 04/04/2019

Trauma

OP-037 / 15:50

Clavicle fractures in adolescents – to fix or not to fix?

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Level IV

Introduction and Objective There has been an increasing trend towards operative fixation of clavicle fractures in adolescents. This study investigates the outcomes and complications of non-operatively treated clavicle fractures.

Materials and Methods This is a retrospective, single institution study on healthy adolescents age 13-17 years who

sustained an isolated, complete and displaced clavicle fracture between 1997-2015. Clinical charts were reviewed for demographic information, fracture location, injury mode; and time to radiographic healing, re-attainment of full shoulder ROM and return to activities. Complications and other relevant issues were also recorded. Midshaft (middle third) fractures were compared with distal (lateral third) fractures.

Results 145 patients (125 males, 20 females; mean age 13.9±0.9 years) were analysed. 99 adolescents (68%) sustained a midshaft clavicle fracture, while 46 (14%) had a distal fracture. 68% of fractures were sports-related, while 21% were non-sports related falls; the remaining 11% were from blunt injury (5%), motor vehicle accident (4%) and assault (2%). Time to radiographic healing was 7.8±4.9 weeks and time to full ROM in the ipsilateral shoulder was 6.7±4.6 weeks. Patients returned to activity at 11.8 ± 5.2 weeks from injury. Between midshaft and lateral third fractures, there were no significant differences in the time to radiographic healing, full shoulder ROM and return to activities ($p=0.865$, 0.433 and 0.202 respectively). There were no reported cases of non-union and none of the patients required surgery. There was a single case of reported intermittent fracture site pain.

Conclusions Clavicle fractures in adolescents can and should be treated non-operatively. Surgical stabilisation should be reserved for cases where early return to sports and competition is important.

Thursday 04/04/2019

Trauma

OP-038 / 15:55

Development and content validation of the patient-reported outcomes of fracture healing (proof) questionnaires

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Level I

Introduction and Objective Comparative studies of children's fracture treatments seldom show differences, possibly because outcome measures used are inadequate. The aim of this study is to describe the development of a new patient/parent reported outcome measure for fractures.

Materials and Methods Children with a wide range of upper & lower limb fractures and parents were interviewed to understand their priorities with respect to treatment outcomes, providing content for the Patient/Parent Reported Outcomes of Fracture Healing (PROOF) questionnaires for the upper (UE) & lower (LE) limb respectively. More patients/parents underwent cognitive briefing to assess relevance of & missing content; comprehensibility, format & ease of use. Changes

made were tested iteratively on other groups until saturation. Pediatric orthopaedic surgeons with known fracture expertise were surveyed by REDCap (with 3 reminders) to accept, modify or reject each item of the PROOF questionnaires, and to complete a 12-item sensibility assessment (0 to 7) of the content, structure, feasibility & utility of the questionnaires.

Results The PROOF-UE (33 items) & PROOF-LE (27) span four domains: "how it looks"; "how it feels"; "how it works"; and "how it recovered". 50/132 (38%) surgeons surveyed scored all 12 items of the sensibility questionnaire well above the threshold of acceptability with an overall mean score of 5.14 (Range: 4 to 6.03). Based on the input from patients/parents & surgeon surveys, 1 item was deleted, 3 items added, & 12 items modified resulting in the final version of the PROOF questionnaires.

Conclusions The PROOF-UE & -LE questionnaires were developed from patient's & parents' priorities. Surgeons confirmed face and content validity. After psychometric testing, the PROOF may provide more meaningful measures of effectiveness of fracture treatments.

Thursday 04/04/2019

Trauma

OP-039 / 16:00

Children's fractures quality register

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Level I

Introduction and Objective Quality of pediatric fracture treatment should be monitored.

Materials and Methods We have used a register for children's fractures since 2017 in a tertiary Level pediatric teaching hospital. This register includes example radiographs of fractures with reference to treatment recommendations. Diagnosis is coded with an extended ICD-10 system. Place and method of treatment are recorded. Experience of the surgeon is registered. Wrong treatment method, technical errors and treatment related complications are monitored. Data entered into the register is double checked by experienced pediatric orthopedic surgeons.

Results 2351 fractures in 2270 patients (29% physeal, 3.3% multiple, 2.0% open fractures) were treated during last 21 months. Distal radius and forearm (S52.5, S52.6) fractures comprised 19.9% of all fractures. Most (69.6%) of the fractures were treated in ER and 30.4% under anesthesia in OR. Internal fixation was performed in 25.4% of all cases. Treatment in OR was performed by 11 different attending surgeons (1-47 cases/surgeon) in 32.0%, by 30 residents (1-40 cases/surgeon) assisted by the attending surgeon in 33.8 % and by the resident alone in 34.2% of the cases. Wrong choice of the treatment method was chosen in 25 (1.1%) and technical errors in internal fixation occurred in 28 (4.7%) of the cases.

Surgeon specific rate of substandard internal fixation varied between 0 and 22%. Complications of treatment leading to temporary or permanent disability occurred in 118 (5.0%) of the cases. Eight (0.01%) iatrogenic nerve injuries were caused by seven surgeons.

Conclusions One in four of pediatric fractures are currently internally fixed in our institution. The rate of technical errors and complications of treatment are currently unacceptably high at 5% and should be lowered to below 1% in the near future.

Thursday 04/04/2019

Foot

OP-040 / 16:15

Subtalar arthroereisis for the treatment of symptomatic paediatric flexible flatfoot

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Level III

Introduction and Objective Surgical intervention has been proposed for the treatment of the painful flexible flatfoot when conservative measurements fail to alleviate symptoms. Subtalar arthroereisis is a recognised surgical procedure for symptomatic flatfeet. It has a controversial history and has previously been associated with high failure rates and excessive complications. We performed a systematic review of the international literature to assess the outcomes of arthroereisis for the treatment of symptomatic paediatric flatfoot.

Materials and Methods A search was conducted using the online Cochrane Library, Medline and PubMed databases. Included studies were assessed for methodological quality, as well as radiological, kinematic and clinical outcomes.

Results 32 articles were identified, of which 13 were included in the review. A total of 1603 feet of 1085 patients were operated on. Post-operative hindfoot valgus, supination, dorsiflexion and Viladot grade all corrected to near normal. Radiological measurements demonstrated improvement towards the normal range. Patient reported outcome measures showed superior average post-operative scores following arthroereisis with the exception of the VAS-FA. Patient satisfaction was reported as excellent in 73.0%, fair in 21.7% and poor in 5.3%. Complications occurred in 5.5% of cases, with a reoperation rate of 2.1%.

Conclusions Arthroereisis for symptomatic paediatric flexible flatfoot produces favourable outcomes and high patient satisfaction rates with a reasonable risk profile. There is still a great deal of negativity and literature highlighting the failures of arthroereisis, especially for older implants. The biggest flaws in the collective literature are the lack of high-quality prospective studies, a paucity of long-term data and heterogeneity of utilised outcome measures between studies.

Thursday 04/04/2019

Foot

OP-041 / 16:20

Outcome after subtalar arthroereisis in children with flexible flatfoot depends on time of treatment: midterm results of 95 cases

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Level IV

Introduction and Objective The subtalar arthroereisis (SA) is an established surgical option for pediatric flatfeet (PFF). Hence, the optimal time point for a SA is still discussed controversially. Therefore, the present study evaluates the influence of the patient's age at surgery on the radiological outcome to provide further evidence in this matter.

Materials and Methods From August 2007 to December 2015, 50 patients with 95 PFF were included. Inclusion criteria were: 1) patients with flexible PFF under or equal to 15 years of age, 2) treatment with SA and 3) presence of pre-op, post-op and follow up (FU, mean 33 months, SD±18) routine biplane radiographs under full weight-bearing. Subdivision into group A: 5-8 years, group B: 9-12 years and group C: 13-15 years. The radiographs were analyzed for: 1) calcaneal-pitch (CP), 2) lateral talocalcaneal angle (lat. TCA), 3) a.p. talocalcaneal angle (a.p. TCA) and 4) navicular-cuboidal-index (NCI, overlap of Ossa naviculare et cuboideum).

Results Our study showed the best deformity correction when surgery was performed between 9 and 12 years of age (group B), with significant improvement in all measured parameters without secondary deterioration during FU. In group A, the SA show inferior results with poorer mid-term success with only an improvement in the a.p. TCA; the NCI even deteriorated during FU. Group C showed mixed results. While CP and NCI improved, the lat. TCA deteriorated in the FU period.

Conclusions According to the presented data the ideal age for surgical intervention by SA seems to be between 9 and 12 years. Therefore, surgery before the age of 9 years is no longer recommended and in the younger child observation of the natural course seems to be appropriate. Delayed treatment with surgery at the age of 13-15 was only partially successful with partial deterioration during FU period.

Thursday 04/04/2019

Foot

OP-042 / 16:25

Quality of life in flexible painful flatfoot: the patient's and family's perspective

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Level II

Introduction and Objective This study aimed to evaluate quality of life and satisfaction in patients with flexible painful flat-foot.

Materials and Methods The Oxford Ankle Foot Questionnaire for children (one to be completed before the surgical correction and another after the screw removal), the PedsQL™ Healthcare Satisfaction Generic Module and the PedsQL™ General Well-Being Scale were administered to all patients who underwent arthroereisis for flexible painful flatfoot between January 2014 and December 2016.

Results Two hundred and fifty patients were sent the questionnaires and, so far, 72 (40 male and 32 female) of them responded. The surgical correction was performed at a medium age of 11.92±1.76 years. When the Oxford Ankle Foot Questionnaire for children scores before surgical correction and after the screw removal were compared, the latter scored significantly better for all domains. Healthcare satisfaction was good in all families. Most of the patients scored medium-high on the PedQLTM General Well-Being both when asked about themselves (mean 86.50±7.44) and in general about their health (76.06±12.32).

Conclusions Our results confirmed that flexible painful flatfoot is significantly affecting the quality of life of children and that the arthroereisis is a valuable technique, which improves their quality of life.

Thursday 04/04/2019

Foot

OP-043 / 16:30

A three-in-one procedure to treat talocalcaneal coalition in children: a case-control study

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Level III

Introduction and Objective We aimed to compare conservative and surgical treatment of rigid flatfoot associated with talocalcaneal coalition.

Materials and Methods We retrospectively reviewed a case series of 60 children (26 bilateral; 22 females, 38 males; mean age 12 ± 2 years) treated at our institution, between 2005 and 2016, for painful rigid flatfoot associated with talocalcaneal coalition. Among them, 35 children received conservative treatment, consisting in manipulation, serial casting and insole; 25 children underwent surgical treatment consisting in resection of the coalition, interposition of fascia lata allograft and subtalar arthroereisis by a calcaneo-stop implant (three-in-one procedure). The results were evaluated by the ankle

hindfoot clinical rating system of the American Orthopaedic Foot and Ankle Society (AOFAS) and the Foot and Ankle Disability Index (FADI).

Results The mean follow-up averaged 3 ± 1 years. We observed significant improvement in AOFAS (p value 0.02) and FADI (p value 0.05) in the surgical group. No complications were reported following the surgical treatment and no relapse of the deformity was observed. 24 cases (96%) had none or mild occasional pain at the latest follow-up. A complete restoration of the hindfoot motion was achieved in 17 cases (65%), a partial stiffness of the hindfoot was observed in 8 children (32%), while a marked restriction of the hindfoot motion was present in 1 case (4%).

Conclusions In our experience, the three-in-one procedure showed favourable results in children affected by rigid flatfoot associated with talocalcaneal coalition, achieving aligned and plantigrade foot with symptomatic improvement and restoration of the hindfoot motion in the majority of cases.

Thursday 04/04/2019

Hip

OP-044 / 17:10

How reliable is the modified lateral pillar classification when a large number of raters from multiple centers are involved, and what factors affect the reliability?

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Level III

Introduction and Objective The Lateral Pillar Classification (LPC) and its modification (mLPC) are the most frequently used radiographic classification systems for active Perthes disease. Previous reliability assessments of LPC/mLPC range from fair to good agreement (kappa 0.39 – 0.72). In previous assessments, XR were pre-selected for review, and often were assessed by a small number of observers. The purpose of the study was to determine inter-observer reliability of mLPC using a large international surgeon group with varied experience (2-43 yrs), allowing surgeons to self-select the XR for mLPC assessment (i.e., as done in clinic).

Materials and Methods 40 Perthes cases with serial AP and frog-lateral images at ~3-month intervals during the first 2 years were selected. For each case, 26 surgeons from 4 countries independently assigned mLPC, documenting the XR selected. LPC data were analyzed using weighted kappa statistics. On a case-by-case basis, the performance of raters was determined through surgeon consensus using the mode mLPC as "gold standard" (GS). Percent agreement was

calculated for each surgeon, comparing individual mLPC with group consensus.

Results The weighted kappa for inter-observer correlation was 0.643. Individual surgeon's overall performance varied from 48 – 88% agreement with the mLPC GS. Surgeon mLPC performance was not influenced by years of experience ($p=0.51$). Radiograph selection did not influence GS assignment of mLPC. There was greater agreement on cases of mild B hips and severe C hips.

Conclusions The inter-observer reliability of mLPC is good when including a large number of international surgeons with varied experience. Surgeons frequently did not choose the same XR for classification. Further modification could be considered to help better differentiate between hips on the border of B and C.

Thursday 04/04/2019

Hip

OP-045 / 17:15

The role of Doppler ultrasound and MRI of the hip joint to select treatment strategies for children with Perthes disease

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Level II

Introduction and Objective Objective is to determine the correlation between the parameters of Doppler ultrasound (DU) and contrast MRI of the hip to select treatment strategies.

Materials and Methods Study included 32 patients (44 hips) with Perthes disease. Inclusion criteria were age 5–8 years, initial examination, stage 1–2 of Perthes disease in X-ray. Exclusion criteria were stage of residual deformity, age over 9 years, previous surgeries performed in other clinics. Following parameters were evaluated by DU: RI, maximum systolic blood flow velocity, diastolic blood flow velocity, qualitative blood flow parameters in the hip joint. MRI assessed the area of the femoral head ischemia (%), sphericity and subluxation of the femoral head, deformity according to the Lateral Pillar classification and femoral head recovery.

Results Correlation between parameters RI and systolic blood flow velocity relative to MRI parameters at stages 2 and 3 of the disease was found ($P < 0.05$). At the same time, increased RI was usually observed during the early stage (1) and the lesion area more than 50% according to MRI results (B1-B2), and the femoral head deformity B / C and C according to Lateral Pillar. Blood flow enhancement was noted in late stages of the disease with RI normalization with any area of the femoral head lesion. The choice of conservative treatment or surgery depended on ultrasound and MRI results and the patient's age.

Conclusions Blood flow parameters obtained during DU of the hip joint vessels in patients with Perthes disease correlated to the severity of the femoral head lesion according to MRI.

The techniques complemented each other when it is necessary to select the strategies of complex treatment but ultrasound could be used in dynamic follow-up as a less expensive and more available method.

Thursday 04/04/2019

Hip

OP-046 / 17:20

Minimally invasive surgical techniques in the treatment of Perthes' disease

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Level I

Introduction and Objective Comparative analysis of the results of treatment in children with Perthes disease in 2-3 stages using PRP and temporary blockage of the trochanter major growth zone.

Materials and Methods 3 groups: 1 (control) – 20 children who received standard conservative treatment; 2 (10 children)-temporary blocking of the zone of growth of the large spit with an 8 - shaped plate; 3 (20 children)-introduction of PRP into the focus of necrosis of the femoral head, temporary blocking of the zone of growth of TM with an 8-shaped plate T. the results of treatment were evaluated taking into account clinical and radiological indicators for up to 3 years.

Results In the first (control) group, the duration of the disease corresponded to the average statistical, but there was a significant flattening of the femoral head, anatomical shortening of the thigh was from 1.5 to 3 cm, which further required additional interventions; in the second group, the recovery time of the head was reduced by 3-4 months, anatomical shortening of the thigh was from 0.5 to 1.0 cm; in the third group - the duration of the disease statistically significantly decreased from 6 to 9 months, anatomical shortening of the thigh was from 0.5 to 1.0 cm, and the accelerated transition of one stage of the disease to another.

Conclusions The introduction of PRP in the focus of necrosis of the femoral head stimulates the restoration of the structure of the epiphysis of the femoral head, and the blocking of the germ zone of the large spit prevents the development of multi-plane deformities of the proximal femur and preserve the anatomical structure of the hip joint.

Thursday 04/04/2019

Hip

OP-047 / 17:25

"Abortive", "minimal" or "occult" Perthes' disease - does it exist in MRI?

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Level III

Introduction and Objective Presentation of MRI findings of an occult form of Perthes' disease.

Materials and Methods We reviewed the records of 59 patients with Perthes' disease who were monitored at our institution by serial MRI using T1, T2 and STIR sequences between 2000 and 2010, and looked for changes in the other hip. We also surveyed MRI exams of patients with irritable hips.

Results We identified a subgroup of 14 patients (24%) with changes in the contralateral hip that were compatible with an occult form of Perthes' disease (OPD). We found the same abnormalities in 5 patients with irritable hips. There was no specific treatment. We did advise, however, vitamin D supplementation combined with a calcium rich diet and a restriction of physical activity. The vast majority of the patients were boys (17 of 19 patients). The mean age at diagnosis of OPD was 4.6 years, the mean follow-up was 4.9 years. We noted a benign clinical course in 18 of 19 patients. The characteristic MRI findings include signal alterations in the epiphyseal marrow on T1- and T2-weighted images in combination with variable joint effusion, moderate increase of head size by cartilage thickening, and long-lasting contour irregularities to the bony epiphyseal dome.

Conclusions OPD is a special form of Perthes' disease, such as radiologically defined "abortive" or "minimal" Perthes' disease (Katz 1965, 1968; Harrison, Blakemore 1980; Herring, Lundeen, Wenger 1980). It is typically diagnosed in the other hip of Perthes' disease. There are characteristic MRI findings, such as moderate cartilaginous coxa magna and long-lasting contour irregularities to the epiphyseal dome. It may present as irritable hip with temporary epiphyseal ischemia. Uncommonly, OPD can be the forerunner to classical Perthes' disease.

Thursday 04/04/2019

Hip

OP-048 / 17:43

Prophylactic fixation of the contralateral hip after unilateral slipped capital femoral epiphysis – complication rates and considerations

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Level II

Introduction and Objective The management of the contralateral hip in unilateral slipped capital femoral epiphysis (SCFE) is controversial; prophylactic fixation or scheduled regular follow-up? The purpose of this study was to evaluate the complication rate after prophylactic fixation of the contralateral hip in unilateral SCFE.

Materials and Methods All patients treated for SCFE in the index hip in Sweden between 2007 and 2013 were included in a nationwide register. Through this register we collected numbers of complications after prophylactic fixation of the contralateral hip in unilateral SCFE.

Results 379 children were registered with SCFE in the index hip between 2007 and 2013. Of these, 27 children had bilateral SCFE on initial presentation. Of the remaining 352, 151 were treated with prophylactic fixation of the contralateral hip and 201 were scheduled for regular radiographic follow-up. Of the 201 scheduled for regular radiographic follow-up 43 later developed SCFE in the contralateral hip. Of the 151 children with prophylactically fixated contralateral hip 1 child developed SCFE in this hip despite the prophylactic fixation. 2 children had a peri-implant femur fracture. Perioperative technical difficulties were described for one of these children. One child with a peri-implant fracture also had a subsequent deep infection. This yields a complication rate of 3 % (4/151) in prophylactic fixation. There were no cases of avascular necrosis. An analysis of numbers needed to treat result in a number of 4,8.

Conclusions If all 352 children with a unilateral SCFE would have been treated with prophylactic fixation of the contralateral hip 74 cases of subsequent contralateral SCFE might have been prevented. The complication rate after prophylactic fixation in unilateral SCFE is acceptable when using a correct surgical technique.

Thursday 04/04/2019

Hip

OP-049 / 17:48

Outcomes after slipped capital femoral epiphysis – a population-based study with 3-year follow-up

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Level I

Introduction and Objective To evaluate outcomes 3 years after treatment for slipped capital femoral epiphysis (SCFE): development of AVN, subsequent surgery, hip function, the contralateral hip.

Materials and Methods This prospective cohort study included a total national population of 379 children treated for SCFE

between 2007 and 2013. A total of 449 hips treated for SCFE and 151 hips treated with a prophylactic fixation were identified. The Barnhöft questionnaire, a valid patient-reported outcome measure (PROM), was used.

Results Ninety hips had a severe slip, 61 of these were clinically unstable. AVN developed in 25 of the 449 hips. Six of 15 hips treated with capital realignment developed AVN. A peri-implant femur fracture occurred in three slipped hips and in two prophylactically pinned hips. In three of these five hips technical difficulties during surgery was identified. In 43 of 201 hips scheduled for regular follow-up a subsequent SCFE developed in the contralateral hip. Implant extraction after physal closure was performed in 156 of 449 hips treated for SCFE and in 51 of 151 prophylactically fixed hips. Children with impaired hip function could be identified using the Barnhöft questionnaire.

Conclusions Fixation in situ is justified to remain as the primary treatment of choice in SCFE. Overweight is more common in children with SCFE than in the average population. Prophylactic fixation is a safe procedure when performed using a correct technique. The number of patients who developed AVN after capital realignment is of concern. We recommend rigorous follow-up of both hips, including PROM evaluation, until physal closure.

Thursday 04/04/2019

Hip

OP-050 / 17:53

Severe SCFE patients treated with a modified Dunn procedure have low AVN rate, high survivorship and little osteoarthritis at long-term follow-up

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Level IV

Introduction and Objective The modified Dunn procedure has the potential to restore the anatomy in hips with severe slipped capital femoral epiphyses (SCFE). However, there is controversy about the risk for avascular necrosis of the femoral head (AVN). Therefore, we report on (1) AVN rate (2) clinical outcome, (3) the cumulative survivorship (4) radiographic outcome at long-term follow-up in patients undergoing the modified Dunn procedure for severe SCFE.

Materials and Methods We performed a retrospective analysis involving 46 hips of 46 patients treated with a modified Dunn procedure for severe SCFE (slip angle >60°) between 1999 and 2016. At 8-year follow-up, 44 were available for clinical and radiographic examination. Mean preoperative age was 13 years and 30% presented with unstable slips. Mean preoperative slip angle was 64° (60–90). Survivorship (Kaplan-Meier) was calculated.

Results (1) Two hips (4%) had AVN, both hips had two subsequent surgeries. In total, 10 hips (22%) had subsequent surgeries. (2) At follow-up, mean Mda score was 17 points (14–18), mean mHHS was 94 points (66–100), mean HOOS was 91 points (67–100). (3) Survivorship was 86% at cumulative 10-year follow-up. (4) Postoperative slip angle was 7° (1–16). One hip (2%) had OA progression.

Conclusions The modified Dunn procedure for severe SCFE resulted in a low AVN rate, low risk of progression to OA and high hip scores at long-term follow-up. The slip deformities were mainly corrected but secondary impingement deformities persisted some hips and they underwent further surgical corrections.

Thursday 04/04/2019

Hip

OP-051 / 17:58

Slipped capital femoral epiphysis treatment avoiding femoral-acetabular impingement

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Level II

Introduction and Objective The appropriate treatment in mild slipped capital femoral epiphysis (SCFE) should not only prevent further slipping of the epiphysis but also address potential femoroacetabular impingement by restoring the anatomy of the proximal femur. The aim of this study was to assess femoral head-neck contour in a new method of treatment of SCFE that avoids premature closure of the physis and obtains stability.

Materials and Methods Between 2001 and 2011, we treated 38 patients with unilateral mild SCFE by fixation in situ using a modified screw fixation which does not cause premature physeal arrest. This study reviewed 24 patients for clinical and radiological evidence of femoroacetabular impingement, immediately after surgery and at 6 months and 12 months follow up. Statistical analysis was done comparing the affected and unaffected hip measurements of neck length and α angle.

Results Average α angle immediately after pinning was 56.2±10.6° and on the lateral view, 91.4±8.2. These measurements significantly improved at 6 months post-op to 48.9±5.4° on the AP and 51.2±6.5 on the lateral view (p<0.0001). At 12 months from surgery, AP view alpha angle was 43.0±2.8° (p<0.0001) and on lateral view was 44.2±4.1 (p<0.0001). The neck grew in the same way on the affected and unaffected sides during the first year of treatment. The clinical results in all patients were rated as excellent.

Conclusions Our data support restoration of the anatomy of the proximal femur to avoid the development of femoroacetabular impingement following mild SCFE using a surgical technique which permits residual growth of the neck.

Thursday 04/04/2019

Knee

OP-052 / 15:00

Most patients are not back to normal activities one month following eight plates

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Level II

Introduction and Objective To assess patients postoperatively who undergo 8-plate surgery (temporary hemiepiphyodesis or epiphyodesis) in regards to pain and return to sports and activities.

Materials and Methods Patients ≤ 18 with lower extremity angular deformities or limb length inequality were prospectively enrolled prior to their 8-plate procedure from 2 pediatric institutions from July 2016 to August 2018. Patients were included if they completed the 1-month survey. Participants completed postoperative questionnaires regarding their pain and activity level. Pain was assessed using the FACES Pain Scale.

Results Of the 37 patients that met inclusion criteria (mean age at surgery: 12.3 years \pm 2.2; range: 7-16 years), 20 patients completed the survey at 3 months postoperatively. There was a significant change in pain Level between 1 week and 1 month postoperatively ($p < 0.001$). 77% (27/35) of patients were still taking pain medication at 1 week, which decreased to 35% (13/37) at 1 month. At 3 months, 20% (4/20) patients reported they were still using pain medication. At 1 week, one patient reported returning to their preoperative activity level. Of the 30 patients who played sports, only 2 patients reported a complete return to play at 1 week post-operatively. At 1 month, 57% (17/30) still had not fully returned to sports and 59% (22/37) had not returned to prior activity level.

Conclusions At 1 month following 8-plate procedures, 59% of patients had not returned to their preoperative activity Level and 35% were taking pain medications. Although the 8-plate procedure is small in size, patients and parents should be counseled that there are significant activity limitations and pain levels for a month or longer in many patients.

Thursday 04/04/2019

Knee

OP-053 / 15:05

Complications and errors during guided growth

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Level IV

Introduction and Objective We reviewed the clinical results of guided growth for varus valgus deformities (VVD) or limb length discrepancies (LLD) with an emphasis on complications/errors.

Materials and Methods Adverse events (AEs) were collected and analyzed for all cases treated with guided growth for VVD or LLD. AEs were classified into five groups: improper indication, intraoperative complication, inappropriate follow-up, surgeon misjudgment with timing of removal, and implant failures.

Results During the defined time period, we treated 136 patients for VVD and 103 patients with LLD. In total, we had 88 AEs: improper indication (25), intraoperative complication (29), inappropriate follow-up (12), surgeon misjudgment with timing of removal (14), and implant failures (8).

Conclusions Optimizing clinical outcomes when treating children with guided growth requires careful radiological preoperative planning to define the amount and location of the deformity. A preoperative long standing radiograph should be used to conduct a systematic analysis of limb alignment. Furthermore, it is essential to place the implant precisely and ensure regular follow-up evaluations. Most AEs can be avoided through correct radiological analysis of limb alignment and a basic understanding of guided growth.

Thursday 04/04/2019

Knee

OP-054 / 15:10

Rebound predictors of varus-valgus deformities around the knee corrected by guided growth

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Level IV

Introduction and Objective Guided growth by temporary hemiepiphyodesis is considered to be the preferred primary treatment of coronal plane deformities around the knee. In some cases, the rebound of the deformity takes place. The objectives were to determine the incidence and possible predictors of the deformities rebound.

Materials and Methods We retrospectively reviewed the medical records and X-Ray images of 130 patients with varus-valgus deformities around the knee treated by hemiepiphyodesis during 10 years in our Institution. Patients with the deformity rebound formed the rebound group. In the control group were included patients without deformity rebound during at

least two years follow up. The deformity rebound incidence was calculated. The age, gender, magnitude, localization of the deformity, direction of mechanical axis deviation, comorbidities, beaking of medial growth plate of proximal tibia as possible predictors for deformity rebound were analyzed.

Results Deformity rebound observed in 10 per cent of patients. Mean age of children with the relapse of the deformity was 6.36 years vs 9.18 years in control group. Rebound of the deformity was seen more in boys (M:F = 8:5) – opposite to control group (M:F = 3:8). There were no statistically significant differences between the magnitude of the deformities in experimental and control groups. The valgus-varus rebound ratio was 12:9. 87% of proximal tibia medial growth plate beaking was associated with relapse of varus. Rebound of the deformity was noticed in 20 tibias and only in one femur. Children in the rebound group had comorbidities twice more versus control group children.

Conclusions The child with proximal tibia deformity localization, proximal tibia medial growth plate beaking, young age, comorbidities may need more aggressive overcorrection and more closed follow up.

Thursday 04/04/2019

Knee

OP-055 / 15:25

Outcomes following ACL reconstruction using patellar tendon versus hamstring tendon autograft in adolescent athletes: an age-, sex-, and BMI-matched cohort study

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Level II

Introduction and Objective To compare the re-tear rates and functional outcomes in matched cohorts of adolescent athletes who underwent primary anterior cruciate ligament reconstruction (ACLR) with patellar tendon/bone-tendon-bone autograft (BTB) versus hamstring tendon autograft (HS).

Materials and Methods An initial cohort of 731 patients, aged 13-19 years, who underwent BTB or HS ACLR between 2003-2015 at a pediatric tertiary care hospital by one of 5 surgeons, was identified via electronic medical record query. Propensity score matching was performed through a logistic regression model, based on characteristics frequently used by some surgeons to guide graft selection: age, sex, and body mass index (BMI). The resultant cohort of 269 patients allowed for a 1:2 (BTB:HS, 83:186 patients) match. A chart review and direct contact were used to obtain clinical outcomes data, including validated knee function/activity questionnaires (Pedi-IKDC and HSS-Pedi FABS).

Results Overall mean clinical follow-up was 4.5 years. In the subset of patients providing PROs (52%), no significant differences were seen in HSS-Pedi FABS (BTB: 16, range: 3-29; HS: 17, range: 0-30; p=0.96), mean Pedi-IKDC (BTB: 88.8 ± 10.2; HS: 85.2 ± 16.1; p=0.73), knee pain (p=0.73) or kneeling difficulty (p=0.21). Rates of ACL graft re-tear were not significantly different between groups, both when calculated based on all possible follow-up methods (BTB: 11%; HS: 11%; p=0.91), or amongst patients responding to long-term follow up questionnaires (BTB: 15%; HS: 16%; p=0.85).

Conclusions The current study showed no differences in graft re-tear rates, activity levels, knee pain, kneeling pain, or PROs between adolescents receiving ACLR-BTB and ACLR-HS at medium-term follow-up. For skeletally mature adolescents, graft choice may not influence outcome following ACL reconstruction.

Thursday 04/04/2019

Knee

OP-056 / 15:30

Anterior cruciate ligament reconstruction in adolescents

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Level II

Introduction and Objective Management of anterior cruciate ligament injuries in skeletally immature patients Tanner 2 and 3 is still controversial. The aim of this study is to evaluate the mid-long term results of a partial transphyseal technique and define the safe percentage of lesion of the femoral growth plate in a large serie.

Materials and Methods Between 1989 and 2012, 42 adolescents at risk of growth disturbances (Tanner 2-3) have had a reconstruction of the anterior cruciate ligament using semitendinosus and gracilis tendons. Preoperatively all adolescents were studied for growth characteristics and the percentage of damage that would be produced in femoral physis was determined. The technique reached graft fixation at both insertion sites drilling femoral physis and avoiding tibial physis. All knees were evaluated at follow (mean 9.5 years, max 16 min 4) subjectively by history and objectively by KT-2000 testing and the x-ray of both knees were compared for osteo-arthritis using (Kellgren-Lawrence classification).

Results 33 cases were evaluated at follow up: 1 osteoarthritis grade 2, 1 instability, 2 failures, 29 good stability and function were observed. The mean KT2000 arthrometer values at 30 lb evidenced a difference of +2.4mm (range 1 - 4 mm) between the operated and non operated side (p<0.05). The average IKDC was 90 (min. 68 – max. 97). No adolescents had consequences on growth.

Conclusions This study defines the possibility to perform a partial transphyseal intra-articular ACL reconstruction that avoids tibial physis and involves the distal femoral physis in patients Tanner 2 and 3 and to obtain good results at mid and long term follow up without causing growth disturbances.

Thursday 04/04/2019

Knee

OP-057 / 15:35

Analysis of the incidence of focal periphyseal edema (FOPE). A retrospective study

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Level IV

Introduction and Objective Focal periphyseal edema (FOPE) in adolescent knee joints with open physis is known since 2011. The aim of this retrospective study was to analyze the incidence and also to correlate FOPE with pain and the ensuing treatment performed to avoid future misinterpretations of this purely radiological diagnosis, as well as unnecessary invasive treatments.

Materials and Methods A total of 1201 knee MRI images of 897 patients, performed between 2007-2016 were evaluated retrospectively. The cases were analyzed and classified according to the underlying causes in trauma-associated, unclear knee pain without trauma or other pathologies. All knee MRI's were evaluated retrospectively by one radiologist in terms of the existence of a FOPE lesion. The initially leading diagnoses, other coexisting reasons for knee pain as well as the chosen therapies were documented.

Results Out of the 897 patients, 97 FOPE zones (97/897; 10.81%) were identified in 93 patients (93/897; 10.37%). FOPE being the sole diagnosis causing knee pain was found in 52 patients (52/897; 5.8%). In 84 patients (88/93; 94.62%), FOPE lesions were associated with knee pain. In 79 patients (79/93; 84.94%) a conservative therapeutic approach was performed; in 14 patients (14/93; 15.05%) an invasive treatment was intended.

Conclusions FOPE lesions reportedly are a self-limiting, gender-independent and painful entity. No invasive treatment is needed and lesions heal without consequences after physiological closing of the physis. This purely radiological diagnosis should not be misinterpreted as a pathology requiring treatment and be considered as a differential diagnosis of knee pain in the adolescent age.

Thursday 04/04/2019

Spine 1

OP-058 / 15:50

The surgical volume, more than the number of surgeons or surgeon experience, drives patient outcomes in pediatric scoliosis

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Level II

Introduction and Objective Literature suggests that two surgeons for spine deformity correction surgery can improve perioperative outcomes. However, the surgeon's experience and surgical volume are likely as important. This study seeks to evaluate effect of these factors for spine deformity correction through posterior spinal fusion (PSF).

Materials and Methods Pediatric spinal deformity patients with spinal deformity surgeon from 2012-2017 were included. Patient demographics and radiographic parameters were collected. Analysis was performed for single vs dual attending surgeons, surgical experience, and surgical volume. Median values, Wilcoxon Rank Sums test, Kruskal-Wallis test, and Fisher's exact test were used.

Results 260 cases were performed by 4 attendings. 2 surgeons were highly experienced, 1 of whom is also high volume. The four cohorts were a high experience/high volume surgeon operating alone, two junior surgeons, a highly experienced surgeon with a junior surgeon, and the high experience and high volume surgeon together. Preop Cobb, kyphosis, coronal balance were similar between the groups. Sagittal balance was significantly higher for the highly experienced and high volume surgeon group ($p=0.011$). The high volume surgeon had significantly lower EBL (475 vs 600 vs 700 vs 400cc, $p<0.001$), shorter length of surgery (251 vs 300 vs 300.5 vs 241, $p<0.001$), and anesthesia times (414.5 vs 420 vs 434 vs 369, $p<0.001$). Highly experienced surgeons fused significantly fewer levels compared to less experienced surgeons (12 vs 13, $p=0.05$). When the high volume surgeon operated with another attending, there were no significant changes.

Conclusions High volume surgeons have better outcomes than dual surgeons, irrespective of the dual surgeons' experience. High volume surgeons do not benefit from the addition of a second surgeon.

Thursday 04/04/2019

Spine 1

OP-059 / 15:55

Radiographic outcome and complication rate of 34 graduates after treatment with vertical expandable prosthetic titanium rib (VEPTR®): a single centre report

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Level IV

Introduction and Objective There is paucity of description about the final strategy for patients with EOS at the end of growth. The purpose of this study was to evaluate the radiographic outcome and complications of patients with early onset scoliosis (EOS) who have graduated from vertical expandable prosthetic titanium rib (VEPTR®) treatment, either undergoing final fusion surgery or following a non-fusion approach.

Materials and Methods Final treatment for VEPTR® graduates was divided in "VEPTR® in situ without final fusion", "removal of VEPTR® without final fusion", and "removal of VEPTR® with instrumented final fusion". Radiographic evaluations included main coronal Cobb angle and main kyphosis pre and post VEPTR® implantation, at the end of implant lengthening, after final fusion (if applicable), and at latest follow-up. Complications during VEPTR® treatment and in case of final fusion were reported.

Results 34 VEPTR® graduates were included. 17 underwent final fusion surgery, and 17 followed a non-fusion strategy. Average coronal Cobb angle before VEPTR® implantation was $70^\circ \pm 23^\circ$ (range, 21° to 121°), and $65^\circ \pm 22^\circ$ (range, 17° to 119°) at latest follow-up. Average main kyphosis angle was $53^\circ \pm 27^\circ$ (range, 6° to 137°) before VEPTR®, and $69^\circ \pm 34^\circ$ (range, 10° to 150°) at latest follow-up. There was a 41% complication rate with final fusion surgery leading to a rate of 35% of unplanned returns to the operating room.

Conclusions There is a high complication rate during VEPTR® treatment and with final fusion surgery. The stiffness of the spine and thorax allow for only limited correction when performing a final instrumented spondylodesis. Avoiding final fusion may be a viable alternative in case of good coronal and sagittal alignment.

Thursday 04/04/2019

Spine 1

OP-060 / 16:00

High parental anxiety is associated with increased narcotic use in adolescent patients following spinal fusion

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Level II

Introduction and Objective Parental mental status and behavior may influence postoperative recovery and use of pain

medication. The purpose of this study is to assess if parent's anxiety levels are associated with their children's post-operative narcotic use in adolescent idiopathic scoliosis (AIS) patients undergoing posterior spinal fusion (PSF).

Materials and Methods AIS patients age 11-20 years undergoing PSF and a parent were prospectively enrolled. At the pre-operative appointment, patients completed the Spence Children's Anxiety Scale (SCAS) and parents completed the State-Trait Anxiety Inventory (STAI). High parental anxiety was defined as 1 standard deviation above the normative mean. At the first post-operative visit, patients were asked about medication use.

Results 55 patients (48 females & 7 males) were enrolled. 31% (15/48) of parents of females had high general anxiety trait on the STAI and 69% (33/48) had normal general anxiety. 31% (15/48) of females were taking narcotics at the time of their first post-operative visit (mean: 14 days). At the first post-operative visit 53% (8/15) of female patients with high anxiety trait parents were on narcotics which was significantly different ($p=0.03$) from 21% (7/33) of females with normal anxiety parents. There was no correlation between parental anxiety scales and child anxiety scores ($p=0.15$).

Of the 7 male patients, 29% (2/7) were taking narcotics at their first-post-operative visit, and only one parent had high anxiety scores, so the analysis was limited due to the small number of male patients.

Conclusions Female patients were ~2.5 times more likely to be using narcotics at the first postop visit if parents had high general anxiety.

Thursday 04/04/2019

Spine 1

OP-061 / 16:15

Correlation between spine and chest wall deformities and pulmonary function in Marfan's syndrome

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Level III

Introduction and Objective The purpose of the study was to determine the effect of scoliosis, kyphosis, and chest wall deformity on the pulmonary function of Marfan's Syndrome (MFS) patients.

Materials and Methods In this multicenter study, spirometry, lung volumes, and radiographic imaging were performed on 26 patients (ages 7-18) with MFS. A correlation analysis assessed the relationship between radiographic measurements of spinal curvature and chest wall deformity and the predicted total lung capacity (TLC), forced vital capacity (FVC)

and the ratio between forced expiratory volume in 1 second and FVC (FEV1/FVC). A TLC, FVC, and FEV1/FVC greater than or equal to 80% of predicted value were considered normal.

Results Eighteen patients (70%) had impaired pulmonary function; 12 with restrictive lung disease, 5 with mixed disease, and one obstructive. Thoracic kyphosis (mean 19.3°, range -32°-54°) strongly correlated with FEV1/FVC ($r=0.60$, $p=0.002$). Significant decrease in FEV1/FVC below 80% occurred at kyphosis under 15° ($p=0.004$). Chest wall deformity assessed by radiographic Haller index (mean 3.54, range 1.41–13) strongly correlated with FEV1/FVC ($r=-0.57$, $p<0.003$). The thoracic spinal curve magnitude (mean 55.2°, range 28°-92°) had a moderate correlation with TLC ($r=-0.48$, $p=0.03$). Significant decrease in TLC below 80% occurred at a 40° curve ($p=0.02$).

Conclusions In MFS patients, 3 factors correlate with decreased pulmonary function: 1. Hypokyphosis, 2. Chest wall deformity, and 3. Larger coronal curve magnitude. Hypokyphosis and increased chest deformity strongly correlated with diminished FEV1/FVC. Increasing thoracic spinal curvature moderately correlated with diminished TLC. Further analysis with a larger cohort will help define the true relationship between these deformities and their influence on pulmonary function in this population.

Thursday 04/04/2019

Spine 1

OP-062 / 16:20

Outcome of TLSO for idiopathic scoliosis and role of compliance: study according to SRS and SOSORT criteria

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Level III

Introduction and Objective Proper indication, brace quality and compliance are three factors for brace efficacy in adolescent idiopathic scoliosis. The aim of the study was to assess the outcome of rigid corrective TLSO, considering the patients compliance.

Materials and Methods The study was carried on according to SRS and SOSORT criteria for evaluation of brace treatment. Forty-eight consecutive adolescent girls, all fulfilling SRS brace study criteria (age >10 ys, Cobb 25-40, Risser 0-2, max one year post-menarche) were retrospectively identified in a prospectively collected database. All patients received rigid TLSO full time treatment for 2 years, then part time treatment for the next 2 years (progressive weaning). According to self-reported brace wear time, there were 31 compliant (those who reported school wear and out-of-school wear) and 17 non-compliant (those who reported only out-of-school wear)

girls. The follow-up was minimum 2 years after definitive brace weaning.

Results At baseline the compliant patients were not different ($p>0.05$) from the non-compliant: age 12.5 ± 1.5 vs. 12.1 ± 1.3, Cobb 30.1° ± 3.9 vs. 32.2° ± 5.1, scoliometer 11.1° ± 4.0 vs. 8.8° ± 2.7 while at follow-up the Cobb difference was highly significant 34.9° ± 8.4 vs. 42.2° ± 12.6. The Cobb angle change at the last follow-up was (compliant vs. non-compliant): improvement more than 5° in 7% vs. 6%, stabilization ±5° in 58% vs. 35%, progression more 5° in 35% vs. 59% ($p<0.05$). Final Cobb exceeded 45° in 10% vs. 47% and it exceeded 50° in 10% vs. 29% ($p<0.05$). Recommendation for surgery received 13% of compliant vs. 35% of non-compliant patients.

Conclusions Curve progression and surgical indication were reduced with TLSO. Wearing a brace minimum 20h a day resulted in significantly better final radiological result compared with part time wearing.

Thursday 04/04/2019

Spine 1

OP-063 / 16:25

A dynamic growth friendly technique based on a spring distraction system (SDS): results of the first 20 patients

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Level II

Introduction and Objective Growth friendly systems are needed in severe early onset scoliosis (EOS) to stop curve progression while allowing the spine to grow. We developed a dynamic growth friendly system that integrates a distraction-based system and a sliding technique into a single spring distraction system (SDS). The SDS uses the continuous distraction force of a compressed spring positioned around a sliding rod. The aim of this study was to investigate both the 3D correction, the spinal growth and the complication rate of our new dynamic growth friendly technique.

Materials and Methods Prospective cohort study of the first 20 patients treated with the SDS with at least 1-year follow-up. Adverse events were recorded and Cobb angle, sagittal alignment and spinal growth were measured on standard digital radiographs.

Results Mean age at surgery was 8.3 years and average follow-up was 1.5 years. The average frontal Cobb angle reduced from 59 degrees to 36 degrees and remained stable at 38 degrees ($P=0.13$). Kyphosis decreased after surgery from 31 degrees to 28 degrees. The kyphosis then increased significantly to an average 40 degrees at latest follow-up ($P=0.02$). Two patients improved from a congenital thoracic lordosis to a normal kyphosis at latest follow-up. The post implantation

T1-S1 spine growth rate averaged 10 mm/year. 4 patients required unplanned surgeries. No SDS failures, rod fractures or screw pull-outs were observed.

Conclusions The SDS shows good surgical correction without the need for any lengthening procedures. The physiological spinal growth is maintained over time and the system has the potential to correct hypokyphosis. The dynamic spring-based system possibly prevents implant related stress fracture seen in stiff other growth friendly systems.

Thursday 04/04/2019

Clubfoot

OP-064 / 17:10

A prospective pilot study of the effect of apostherapy in mild residual clubfoot

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Level IV

Introduction and Objective The Ponseti method for congenital clubfoot reduced the need for surgical intervention. 10-20% of children will need further treatment for residual or recurrent deformity. AposTherapy is an innovative physical intervention based on unique biomechanical footwear. It enables intentional deviation of the ground reaction forces and strengthening of specific muscle groups while concomitantly creating controlled perturbation during gait. This pilot study evaluated AposTherapy in residual clubfoot.

Materials and Methods Ten children with idiopathic clubfoot were enrolled. All were managed by the Ponseti method, but showed residual abnormality. None had further treatment other than serial casting, Achillotenotomy and foot-abduction orthosis. Intervention included 6 months of AposTherapy, reaching 5 hours/day with the biomechanical footwear. Outcome measures included balance characteristics (single leg standing, tandem-walking and jumping) and biomechanical evaluation by a computerized gait test.

Results All children accomplished the intervention and evaluation (5 girls, mean age 5, 14 feet). Balance improved in 32/42 (76%) of the tests. Foot progression angle improved in 9/14 (64%), footprint and center-of-pressure (CoP) lengths improved in 68% of tests, and 5/11 feet showed more hindfoot-valgus during walking. CoP sway during gait was improved substantially in 7/10 children.

Conclusions This study presents a novel intervention for residual clubfoot. As a pilot study it included a small cohort and short intervention. The substantial improvement in stance and gait may represent strengthened evertor-muscles and/or improved neuromuscular control and gait-pattern. This type of physical training may be a new modality for non-surgical intervention in children with mild/moderate residual clubfoot.

Thursday 04/04/2019

Clubfoot

OP-065 / 17:15

Rapid decrease of cast-induced forces in the Ponseti method

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Level II

Introduction and Objective The Ponseti method is an effective evidenced-based treatment for clubfeet. This treatment method uses gentle manipulation to adjust the position of the clubfoot in serial steps towards a more physiologic position. Casting is used to hold the newly achieved position for a week. The time needed for this part of the treatment is usually 5 weeks. The assumption is that over time the tissues in the clubfoot adapt to the new position and involved forces decrease. There are no objective data present to support this assumption. The aim of the current study is to test this hypothesis by measuring the forces between clubfoot and cast in the Ponseti method.

Materials and Methods Force measurements were done during the treatment of 10 idiopathic clubfeet. Force data were collected for multiple weeks at the location of the talar neck (TN) and the first metatarsal (FM) during consecutive plaster periods with sensors between foot and plaster that stayed in situ for one week.

Results In all measurements the force decreased over time, the median FM force decreased from 0,29 N to 0,09 N and the median TN force from 0,41 N to 0,03N. The median (inter-quartile range) of the half-time was determined at 26 (20-53) minutes for FM and 22 (9-56) for TN.

Conclusions This is the first study that provides objective force data that supports the hypothesis of decrease in corrective force over time during the casting period in the Ponseti treatment of idiopathic clubfoot. An important new insight on the physiology of the Ponseti method is that the required correction time may well be much shorter than the originally proposed and generally accepted period of one week.

Thursday 04/04/2019

Clubfoot

OP-066 / 17:20

Poor evertor muscle activity is a predictor of recurrence in idiopathic clubfoot treated by the Ponseti method: a prospective longitudinal study with a 5-year follow-up

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Level II

Introduction and Objective After correction of idiopathic clubfoot with the Ponseti method recurrence has been reported in up to 40%. It has been difficult to predict which feet are at risk of recurrence, despite numerous studies investigating various potential risk factors. The foot abduction brace (FAB) has been the standard of care in preventing recurrence but even with excellent compliance recurrences still occur. A body of evidence points to a congenital neuromuscular imbalance constituting the deforming forces in clubfoot. Poor evertor activity has been cited specifically as a risk factor for recurrence. This study aims to evaluate whether poor evertor muscle activity on clinical examination can predict recurrence in idiopathic clubfoot.

Materials and Methods Data were collected prospectively between 2010 and 2015. Sex, age, laterality, Pirani score, cast number, FAB compliance and evertor activity were recorded. Non-idiopathic clubfoot as well as co-morbidities affecting correction were excluded. Evertor activity was scored in a semi-quantitative repeatable manner; 0, 0.5 or 1 as previously described. Recurrence was defined as deterioration of any of the four deformity components following a complete correction.

Results 104 patients (172 feet) fitted the inclusion criteria; 74 male with mean follow up 62 months (range 41-71 m). All patients achieved primary correction, 97% complied with the FAB regime. 19 patients experienced recurrence (18.3%) treated with re-casting. 14 patients required additional surgery (13.5%). Recurrence was highly associated with poor evertor activity ($p < 0.001$).

Conclusions Results at five years confirm that this semi-quantitative evertor muscle activity clinical assessment is predictive of recurrence. We suggest this assessment be implemented routinely to assist with tailoring patient's treatment strategy.

Thursday 04/04/2019

Clubfoot

OP-067 / 17:35

Correlation of structural abnormalities and quality of life in children with clubfoot

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Level II

Introduction and Objective Older children with residual clubfoot pose a dilemma. Foot deformity that is significant enough to cause impaired quality of life is unknown. Investi-

gating the correlation between foot deformity and perceived Level of disability could help guide management. The aim of this study was to correlate foot deformity with perceived disability in children previously treated for clubfoot.

Materials and Methods We collected data on children with idiopathic clubfoot aged 5-16 (mean 10 years, 49 boys, 42 right legs). All subjects had foot kinematics collected using 16 Vicon T-series cameras. Foot Profile Score (FPS) was calculated from the kinematic data. Oxford Ankle Foot Questionnaire (OxAFQ) and a pain score were also collected. Spearman rank correlation identified the relationships between the gait variables (FPS and the 6 component scores of the FPS) and the OxAFQ domains (physical, emotional, school/play) and pain score.

Results Forefoot supination was significantly associated with the physical ($r = -0.37$, $p < 0.01$) and emotional domains ($r = -0.35$, $p < 0.01$). The overall FPS showed only mild correlation with the physical ($r = -0.28$, $p = 0.02$) and emotional domains ($r = -0.28$, $p = 0.02$). The pain score also showed only mild correlation with forefoot supination ($r = -0.26$, $p = 0.03$) and forefoot adduction ($r = -0.25$, $p = 0.04$).

Conclusions This study suggests that in older children with clubfoot, forefoot supination negatively affects perceived disability. Our findings suggest this is the most important kinematic factor affecting perceived function. Clinical assessment of supination should play a part in management decisions in older children with residual clubfoot deformity. Detailed analysis of kinematic deviation in specific points of the gait cycle may shed more light in the correlation between structure and function.

Thursday 04/04/2019

Clubfoot

OP-068 / 17:40

Does treatment of idiopathic clubfoot have an impact on attainment of developmental milestones? A multi-centre, international sibling case-control study

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Level III

Introduction and Objective The Ponseti method is a well-established approach to treating clubfoot. Potentially, both the underlying pathology and adherence to post-correction bracing can affect developmental milestones. This can cause parental concern and affect the compliance with the foot abduction brace (FAB). This study investigates the age

at which infants with idiopathic clubfoot treated using the Ponseti method achieved three selected developmental milestones and whether or not this correlated with FAB use.

Materials and Methods A prospectively collected clubfoot database from four centres was visited. Inclusion criteria were patients with idiopathic clubfoot with no co-morbidities or prior treatment elsewhere with a five year follow up who had a typically developed sibling. Age at attainment of the selected developmental milestones was compared to the sibling control group.

Results 128 patients fitted the inclusion criteria; 46 female and 82 male, 56 with bilateral deformity. The mean age at 1st cast was 4.5 weeks. The mean age at which patients began standing independently was 11.8 months (range: 8-17m). They walked independently at 14.3 months (range: 11-21m). For both milestones, this was statistically significantly later than their sibling control group who stood and walked at a mean age of 10.4 months (range: 8-15m) and 13.1 months (range: 9-24m) respectively ($p < 0.001$). FAB compliance had no significant effect on the delay. Patients became 'dry at night' a mean 2m later than their siblings (NS).

Conclusions Caretakers of infants with idiopathic clubfoot treated according to the Ponseti method should be informed that independent standing and walking is achieved approximately six weeks later than their typically developed siblings. The delay is not related to the use of the foot abduction brace.

Thursday 04/04/2019

Clubfoot

OP-069 / 17:45

Results at skeletal maturity of a new technique for treatment of pes cavovarus

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Level II

Introduction and Objective Treatment of pes cavovarus in children and adolescents is disappointing. The goal is to present the results at skeletal maturity, of a new mini-invasive surgical technique, using growth guidance at an early age.

Materials and Methods Prospective study with the following admission criteria: Pes cavovarus with + Coleman test, patient skeletally immature. 8 patients (4 boys/ 4 girls) and 15 feet (all skeletal mature at final FU). Age at surgery ranged from 9-13 years. 5 patients had underlying neurological etiology, in 3 etiology was unknown. The surgery consisted in a dorsal hemiepiphysiodesis with a 2 hole-plate and screws of 1st metatarsal, associated with a percutaneous plantar release. Clinical assessment of results comprised hindfoot deformity measurement, and evidence of callosities at preoperative and final check-up. Comparative radiological measurements included Meary angle, Calcaneal Pitch and 1st MTT-Talus angle on standing x Rays pre and postoperatively. A validated

foot child questionnaire was used to assess the different domains of satisfaction.

Results Median FU was 42 months. Clinically, heel position improved from a mean of 6 degrees varus to a mean 6 degrees valgus. Clinical callosities disappeared in 5 patients and improved in 3. Radiologically the mean Meary correction was 4°. The calcaneal pitch did not change. The questionnaires revealed a high degree of satisfaction with the procedure. Shoe wear improved significantly. 1 patient had a postoperative wound infection and 2 patients presented migration of the plate. 1 foot in 1 patient presented a deformity relapse due to material failure requiring reoperation.

Conclusions Cavovarus deformity at an early age could be treated by minimally invasive surgery. Results are preserved until skeletal maturity, and is associated with a high clinical satisfaction.

Friday 05/04/2019

Spine 2

OP-070 / 07:30

The safety and efficacy of intrathecal morphine in early onset scoliosis surgery - a 25-year single center experience

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Level III

Introduction and Objective Pre-incision intrathecal morphine (IM) is a popular adjunct for pain management in pediatric spinal deformity surgery. It has not been studied in early onset scoliosis (EOS) surgical patients. This study represents our 25-year experience with IM in EOS and growing rod surgery. **Materials and Methods** Our prospective Pediatric Orthopaedic Spinae Database (1992-2018) was reviewed to identify EOS patients undergoing distraction-based growing rod surgery who received (IM) or did not receive IM (non-IM). We assessed age, gender, diagnoses, surgical time, pediatric intensive care unit (PICU) admission, and IM complications (respiratory depression, pruritus, nausea/ vomiting). We also assessed start time for opioids following surgery and pain scores.

Results There were 97 patients (171 procedures) who met inclusion criteria: 26 IM patients (43 procedures) and 71 non-IM patients (128 procedures). We only included data from initial insertion and final fusions. IM was not used for lengthening procedures, short procedures (< 3 hours), respiratory concerns, paraplegia, unsuccessful access to intrathecal space, and anesthesiologist decision. There were 2 patients with IM that had mild respiratory depression following initial insertion but did not require PICU admission. An IM patient at final fusion had respiratory depression and required PICU admission. There was no difference between pruritus and

nausea / vomiting at final fusion. The first dose of opioids occurred at a mean of 11.3 hrs post-operatively in IM group vs 2 hrs in the non-IM group for both procedures ($p=0.001$). Pain scores were significantly lower in the IM groups in the Post Anesthesia Care Unit ($p=0.001$).

Conclusions Pre-incision IM is a safe and effective adjunct of pain management for EOS patients undergoing growing rod insertion and final fusion.

Friday 05/04/2019

Spine 2

OP-071 / 07:35

Treatment of early onset spinal deformities with magnetically controlled growing rods: a single centre experience of 30 cases

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Level IV

Introduction and Objective The treatment of early onset scoliosis (EOS) continues to be a major challenge, even when using motorized growth-friendly implants. We report on 30 cases operated with magnetically controlled growing rods (MCGR) at our institution, analysing radiological parameters and complications.

Materials and Methods Consecutive case series of 30 EOS patients undergoing MCGR treatment at a single institution. The nature and effects of complications were recorded for all patients. Radiographic evaluations including changes in main coronal Cobb angle before and after MCGR insertion, and at latest follow-up, as well as changes in T1-T12 and T1-S1 distances were performed for patients with a minimum follow-up of 2 years. Separate analyses were carried out for patients who were previously treated with non-motorised growth-friendly implants.

Results There were 12 documented complications in 11/30 (37%) patients leading to a total of 13 unplanned returns to the operating room. 18/30 patients had a minimum follow-up of 2 years. Average main coronal Cobb angle before MCGR implantation was $66^\circ \pm 21^\circ$ (range, 27° – 121°), changing to $45^\circ \pm 15^\circ$ (range, 13° – 79°) after MCGR implantation, and $52 \pm 15^\circ$ (range, 30 – 82°) at latest follow-up. There was a relevant increase in both, T1-T12 ($+1.4 \pm 1.1$ cm) and T1-S1 ($+2.7 \pm 1.6$ cm) distance with MCGR implantation with a trend towards smaller increases of the T1-S1 distance during treatment. Deformity correction and gain in spinal length was significantly less in patients with previous growth-friendly treatment compared to patients without previous spine surgery.

Conclusions Despite improved patient's comfort, MCGR show a considerable complication rate. The deformities can be well controlled, but diminished implant lengthening is already apparent within two years after MCGR implantation.

Friday 05/04/2019

Spine 2

OP-072 / 07:40

Surgical and health related quality of life outcomes of growing rod graduates for severe versus moderate early-onset scoliosis

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Level III

Introduction and Objective Severe early-onset scoliosis (EOS) represents a challenge. We aimed to describe outcomes at the end of growing rod treatment in severe EOS as compared with moderate EOS.

Materials and Methods Review of an EOS database identified 41 children with severe EOS (major curve $\geq 90^\circ$) who were treated with growing rods before the age of 10 years (mean 5.5 years) and had completed treatment (minimum 2-year follow-up after last lengthening or final fusion, mean follow-up 9.8 years). From the same registry, 41 age, gender, type of EOS, and number of lengthening matched patients with moderate EOS (major curve $< 90^\circ$) were identified (mean follow-up 8.0 years). Twenty-eight (68%) patients in the severe EOS and 12 (29%) in the moderate group underwent final fusion during follow-up ($p=0.0010$).

Results Mean major curve was 102° preoperatively in severe and 64° in moderate group ($p < 0.001$) and was corrected to a mean of 56° in the severe and 36° in the moderate group ($p < 0.001$) at final follow-up. 14 (34%) children in the severe and thirty-three (80%) in the moderate group had a scoliosis of less than 45° at final follow-up (RR 0.43, 95%CI 0.20 – 0.56, $p < 0.001$). At FFU 30 (73%) children in severe and 36 (87%) in moderate group had achieved a T1-T12 length ≥ 18 cm (RR 0.83, 95%CI 0.67 – 1.04). 36 children (88%) in the severe and 27 (66%) in the moderate group presented with at least one complication (RR 1.33, 95%CI 1.04–1.71). The mean scores of early onset scoliosis item-24 questionnaire were similar in the two groups at final follow-up. The highest score of the domains was for pulmonary function in both groups (94.4 for severe vs 86.5 for moderate, $p=0.056$).

Conclusions Delaying surgery beyond 90° scoliosis results in larger residual deformity and more complications than treating it at lesser curve magnitude.

Friday 05/04/2019

Spine 2

OP-073 / 07:55

The titanium-made growth guidance technique for early-onset scoliosis at minimum 2-year follow-up: a prospective multicenter study

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Level III

Introduction and Objective The management of early-onset scoliosis (EOS) remains a serious challenge in pediatric orthopedics. The growth-guidance system (GGS) is one of the surgical options that allows continuous growth along a rod, averting the need for repeated operative lengthenings. The objective of this study was to evaluate the outcomes of the growth-guidance system in the treatment of EOS.

Materials and Methods A prospective study, including 81 patients from 4 departments treated with this method from 2013 to 2015, was conducted with a minimum follow-up period of 24 months. The follow-up data of 57 patients was available, thus the drop-out rate was 29.63%. There were 44 girls with a mean age of 10.03 years and 13 boys with a mean age of 8.04 years.

Results The mean preoperative Cobb angle was 65.3 degrees (36-139) was corrected to 23.7 degrees (2-94), and at the end of the two-year follow-up increased to 30.7 degrees (8-93). The predominant proximal Level of instrumentation was T5 and the distal was L1. The combined length of T1-T12 and T12-S1 increased on average by 33.19 mm in 24 months. The overall rate of serious complications was 43.86%. The most prevalent device-related complications were: the dislodgement of top screws because of the short length of the rod (14 cases), the implant failure (11 cases), and loss of correction in 9 cases.

Conclusions The results show that the growth-guidance system used in this study allows for a good and stable correction while preserving the spine's ability to grow in at least 2-year

follow-up. The complication rate is acceptable and comparable with other growth-friendly techniques. To date, this is the largest successful study on the use of titanium-made growth-guidance systems.

Friday 05/04/2019

Spine 2

OP-074 / 08:00

Results of surgical treatment of AIS Lenke 1 using MIS and standard open approaches

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Level II

Introduction and Objective The main task of modern surgery AIS is the desire to minimize invasion. The aim is to compare classical dorsal AIS correction with minimally invasive one.

Materials and Methods 65 dorsal correction of AIS using pedicle screws were used as study materials. Patients were divided into 2 groups. The group 1 - 39 patients (35 female & 4 male) who were operated from open access. The group 2 - 26 patients (22 female & 4 male) who were corrected using the MIS concept. Patient selection criteria were AIS Lenke 1 (a,b,c), dextral curve, Cobb angle up to 80°. The angle of curve, kyphosis and lordosis parameters before and after surgery, correction and derotation values, blood loss, duration of manipulation and period of hospitalization were evaluated.

Results The period of observation is from 6 years to 6 months. The average deformity in the 1st group was 56.1°±13.9; in the 2nd - 53.9°±12.9. The angle after operation in the 1st group was 6,9°±5,1; in the 2nd - 8,5°±6,0. The percent of correction was in 1st group 88.5±7.6, in the 2nd group - 84.6±8.7. The kyphosis and lordosis in the 1st group were amounted to 14.2°±9.8 and 44.8°± 8.7 before and 18.4°±4.6 and 45,5°±8,7 after surgery; in the 2nd group, the indexes before surgery were 20.3°±10.5 and 55.6°±9.3, after - 13.9°±5.7 and 45.2°± 7.9. The derotation in the 1st group was 41.2%±14.1, in the 2nd group - 35.2%±12.4. The blood loss in ml was 564.3±242.7 in the 1st group and 246.3±121.7 in the 2nd group. Timing of surgery in minutes was 266.6±64.2 in the 1st group and 399.8 ± 56.3 in the 2nd group. The number of hospital days after surgery was 11.2±1.4 in the 1st group and 6.7±1.7 in the 2nd group.

Conclusions With equal correction of deformations in all areas, when using MIS-access, blood loss is significantly reduced, patients are dismissed earlier, but the timing of surgery is increased.

Friday 05/04/2019

Spine 2

OP-075 / 08:05

Metal ion release in children having spinal fusion for scoliosis

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Level II

Introduction and Objective Raised metal ion levels are reported following instrumented spinal fusion in adolescent idiopathic scoliosis. This study compared 5 different systems.

Materials and Methods Titanium, cobalt and chromium levels were measured in 57 paediatric patients undergoing posterior instrumentation for scoliosis/kyphosis. Five different constructs were compared: 1) URS (titanium screws and rods); 2) Expedium (titanium screws and CoCr rods); 3) Expedium Verse (titanium screws with CoCr saddles and cobalt chrome/titanium rods), 4) K2M (titanium screws and Ti/CoCr rail system) and 5) Response (titanium screws and CoCr/titanium rods). Specimens were analysed using high-resolution inductively coupled plasma mass spectrometry.

Results An immediate post-operative rise in serum titanium (all implants) was observed and remained elevated in all systems. Titanium levels rose rapidly between the first post-operative day and 30 days post-operatively. By 30 days, the titanium levels were higher in patients with CoCr rods (median=3.09 ppb) compared to Ti rods (median=1.94), but reduced to similar raised levels at 2 years. Cobalt levels in patients with CoCr rods were raised by 24 hours, peaked at 30 days (median 1.69 ppb) and reduced to baseline by 2 years. Cobalt levels in patients with titanium rods were lower but also peaked at 30 days (median=0.43). Chromium levels peaked earlier at the immediate post-op sampling for both rod groups and by 2 years reduced to below pre-op levels.

Conclusions Titanium levels remain raised in all 5 systems tested, with similar long-term levels irrespective of the type of implant. Cobalt and Chromium levels generally reduced to baseline by 2 years. The long-term clinical effect of raised titanium in scoliosis patients remains unknown.

Friday 05/04/2019

Spine 3

OP-076 / 08:20

The effect of providence night-time bracing in treatment of adolescent idiopathic scoliosis

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Level II

Introduction and Objective Since 2006 the Providence Night time Brace, has been used for conservative treatment of scoliosis. Previous studies comparing the outcome after full time bracing and Night time bracing, has reported comparable outcome with curves < 35°. No previous studies have reported, the effect of treatment in curves > 35°. The aim of this study was to report the outcome after treatment in a cohort of AIS patients, with curves between 20-45°.

Materials and Methods 124 patients with Adolescent idiopathic scoliosis were included in this study, diagnosed with Cobb > 20°, a remaining growth potential and no previous scoliosis treatment. Providence Night time treatment, 8 hours nightly, was initiated with a in brace correction > 70%. Treatment was continued until 2 years post menarchal for the females, and until 6 months growth arrest in boys. The patients were evaluated by standing radiographs during treatment, 6 and 12 months after termination. To investigate the effect, of treatment according to the severity of the curve the patient were divided into groups, according to the initial Cobb before treatment.

Results 124 patients were included in this study and 80 patients terminated brace treatment and follow up. The mean in-brace correction was 83%, and curve progression was observed in 9 patients. Brace treatment was successful in 88.7% of patients, also in patients with curves > 35° when treatment was initiated. 5% of the patients were referred to surgical treatment due to progression.

Conclusions Providence night time braces are effective, as a treatment in adolescent idiopathic scoliosis patients. Also, in patients with Cobb > 35° before treatment. This study reports a success rate of 88.7 % after treatment which is comparable to fulltime treatment with Boston braces.

Friday 05/04/2019

Spine 3

OP-077 / 08:25

Effectiveness of bracing alone in idiopathic EOS

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Level IV

Introduction and Objective Scoliosis before 6 years of age are usually managed with serial casting to reduce the curve then thoraco lumbar brace to maintain the reduction. Our strategy was to use only bracing, without preliminary serial casting. The goal of this study was to analyse the results of this strategy.

Materials and Methods We retrospectively reviewed the data of all children who had been treated for idiopathic scoliosis diagnosed before the age of 6 years with CTM brace, between 1999 and 2015 at a single institution. The minimal follow-up was 18 months. Secondary scoliosis were excluded. Daily brace time was 22 hours, decreased to 12h in case of satisfactory correction without progression. Bracing was interrupted when the spine was balanced and the curve showed no progression at 6 month interval. Bracing time, Cobb angle and rib vertebra angle difference (RVAD) were recorded.

Results Forty six patients were included (27 girls and 19 boys). Mean age at diagnosis was 35 months (9-71). Cobb angle at onset of treatment was 35° (13-70) and RVAD was 20.5° (0-60). Forty patients had a satisfactory result. Mean age at diagnosis was 35 months (9-71), RVAD was 18° (0-55). Cobb angle at the onset of treatment was 32° (13-60) and 27° (0-60) at latest follow-up. Mean full time bracing was 25.2 months (4-42) and half time 18.5 months (0-72). Mean follow-up after bracing was 47 months (0-145).

In 6 patients scoliosis progressed despite bracing. Five were managed with serial casting and 1 with a Milwaukee brace.

Conclusions Bracing alone is an alternative to serial casting for idiopathic EOS. It provides in most cases satisfactory correction which allows treatment interruption before skeletal maturity. In case of failure serial casting can be performed.

Friday 05/04/2019

Spine 3

OP-078 / 08:30

Concomitant low-grade isthmic L5-spondylolisthesis (SP) does not affect the course of adolescent idiopathic scoliosis (AIS)

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Level III

Introduction and Objective The literature on concomitant SP in AIS is scarce. Purpose of this study is to investigate if SP affects the course of AIS.

Materials and Methods At the authors' institution, 1531 consecutive patients with AIS, mean age 13.9 (1.8) yrs, had standing pa and lateral whole spine radiographs, mean primary curve 29.2 (11.5)°. Of them, 120 (7.8%) had SP, mean slip 15.0 (8.3)% (Study group=S). A paired control group, matched for age, gender, Cobb angle, apex Level and sidedness of the primary curve, was created. For 2 patients, no adequate pair was found (Control group=C, n=118). The analysis is based on radiographs and clinical records, mean follow-up 4.4 (4.3) yrs. The National Hospital Registry was checked for surgical treatment later or elsewhere, mean follow-up 25.4 (2.8) yrs. All radiographic measurements were performed by one spinal radiologist. X²statistics and t-tests were applied to calculate statistical differences in distributions between S and

C. Statistically significant threshold was accepted at P<0.05, two-tailed.

Results At diagnosis, there was no significant difference between the patients of S and patients with AIS only (n=1411) in age (13.9y/13.8y), gender (86.9%/83.3% female), Cobb angle (29.2°/28.9°), and curve type (Th:67.5%/62.1%; Th-l:25.0%/25.0%; L:7.5%/13,0%). In comparison between the matched groups (S/C), no significant difference was found. Bracing for scoliosis: initiated in 41.6%/43.2%, progression > 5° in 20.8%/11.8% of braced patients. Back pain interfering with daily activities: at admission 4.2%/1.7%, at follow-up 2.6% /4.2%. Surgery for Scoliosis: 9.2%/10.2%. 12/120(10%) patients had fusion for spondylolisthesis.

Conclusions In a consecutive series of 1531 teenagers with AIS, 120 (7.8%) had concomitant low-grade L5-slip. Compared to a matched control group, spondylolisthesis did not influence the clinical or radiographic course of AIS.

Friday 05/04/2019

Spine 3

OP-079 / 08:45

Comparison of sublaminar bands and all-pedicle screw instrumentation for the correction of Lenke 1 and 2 adolescent idiopathic scoliosis

Sébastien Pesenti*¹; Renaud Lafage²; Brice Henry¹; Colleen Wixted²; Manon Bolzinger¹; Han Jo Kim²; Tejbir Panu²; Matthew Cunningham²; Elie Choufani¹; Virginie Lafage²; John Blanco²; Jean Luc Jouve¹; Roger Widmann²

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Level III

Introduction and Objective AIS is a 3D deformity with coronal deviation being associated with changes in thoracic kyphosis (TK). While sublaminar bands (SBand) may better restore TK, comparison to pedicle screws (Pscrow) has never been conducted. We aimed to compare radiographic outcomes of SBand and PScrow used in AIS corrective surgery

Materials and Methods Lenke 1-2 AIS patients treated with SBand or PScrow were included. Baseline, immediate post-operative and 2-year (2Y) data were studied. After matching based on preoperative coronal Cobb angles and sagittal alignment, postoperative alignment was compared between PScrow and SBand groups. A sub-analysis was conducted with stratification by preoperative TK (<20°, 20-40°, >40°)

Results 151 patients were included (mean 15yrs). After matching, 90 patients remained for analysis. PScrow had a larger Cobb angle correction (PScrow 56° to 17°; SBand 56° to 20°, p=0.002); SBand showed a loss of Cobb correction at 2Y (20° to 24°, p<0.001). The 2Y overall correction of PScrow was larger than SBand (67% vs 57%, p<0.01). PScrow induced flattening of TK (26° to 18° and 21° at post-op and 2Y, all p<0.01), while TK increased in SBand (26° to 28° and 35° at post-op and 2Y). For TK<20°, SBand achieved greater TK

increase than PScrew (10° vs. 1°); for TK 20-40°, PScrew had a loss of TK compared to SBand (-10° vs. no change).

Conclusions This study demonstrates that PScrew and SBand have different advantages. PScrew can correct hyperkyphosis and maintain Cobb correction with a minimal loss at 2Y. SBand can restore sagittal alignment while providing acceptable coronal correction. These findings are important as we further understand the long-term implications of sagittal plane correction in AIS patients. However, further technique-related parameters need to be investigated to better understand correction mechanisms.

Friday 05/04/2019

Spine 3

OP-080 / 08:50

Pelvic screw fixation maintains lumbar lordosis in growing rod constructs better than S hooks

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Level III

Introduction and Objective There is little comparative data on how different types of pelvic fixation in growing rod constructs maintain or improve lumbar lordosis (avoid lumbar kyphosis) for optimal sagittal alignment.

Materials and Methods Early onset scoliosis (EOS) patients of all diagnoses with distraction-based implants with pelvic fixation from 2000 to 2013 were reviewed from two EOS multicenter databases. Patients were divided into two groups by type of pelvic fixation (1) screws (sacral-alar-iliac (SAI) screws or iliac screws) 2) S hooks. Exclusion criteria were an index instrumentation ≥ 10 years old and follow up < 2 years. Lumbar lordosis was measured preoperatively, postoperatively, and at final follow up (prior to fusion or change in pelvic fixation type). An increase in lordosis was recorded as a positive value, a loss of lordosis (gaining kyphosis) was recorded as a negative value.

Results 129 patients met inclusion criteria. Mean age at index surgery was 6.1 years (range 1.0-9.9 years) and mean follow up was 4.9 years. Pelvic fixation in the 129 patients was: screw=38 (SAI=11, Iliac=27) and S hook=91. After index surgery lumbar lordosis increased in the screw group ($5.9^\circ \pm 27.2$), while it decreased in the S hook ($-5.8^\circ \pm 22.4$)

($p=0.019$) group. There was also an increase in lumbar lordosis in the screw group ($0.9^\circ \pm 30.0$) and decrease in the S hook group ($-11.3^\circ \pm 24.1$) from preoperative to final follow up ($p=0.041$). At final follow up, there were 4 patients in the S hook group and no patients in the screw group that had lumbar kyphosis of $\geq 10^\circ$.

Conclusions Distraction based growing spine constructs anchored with screws were superior to S hooks in the maintenance of lumbar lordosis.

Friday 05/04/2019

Spine 3

OP-081 / 08:55

Are postoperative standing radiographs necessary before hospital discharge in adolescent idiopathic scoliosis?

Simon Tournemine¹; Audrey Angelliaume*¹; Anne-Laure Simon¹; Christophe Vidal¹; Keyvan Mazda¹; Brice Ilharborde¹

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Level II

Introduction and Objective Standing radiographs are usually performed before hospital discharge (before day 6) after posterior fusion for AIS. However, patients are often still painful and have not recovered yet their physiological balance. The aim of this study was to evaluate the relevance of such early radiographs and more specifically investigate if postoperative alignment could be analysed, and if the verification of implants locations affected surgical decisions.

Materials and Methods All consecutive AIS patients operated between January 2015 and January 2016 were included. All patients underwent biplanar stereoradiographs before discharge, at 4 months postoperative and at last follow-up (minimum 2-year). 15 parameters (8 coronal and 7 sagittal), reflecting correction and spinal alignment were measured and compared. The incidence of implants misplacement was recorded.

Results 87 patients were included. A significant difference was found for 13 out of the 15 parameters between the first erect radiograph and the 4-month follow-up visit, including the central sacral vertical line and the sagittal vertical axis, which are commonly used to assess postoperative alignment. Both clavicle and last instrumented vertebra frontal tilts were also significantly different at 4 months. In opposition, no significant change occurred for the main parameters between the 4-month visit and latest follow-up. In 4 cases, 1 pedicle screw was considered misplaced on the first radiograph, but all patients remained asymptomatic and no revision surgery was performed.

Conclusions Having standing postoperative radiographs is pleasant for patients and physicians after AIS surgery, but these radiographs do not reflect the final spinal alignment and do not affect surgical decisions. They seem to be unnecessary if an intraoperative control has already been performed.

Friday 05/04/2019

Infection

OP-082 / 09:10

Is *Kingella Kingae* today's primary cause of pediatric osteoarticular infections? A 20-year epidemiological follow-up study in Western Switzerland

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Level III

Introduction and Objective Acute pediatric osteoarticular infection (OAI) require a sensitive diagnosis for treating adequately the causative pathogen. This study aimed to contrast the bacteriological epidemiology of OAIs over two decades, using two patient groups, before and after the extensive use of nucleic acid amplification assays (NAAs) in diagnostic processes.

Materials and Methods The epidemiological data and bacteriological etiology of all children with an OAI admitted to our institution over a 20-year period (1997–2016) were assessed retrospectively. The population was divided into two cohorts, using the start of regular use of PCR (2007) as a convenient dividing point. The *conventional* cohort included children with an OAI who were mainly investigated using classic culture methods; the *molecular* cohort investigated patients who were also tested using molecular assays.

Results *Kingella kingae* has become the dominant pathogen isolated in cases of OAI. It was responsible for 51% of cases; other typical pathogens were responsible for 39.7% of cases in the *molecular* cohort. A statistically significant rise in the mean incidence was observed, as was a decrease in the mean age for a diagnosis of OAI after 2007. However, 21.6% of OAIs in our pediatric population remained of unknown origin.

Conclusions By detecting fastidious pathogens, the extensive use of NAAs has increased the identification rate of OAIs, especially in children aged from 6–48 months old. We propose that PCR assays be incorporated into modern diagnostic algorithms for OAIs. Further studies are needed to reveal the bacteriological etiologies of OAIs due to unknown pathogens.

Friday 05/04/2019

Infection

OP-083 / 09:15

Arthroscopic lavage for the treatment of septic arthritis of the hip in children

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Level IV

Introduction and Objective Arthroscopic treatment of septic arthritis of the hip in the paediatric population is still not an established technique despite its minimally invasive nature and low morbidity. The goal of this study is to present the results of arthroscopic drainage and lavage together with a short course of antibiotics administration for the treatment of septic arthritis of the hip in children over the age of 5 years.

Materials and Methods Kocher's criteria together with CRP levels were used to calculate the predicted probability of septic arthritis. Children with 2 Kocher predictors or more, and with CRP levels >20 mg/L underwent joint aspiration with fluoroscopy in the operating theatre. White cell count with differential, gram stain and cultures were obtained. 3 portal arthroscopic technique was used for drainage and irrigation in eight children with septic coxitis. Continuous intra-articular irrigation was not performed, nor were decompression drains used. The children were treated with intravenous antibiotics for 4–5 days, followed by oral antibiotics. The children were followed weekly. Antibiotic treatment was stopped when CRP levels were <20 mg/L. All children were followed clinically and radiologically for 24 months.

Results *Staphylococcus Aureus* was the infecting organism in all cases. All patients had a rapid recovery; they all had excellent clinical and radiological results. All of them had a full range of motion of the affected hip. No complications occurred in this group of children.

Conclusions 3 directional arthroscopic surgery combined with large volume irrigation and a short course of antibiotics administration appeared as an effective treatment modality in cases of septic arthritis of the hip in children older than 5 years. It is less invasive than arthrotomy, and offers low post surgical morbidity.

Friday 05/04/2019

Infection

OP-084 / 09:20

When must we operate on septic arthritis of the hip joint?

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Level IV

Introduction and Objective Septic arthritis of the hip joint (SAHJ) is usually treated with arthrotomy and drainage, associated with drain problems, scarring and joint instability. Repeated aspirations of the hip joint in children with SAHJ, are used successfully and became the standard of care in Israel. In the recent years, several children did not respond to the treatment as expected and underwent hip joint arthrotomies.

The aim of this research was to identify the characteristics of the operated group.

Materials and Methods We conducted a retrospective analysis of the children who were diagnosed with SAHJ and treated with repeated aspirations, at the Sheba Medical Center, between 2005-2017. We divided the patients into 2 groups: children who responded to this method and children who did not improve clinically and required an arthrotomy. The data was extracted from the children's' charts.

Results We have identified 64 patients with complete data; 58 children (90.63%) were treated successfully with repeated aspirations and 6 children (9.37%) did not improve and were treated surgically. Five out of 58 children from the control group (8.6%) and 5 out of 6 from the arthrotomy group (83.3%) had chronic comorbidities ($p=0.0002$). The patients who responded to aspiration had 1.3 days of fever compared to 5.3 days in the operated group ($p=0.0101$). The Level in C-Reactive Protein (CRP) before and after the first aspiration decreased by 12.2 mg/l in the aspirated group and increased by 73.7mg/l in the operated group ($p=0.0015$).

Conclusions Children with SAHJ respond well to treatment with repeated aspirations of the joint, which is both safe and effective. Patients who have more chronic comorbidities, have more days of fever, and show an increase of CRP after the first aspiration are more likely to require a hip arthrotomy.

Friday 05/04/2019

Best of the Best

OP-085 / 09:35

Incidence of cancer and infertility, in AIS patients treated 25 years prior

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Level III

Introduction and Objective AIS patients are exposed to repeated x-rays during treatment for AIS. Even with reduced radiation, the cumulative radiation is a concern. Previous studies from Ronckers et al. has reported an increased rate of cancer related mortality, in AIS patients.

Materials and Methods 219 consecutive AIS patients treated from 1983-1990 were requested to return for clinical examination. The incidence of cancer was determined through chart review and clinical examinations. The subjects and 100 controls were queried regarding infertility, age at first pregnancy and spontaneous abortions. Using mAs, kV and number of x-rays, a radiation physicist estimated the total radiation dose received by the patients.

Results 159 patients participated in the study. Medical charts were available in 209 patients. Radiation information was available in 211 patients. The total radiation exposure was 2,4-5,6 mSv/year. 9 AIS patients developed cancer, 3 breast

and 4 endometrial. The Incidence of cancer in this cohort was 17 times greater, than the age-matched incidence. The rate of breast cancer was higher than the age-matched population, but the rate of endometrial cancers were significantly increased compared to the age-matched population. Infertility and spontaneous abortion rates in AIS patients were comparable to age-matched controls. There seem to be a correlation between BMI at first radiograph and the risk of developing cancer, later in life.

Conclusions The patients received a radiation dose during their treatment period, which is comparable to the radiation received during treatment with new equipment. The rate of cancer in this cohort is high, and we are the first to report an increased rate of endometrial cancers. Awareness should be made to reduce the cumulative radiation dose, during treatment.

Friday 05/04/2019

Best of the Best

OP-086 / 09:40

Setting priorities in research for the orthopaedic management of lower limb conditions in the paediatric population - a James Lind Alliance research priority setting partnership

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Level I

Introduction and Objective To identify and prioritise research questions concerning the orthopaedic treatment of lower limb conditions in children by engaging parents, children and clinicians.

Materials and Methods A national study involving a multi-disciplinary team, with collaboration from the James Lind Alliance group. Electronic surveys were distributed to organisations representing patients with lower limb orthopaedic conditions, and health professionals involved in the management of these conditions. Participants were asked to submit research questions they considered important. A literature search on all questions followed, to ensure that the question had not been answered in the evidence published by the National Institute for Health and Care Excellence (NICE), the Cochrane Library, randomised control trials or a systematic review. A question

was confirmed a 'true uncertainty' if it could not be answered using the above search method. True uncertainties were reduced, condensed and amalgamated using an iterative process and further prioritised using a second online survey, whereby respondents were asked to rank their top 10 preferences as research priorities.

Results 389 individuals generated 1023 questions in a process that took 16 months to complete. 801 questions were classified as true uncertainties. The James Lind Alliance process then produced an interim top 25 and a final top 10 research priorities, which included general questions, in addition to the most important questions pertaining to cerebral palsy, hip dysplasia, Perthes' disease and SCFE.

Conclusions We provide a systematic and transparent process to identify the top 10 research priorities in paediatric orthopaedics. This allows surgeons, academics and research funding bodies to unite and address key uncertainties in paediatric orthopaedics.

Friday 05/04/2019

Best of the Best

OP-087 / 09:45

Investigation of the stress-strain state of the foot model before and after surgical treatment by different methods

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Level III

Introduction and Objective To compare the stress-strain state of the bone elements of the foot in normal, and with flatfoot deformity after surgery using a variety of methods.

Materials and Methods To solve this problem, a finite-element model of the normal and flatfoot were constructed. Identified 12 points on the foot, which determined changes.

Results In normal foot is determined that the intensity of stress in all bony elements of the foot from 0.1 to 1.7 MPa, flatfoot - 4.9 MPa to 7.2 MPa and on surfaces of the talo-calcaneal joint to 6.9 MPa, and on the postero-lateral surface of the talus bone the highest stress concentration is from 1.0 MPa to 13.5 MPa. Flatfoot model: in the calcaneus, from 4.2 MPa in flatfoot deformity to 8.0 MPa in the case of arthroereisis with a conical implant and to 7.1 MPa with a cylindrical implant. In arthrorisis using correction screw has the highest maximum voltage 4.2 to 9.1 in the case of setting the screw in the heel bone. Method of calcaneus osteotomy: corrective calcaneus-cuboid arthrodesis with use of wedge - shape graft, there is a zone of increased stress around the tuberosity of the calcaneus - from 7.2 to 7.9. In other checkpoints, the stress Level of this model same like with osteotomy of the calcaneus.

Conclusions Increase and redistribution of stresses in bone and cartilage elements of the flatfoot deformity can be the

starting mechanism of development of instability ankle joint and arthritic phenomena in the joints of the foot. All options of surgical correction of flatfoot deformity lead to the normalization of stress-strain state, but the best is the option of using corrective osteotomy of the calcaneus, due to a more uniform stress distribution in the bone elements of the model of the foot.

Friday 05/04/2019

Best of the Best

OP-088 / 10:00

Is acetabular dysplasia properly interpreted in congenital femoral deficiency? Three-dimensional analysis of pelvis computed tomography

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Level III

Introduction and Objective Proximal femur pathology in patients with Congenital Femoral Deficiency (CFD) is thoroughly described in the literature, while the acetabular morphology and the hemipelvis structure are barely investigated. Thus, the aim of the study was to define morphology of the pelvis as well as acetabulum spatial orientation, of which acquaintance is crucial for the adequate hip surgical correction.

Materials and Methods 3D analyses of 14 CT of children's pelvises with unilateral CFD were compared with 34 pelvises' CT of healthy individuals. Geometric morphometrics was used to analyse shape and size differences in the pelvis (procrustes ANOVA). Association between pelvis shape directional asymmetry and classification of CFD (Aitken, Paley, Pappas) was analysed. The dysplastic acetabulum orientation was compared with the opposite side and with healthy individuals (paired t-test). Variability of acetabulum orientation in different types of CFD was checked (bivariate correlation).

Results The hemipelvis with CFD is characterised by smaller acetabulum, more bent outside ischium and less upright ilium. Multivariate regressions revealed the greater Level of directional asymmetry in more severe types of CFD (mostly in the shape of acetabulum and bending of the ischium). The assessment of acetabulum orientation shows significant changes in anteversion ($1.3^\circ \pm 16.3^\circ$), inclination ($80.4^\circ \pm 11.9^\circ$) and tilt ($126.6^\circ \pm 96.5^\circ$) in CFD. Retroversion and steepness increase remarkably with severity of the disease.

Conclusions The affected side of the pelvis is remarkably smaller and more deformed in the CFD, what has to be considered while lengthening the leg. The acetabulum in CFD presents significant dysplasia with its severe retroversion and

steepness, what challenges validity of classic transiliac osteotomy in patients with CFD.

Friday 05/04/2019

Best of the Best

OP-089 / 10:05

Development of a risk prediction model for developmental dysplasia of the hip in at-risk newborns

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Level I

Introduction and Objective Widely-accepted risk factors exist to identify newborns *at-risk* for DDH. While benign hip instability will resolve spontaneously, DDH should be detected within 6-8 weeks postpartum to enable successful splinting. We wanted to determine in *at-risk* newborns how perinatal risk factors can be best utilized to predict DDH within 8 weeks post-partum.

Materials and Methods We prospectively ascertained the presence of 10 widely-accepted risk factors for DDH by examining 13,276 newborns at a median age of 1 day. Those with at least 1 risk factor were included. They underwent hip ultrasonography at a median age of 8 weeks to determine the presence/absence of DDH. Variables were collected in standardized fashion. Outcome assessors were blinded. We used logistic regression to develop the model.

Results We followed 1,945 of 2,192 (89%) of eligible newborns and found 77 (3.9%) cases of DDH at 8 weeks. Of 9 candidate predictors with sufficient high prevalence, 4 resulted in the model: female sex (OR=5.6; 95% CI: 2.9-10.9; $P<0.001$); family history of DDH (4.5; 95% CI: 2.3-9.0; $P<0.001$), birth weight >4000g (1.6; 95% CI: 0.6-4.2; $P=0.34$) and abnormal examination of hip (58.8; 95% CI: 31.9, 108.5; $P<0.001$). This model demonstrated excellent discrimination (C statistic=0.9; 95% CI: 0.8-0.9) and calibration of observed and predicted risk ($P=0.35$).

Conclusions We developed and internally validated a new risk prediction model. It can be used as a tool to quantify in at-risk newborns an individual's absolute predicted risk of DDH within 8 weeks postpartum. The tool is based on clinical variables that are available at bedside at the point of childbirth. Understanding the predicted risk will aid the counselling of mothers of at-risk newborns, and has the potential to refine existing triage and follow-up pathways.

Friday 05/04/2019

Best of the Best

OP-090 / 10:10

Clubfoot assessment of correction and recurrence: are we speaking the same language?

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Level III

Introduction and Objective The Ponseti method of clubfoot correction is the "gold standard". A variety of methods assessing severity at presentation have been reported. Classification later in the treatment course is more challenging. Reporting standards vary widely with often a complete absence of definition of the corrected or relapsed foot. This study aims to determine how clubfoot is assessed at presentation, correction and at relapse.

Materials and Methods A systematic review was performed according to PRISMA guidelines. Studies reporting idiopathic clubfoot treated by the Ponseti method (1/1/2012-31/12/2016) were included. Data extracted included demographics, Ponseti methodology, assessment methods and relapse rates. Four distinct assessment time points were nominated (initial assessment, after correction, in brace and at relapse). Assessment methodologies were grouped into five categories (Pirani, Dimeglio, Functional, Qualitative, 'Other'). **Results** 84 studies were included (7,335 patients, 10,535 clubfeet). There was high variability in methods used across time points. 80% of studies reported use of any assessment method at presentation and only 57% gave a relapse definition. At every time point, Pirani scoring was the most frequently used despite not being validated for post-treatment use. Later in treatment, a variety of functional and qualitative methods became more frequently used. When reported, relapse rate varied from 1.9-53.9%.

Conclusions The literature demonstrates significant variability in terms of clubfoot assessment and how outcomes are reported as demonstrated by broad reported rates of recurrence and surgical intervention. The development of a repeatable, validated core outcome set on the definition of clubfoot at birth, at correction and at relapse is essential to allow comparison and improve management outcomes.

Friday 05/04/2019

EPOS STUDY GROUP: CEREBRAL PALSY AND SPINAL DEFORMITIES

Chairpersons: Reinald Brunner, Switzerland and Carol Hasler, Switzerland

Room: Grand Ballroom A

OP-091 / 14:30

Introduction

Reinald Brunner¹

¹Orthopaedic Department, Children's Hospital, University of Basel, Basel, Switzerland

OP-092 / 14:32

Natural history of spinal deformities in cerebral palsy

Reinald Brunner¹

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Purpose Deformities of the spine present a frequent problem in patients with cerebral palsy. Etiology and natural history will be described as a basis for discussions on management.

Methods A literature research (PubMed, Cochrane, Google Scholar) was carried out. Based on this information and the personal experience of the author, natural history and etiology are described.

Results The literature is relatively scarce on this issue. The risk for development a scoliosis in cerebral palsy patients increases with increasing GMFCS Level and reaches 60-70%. The deformity starts in middle childhood, increases rapidly especially during puberty, and continues during adulthood. The deformity is first grossly mobile and later becomes rigid. It is mainly the whole body involved child which is at risk. Patients with GMFCS I and II seem to have the same incidence as neurologically normal individuals which may suggest a non-neurologic etiology. While the natural history is well described, etiology is more unclear. The cause is seen in the combination of weakness, poor posture control, and a deficit of motor control. Cerebral palsy is usually seen as a motor disorder, and scoliosis is often attributed to spasticity and asymmetrical muscle tone as patients with high GMFCS levels also show a high degree of spasticity. However, these patients usually present with high tone in the extremities but low tone in the trunk. Not only the motor but similarly the sensory part is affected, and patients with severe cerebral palsy also have equilibrium problems and thus difficulties to control gravity. As a consequence, they face difficulties to control the mobile spine as a chain of articulated bones in an upright position which leads to increased curves in the frontal and sagittal plane. Most often, the curvature occurs at the thoracolumbar region where the stiffer thorax bends over the more mobile lumbar spine but all shapes including long c-shape deformities can occur. The larger the angle, the greater becomes the lever arm for gravity and the faster progress the curves. The incidence of spinal deformities is thus linked to upright posture what we apply to include the patients in the community. Interestingly this is not the case in India where these patients are usually left lying, and spinal deformities are much less a problem. Apart from this collapsing type of scoliosis spasticity of the spinal muscles can present as a rare cause of spinal deformity. Factors such as oblique pelvic position, restriction of hip flexion, short hamstrings for reduced lumbar lordosis in sitters, and long hamstrings for lumbar hyperlordosis in walkers are known to lead to secondary spinal deformity. Besides this neurological spinal deformity, there exist of course also the other deformities such as congenital or idiopathic types of scoliosis. The latter is more typical for hemiplegic patients (usually GMFCS I and II)

who have a normal equilibrium reaction and more often show the Level of the deformity in the thoracic spine.

OP-093 / 14:47

Neuromuscular scoliosis: Is there a place for conservative treatment?

Uri Givon¹

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Purpose Neuromuscular scoliosis (NMS) is a common problem in patients with cerebral palsy (CP) and other disorders. Conservative treatment methods are used in an attempt to prevent or delay surgery. Evaluation of these methods and technologies is required.

Methods A literature research (PubMed, Cochrane, Google Scholar) was carried out.

Results The literature is relatively scarce on this issue, with less than 10% of the manuscripts discussing conservative therapy. Physical therapy, horseback riding therapy, bracing and seating systems are all common conservative therapy technologies in use today. The data about these technologies is all Level 4 or 5, leading to mostly intuitive care by physicians and therapists. Patients with GMFCS levels of I-II without cognitive challenges may be treated with may be treated by Schroth method, just like able-bodied children. Horseback riding may be used in all GMFCS levels with adequate adaptations. Bracing is used mostly in GMFCS IV-V patients who are wheel-chair users. Most of the methods are considered as temporizing means in order to delay surgery, but since they significantly affect patients' quality of life, should be used after careful evaluation and discussion with the parents and caregivers.

More high-level research is necessary in order to fully evaluate the effectiveness of conservative therapies for NMS.

OP-094 / 14:57

The pelvis - fundament of the spine

Carol Hasler¹

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Purpose The pelvis represents the crucial pivot zone between the trunk and the lower extremities. In walkers the predominant role of the pelvis is to adapt posture in a three-dimensional way, to conserve muscular energy (« cone of economy », Jean Dubousset, Journal Pediatric Orthopedics 2011) and to allow for an unrestraint field of action of the upper extremities. On the other side of the functional scale - in severely disabled non-ambulatory patients - the pelvis, the lumbosacral junction and their interplay with the hip joints need to provide a solid fundament for unsupported sitting and balanced positioning of the head, ideally on the upper extension of the central sacral vertical line.

Methods Based on a literature review (PubMed, Cochrane) and two decades of own surgical experience in the field of

neuromuscular spine deformities during growth, the current anatomic and biomechanic understanding and its practical implication for the clinical and radiographic assessment and surgical strategy is highlighted.

Results The complex mutual relation between the pelvis, the spine and the lower extremities depends on multiple factors which require comprehensive consideration when it comes to non-surgical (seating, wheelchair adaptation, sitting and walking aids) and surgical (positioning of the patient on the OR table, use of traction, lumbosacral fixation, type of fixation, sagittal and coronal balancing etc.) decision-making and choice of strategy: Individual pelvic orientation, particularly pelvic incidence as a given genetically determined value; sacral slope and pelvic tilt; intrapelvic left-right asymmetries; presence of lumbosacral malformations with oblique S1, L5 take off; hip joint contractures; sagittal profile; transverse plane orientation; lumbar scoliosis; hip and knee joint contractures; leg length differences; muscle tone; growth dynamics as well as natural history of the underlying neuromuscular pathology. Meticulous preoperative dynamic and static assessment in the gait laboratory with inclusion of the trunk, whole body imaging (EOS system) and an in-depth discussion with the caregivers and patients about their expectations, the therapeutic options at disposal and their pros and cons is key for a successful treatment.

OP-095 / 15:07

The pelvis - rooftop of the hips

Reinald Brunner¹

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Purpose The position of the pelvis is an important factor to control the spine and its shape. The causes for abnormal pelvic positions are discussed.

Methods Based on personal experience of the author and biomechanical considerations, factors influencing the position of the pelvis and consequences are described.

Results For highly functional individuals a horizontal, non-rotated, and normally inclined pelvis is regarded as optimal precondition to avoid consecutive spinal deformities. Standing and walking on two legs requires equal leg length and adequate control of hip and trunk muscles. At that structural and functional leg length discrepancy may differ and even be inverse. Time spent in abnormal position and importance of the difference are crucial factors leading to deformities above the pelvis. In walking patients, reduced hip muscle control seems to be more important: hip extensor weakness which often occurs after hamstring lengthening for correction of a knee flexion gait, is known to produce pelvic inclination and hyperlordosis. Hip abductor weakness leads to hypermobility of the lumbar spine. However, if function is reduced, the patients spend far more time sitting. Sitting stable requires loading the thighs beside the pelvis and a stable connection between these segments, thus located hips. Severe asymmetric muscle atrophy (post-polio) or hip dislocation lets the pelvis drop to the affected side. Hip pain may lead to a lift of the pelvis on the affected side to reduce load, and similarly does

a restriction of hip flexion. The result is a lateral bent of the spine. Asymmetrically located hips and major asymmetries of the proximal femur thus should be avoided. If both hips are unstable or are even resected like in salvage procedures for dislocated hips in cerebral palsy, the pelvic position becomes unstable and pads need to be added in the seat for trunk control, with a high risk for developing scoliosis at the long-term. Some patients with neurological and neuromuscular diseases develop extremely short hamstrings which pull the pelvis into retroversion which requires a consecutive kyphosis at the lumbar spine to compensate. A stable and well controlled position as close to normal as possible thus is required for functional patients as well as for sitters. Interfering factors need to be identified and addressed when treating spinal deformities.

OP-096 / 15:22

The pelvis - spare it or fuse it?

Dror Ovadia¹

¹Dana Dwek Children's Hospital, Tel Aviv Medical Center, Tel Aviv, Israel

OP-097 / 15:37

Scoliosis and dislocated hip: hip first or spine first?

Elke Viehweger¹

¹Marseille, France

OP-098 / 15:47

Scoliosis and dislocated hip: hip first or spine first?

René Castelein¹

¹UMC Utrecht, Utrecht, Netherlands

Cerebral Palsy in many cases leads to a neuromuscular type of scoliosis, often with pelvic obliquity that may require surgery. Also, in many cases one of the hips will show a tendency to displace and may ultimately dislocate if left untreated. Often, but not in all cases, the hip on the high side of the pelvic obliquity will become the dislocated hip. Over the years, more aggressive soft tissue and bone strategies have evolved to prevent the hips from becoming dislocated, but the presentation of one of these problems, or the described combination of the two, is very variable and individually determined. Whether the child ambulates, or is wheelchair bound obviously plays an important role in the decision-making process. This issue is further complicated because not all dislocated hips will ultimately become symptomatic, and if they do, they may demonstrate various degrees of femoral head deformation, sometimes leaving only salvage procedures like proximal femoral resection as a final option. Spine surgery is meant to result in a Level pelvis, which may make the hip more, but also less symptomatic. In general treatment is determined by the wide variation in clinical presentation. If the child is young, the scoliosis still mild and the hips begin to migrate, the rational is to treat the hips first to keep them located. This may be staged, usually starts with soft tissue procedures and may ultimately require osteotomies of the pelvis and/or proximal femur. At the adolescent age, and there is a scoliosis as well as a dislocated hip,

the symptoms usually give direction to the order of treatment. If both conditions are painless it is best to Level the pelvis first as part of the correction of the scoliosis, and then address the hips based on the remaining complaints. If the child is comfortable and balanced in a wheelchair, it may be best to leave the hips alone, surgery may transform a painless mobile hip into a painful stiff one. If the hip is symptomatic, the degree of deformation of the femoral head determines whether an attempt can be considered to relocate the hip, usually through a combination of soft tissue and bony procedures, or a valgisation osteotomy (Schanz or McHale type osteotomy) can bring relief. In severe cases a proximal femur resection, that should be performed at the Level below the lesser trochanter may be indicated. In all cases great attention should be given to the sagittal balance, patients with stiff hips may need a lumbar kyphosis to obtain adequate sitting balance.

OP-099 / 16:02

The sagittal profile

Brice Ilharreborde¹

¹Robert Debré University Hospital, Paris, France

OP-100 / 16:12

Head control in patients with cerebral palsy

Ana Presedo¹, Anne-Laure Simon¹ and Marie-France Rietz P.T.²

¹Pediatric Orthopedics Department, Robert Debré University Hospital, Paris, France, ²Lycée Toulouse Lautrec Rehabilitation Center, Vaucresson, France

Introduction Postural control is often impaired in patients with CP (cerebral palsy) and is related to the severity of neurological involvement. Many factors can contribute to abnormal trunk and head alignment. Abnormal head posture and upper trunk compensations may be related to visual impairment and ocular motor disorders, present in half of the children with CP. On the other hand, lack of motor control, weakness and abnormal movements related to the neurological lesion contribute to abnormal posture, and compensatory mechanisms may develop. Arthrosis of cervical spine and degenerative myelopathy can result over time. The therapeutic approach of these patients should be the focus to prevent abnormal posture from an early age. Treatment of the complications will involve surgery in most of the cases and should be planned in a multidisciplinary team in order to properly manage adjustments to postoperative changes.

Purpose The goal of this presentation is to update knowledge regarding neck and head control in patients with CP (GMFCS III-V). Also, to discuss prevention and therapeutic options, based on our clinical experience.

Methods A review of recent literature was conducted. The key words "head control and cerebral palsy" were used to search articles into PubMed data base. We selected those articles related to causes of abnormal head and neck control, orthopedic and neurological complications, and therapeutic modalities. Clinical examples are discussed in order to illustrate the different aspects of this pathology, discussed in the literature.

Discussion Abnormal head and neck posture in patients with CP are frequently reported in the literature. Many causes can contribute to this problem, those related to visual impairment can be potentially corrected and thus a complete evaluation is recommended as soon as the diagnosis of CP is done. Other causes cannot be resolved but since they may induce compensatory mechanisms, early therapeutic management should focus on the prevention of secondary problems. The functional Level of CP and the type of tone disorder determine the evolution of pathology and compensatory mechanisms and should be taken into account. We present examples of patients with different degree of involvement and type of abnormal movement, in order to discuss the different modalities of therapeutic management. We believe that a multidisciplinary approach and coordination between pediatric and adult teams are necessary in order to prevent and treat the orthopedic and neurological complications in these patients.

OP-101 / 16:27

Closure

Carol Hasler¹

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Friday 05/04/2019

EPOS STUDY GROUP: SPORTS MEDICINE

Chairperson: Franck Accadbled, France

Room: Grand Ballroom A

OP-102 / 17:00

Introduction

Franck Accadbled¹

¹Hôpital des Enfants, CHU de Toulouse, France

Pediatric sports medicine has gained popularity and input in the last few years. Our clinics receive more and more referrals from young athletes for whom sport represent a large part of daily life. The pediatric Orthopedic surgeon needs to know how to diagnose and best manage those sports injuries and interact with the patient's family, physiotherapist, coach, etc. This Sports Symposium will provide an insight on recent advance in this field, more specifically the specificity of young females regarding ACL injury, primary & secondary prevention of ACL rupture and return to sport and current management of an ACL tear. Education using an arthroscopy simulator and results of hip arthroscopy will be also presented.

OP-103 / 17:03

ACL injuries in the female athlete adolescents

Virginie Pollet¹

¹Birmingham Women's and Children's Hospital, Birmingham, United Kingdom

Purpose Review of the most recent literature on sports related ACL-injuries in girls/(pre-) adolescent athletes with emphasis on gender difference, prevalence of injuries and relation to type of sports and recommendations on prevention.

Methods PubMed search for "athletic" AND "injuries" AND "female" AND "adolescent" AND "knee" published within the last 5 years. Identification of epidemiological, gender, mechanical, and sports related differences as well as effect of neuromuscular training on prevention

Results The search generated 852 articles with 119 articles selected based on the title only. After reading the abstracts, 54 manuscripts were further analysed and the following data was extracted: The difference in ACL-injury rate between boys and girls appears around the age of 12 years. Menstrual cycle and specific adaptations on hip and knee kinematics during adolescent growth make female athletes more prone to ACL-injuries. Other external factors such as shoe wear, field surface, single- versus multisport participation and early specialization are contributing to the increased risk. Gender- and age-specific neuromuscular training programs already at a young age can decrease the incidence of adolescent ACL injuries. Early surgery for instability is warranted and a longer post-operative rehabilitation program is needed, especially for the pre-adolescent athlete, prior to return to sports.

Conclusion A gender specific neuromuscular trainings program, taking into consideration the individual skeletal and muscular growth and subsequent biomechanical alternations as well as the hormonal influences, can help preventing ACL-injuries in the female young athlete.

OP-104 / 17:13

ACL: what's new about rehabilitation, functional testing & RTP in children and adolescents?

Stephan Tercier^{1,2}, Marco Turati^{3,4}

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Anterior cruciate ligament (ACL) injuries are occurring in skeletally immature athletes with increasing rate. Different surgical treatments are proposed and the percentage of ACL surgery is on the rise in this specific population. Multiple variables should be considered during ACL post-operative evaluation in skeletally immature patients. Readiness to return to sport depends not only on painfree ROM and muscular rehabilitation: growth arrest, proprioception and psychological aspects are essential factors that requires a specific measurement in the post-operative follow-up. New rehabilitation protocols, pediatric functional knee scoring measures and neuromuscular control test are being established. The aim of this work was to present an up-to-date about rehabilitation, functional evaluation,

pediatric patient-reported outcome measures and return to play in children and adolescent after ACL reconstruction.

OP-105 / 17:23

Battle session: Operative management of recent ACL tear: reconstruction or repair?

Stephan Tercier^{1,2}, Marco Turati^{3,4}

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OP-106 / 17:33

Anterior cruciate ligament tears in children: management and growth complications. A Survey of EPOS and POSNA Membership

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¹Hôpital des Enfants CHU de Toulouse, Toulouse, France, ²Boston Children's Hospital, Boston, United States

Introduction The primary aim was to observe current trends in the management of ACL tears in skeletally immature patients and to investigate variations between POSNA and EPOS membership. The secondary aim was to determine the incidence, type and severity of growth-related complications of ACL reconstruction.

Material and Methods An invitation email to fill an electronic questionnaire was emailed to all EPOS and POSNA members. The study had been submitted to the POSNA Evidence Based Practice Committee, to the EPOS Scientific Committee and then to the EPOS Board. Data collection was automatic through *surveymonkey*. Descriptive statistics were applied.

Results Response rate was 24% for EPOS and 16% for POSNA membership. To the question 'which is your recommended initial treatment in a prepubescent boy with complete acute ACL disruption?' 17% of EPOS and 70% of POSNA responders answered 'ACL reconstruction within 3months'. To the same question concerning a pubescent adolescent, 61% of EPOS and 83% of POSNA responders answered 'ACL reconstruction within 3months'. The preferred tibial tunnel was epiphyseal for a prepubescent child (40%) and transphyseal for a pubescent adolescent (78%). The preferred femoral tunnel was epiphyseal for prepubescent child (53%) and transphyseal for a pubescent adolescent (61%). 21% of responders had observed a clinically relevant growth disturbance after reconstruction, mostly at the femur. There were 5 reported cases of LLD>2cm, 1 case of varus>10°, 3 cases of valgus>10° and 1 case of recurvatum<10°.

Discussion This survey demonstrated significant variations in the management of ACL tears in children and adolescents

between EPOS and POSNA members. There is a trend to perform transphyseal tunnels especially in pubescent adolescents. Reported cases of clinically significant growth disturbances are relatively low.

OP-107 / 17:53

Hip arthroscopy in adolescents. Technique and results

Manoj Ramachandran¹

¹London, United Kingdom

This talk will cover the history, indications, technique and outcomes of hip arthroscopy for paediatric and adolescent hip disorders. The evolution of hip arthroscopic techniques will be addressed first. This will be followed by the various indications that arthroscopy has been used for in the hip, with a focus on the most frequent paediatric orthopaedic disorders that arthroscopy has been utilised in. The operative technique will be discussed including tips and tricks for the budding hip arthroscopist. Each specific paediatric hip disorder will be tackled. Finally, a literature review of the outcomes for a variety of paediatric hip indications will be discussed.

OP-108 / 18:08

Evaluation of a theoretical and practical pediatric arthroscopy course, using a virtual knee simulator

Quentin Baumann¹, Alexandre Hardy¹, Franck Accadbled¹, SFAJ and EPOS Sports Study Group

¹Hôpital des Enfants, CHU de Toulouse, France

Purpose To evaluate a surgeon cohort before and after a theoretical and practical course of arthroscopy studied with a knee virtual reality (VR) arthroscopy simulator. Identify the parameters most modified by this teaching.

Methods 34 surgeons were included prospectively during the Advanced Arthroscopic Course of the European Pediatric Orthopedic (EPOS) in January 2018. A first evaluation was done before the course by the ArthroS TM Arthroscopy simulator. This was a diagnostic knee arthroscopy. The same exercise was conducted after the course. We collected data provided by the simulator, compared the overall scores and parameters evaluated by the simulator: time of completion of the exercise, percentage of iatrogenic lesions of the cartilage, distance traveled by the instruments, identification of different anatomical structures.

Results On completion of the course, trainees showed significant improvement in most of objective measures recorded by the simulator. The overall performance score improved after participation in the course with an average of 199 to 203 points ($p = 0.02$). The duration of exercise was shortened from 185. sec to 115.9 sec ($p = <0,01$). The camera path to visualize the structures was statistically shorter as well as that of the probe from 85.2 to 49.2 cm respectively to 65.5 to 15 cm with ($p = <0,05$). In detail there was less cartilage damage to the tibia $2.7 \pm 1.7\%$ (0; 6.7) versus $1.8 \pm 1.8\%$ (0; 7) ($p = 0.03$) the rate of damage to the femur also decreased although not significantly $4.4 \pm 1.8\%$ (1.9, 8.8) versus $4 \pm 1.5\%$ (1.9, 6.7).

Conclusions Participation in the EPOS theoretical and practical courses improved the overall score obtained on the

arthroscopy simulator. The most significantly improved parameters were exercise speed and motion savings.

FREE PAPERS

OP-109 / 18:23

The safe distance to the popliteal neurovascular bundle in pediatric arthroscopic knee surgery: an age-based anatomical study

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Level III

Introduction and Objective The purpose of this study was to quantify the distance to the popliteal vasculature from various points on the posterior horn of the lateral meniscus and investigate how this distance changes based on patient age, height, weight, body mass index (BMI), and skeletal maturity. **Materials and Methods** A study of children and adolescents (10-18 years old) was performed, examining knee MRIs taken in full extension. Free edge distance (between the anterior free edge of the posterior horn of the lateral meniscus to the closest point of the popliteal vessels) and meniscocapsular distance (from meniscocapsular junction to the closest wall of the popliteal vessels) were measured and the midpoint distance was calculated from these two distances. Statistical analyses were performed to investigate potential relationships between the measured distances and age, height, weight, and BMI.

Results A total of 144 subjects (8 male and 8 female per age group) were included in the final data analysis. Mean distance to popliteal vasculature increased linearly with age for the free edge ($p < .001$), midpoint ($p < .001$), and meniscocapsular ($p = .005$) distances. A multiple regression analysis indicated that height, weight and BMI predicted 45% of the variance in free edge distance ($p < .001$). Additionally, multiple regression analysis demonstrated that height, weight and BMI predicted 23% of the variance in meniscocapsular distance ($p < .001$). Mean free edge distance was significantly different between the open and closed growth plate groups ($p = .001$).

Conclusions There were significant associations between lateral meniscus free edge, meniscocapsular, and midpoint distances and age, height, weight, BMI, and skeletal maturity. Knowing the safe distance to the popliteal vasculature will increase the safety of pediatric lateral meniscus repair.

OP-110 / 18:28

Medial patellofemoral ligament reconstruction in children - a comparative randomized short-term study of fascia lata allograft and gracilis tendon autograft reconstruction

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Level II

Introduction and Objective Many surgical procedures have been described to treat recurrent patellar dislocation. The goal of the study was to evaluate the results of medial patellofemoral ligament reconstruction in children. Two operative procedures were evaluated.

Materials and Methods 44 children with unilateral recurrent patellar dislocation underwent MPFL reconstruction. The 1st group contained 22 patients and surgery was performed using a fascia lata allograft. In the 2nd group of patients which also contained 22 children and autologous gracilis graft was used. The mean age of the patients was 14.9 years and the mean follow-up was 24 months. Pre-operatively, all patients were evaluated clinically (Kujala score questionnaire) and radiologically. The same evaluation was used 18 to 30 months post-operatively to estimate the results of our treatment.

Results In 1st group of children operated with cadaver allografts, the Kujala score significantly improved from 73.91 points preoperatively to 94.50 points post-operatively. The average duration of operating procedure was 1 hour and 35 minutes. As shown by subjective symptoms, the results in 95% of patients were rated as good or very good. Similar results were obtained in patients in 2nd group, where MPFL was reconstructed with ipsilateral gracilis tendon. Kujala score increased from 70.77 points preoperatively to 94.32 postoperatively. Our results were estimated as good or very good in 93% of patients.

Conclusions Both techniques were effective in the short-term (18-30 months) in treatment of recurrent patellar dislocation. The use of cadaver allograft spares the hamstring muscles and reduces the time of surgery. Therefore, such study appears to be useful because it provides valuable information that would help to guide treatment of this condition in children.

OP-111 / 18:33

Are the radiological landmarks reliable guidance for femoral tunnel positioning during medial patello-femoral ligament (MPFL) reconstruction?

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Level II

Introduction and Objective Placement of the femoral tunnel is a critical step for successful MPFL reconstruction. Recently its positioning, based on radiological intraoperative guidance has gained popularity and became a standard.

Aim: Prospective, intraoperative assessment of the MPFL graft isometry with Schottle's point femoral fixation.

Materials and Methods 100 single bundle, primary MPFL reconstructions were done by authors between 2015 and 2018 for recurrent patellar instability, using twofold ipsilateral

gracilis tendon graft. Based on preoperative imaging workup, all other pathologies predisposing to patellar instability were addressed at the same setting, before femoral MPFL graft fixation. After provisional, fluoroscopically guided femoral fixation in Schottle's point the graft length changes were checked through the ROM (0-130 fl.) If isometry/favorable anisometry was confirmed – the graft was fixed definitely. If unfavorable anisometry (> 5 mm) was apparent, then femoral entrapment was shifted distally (+/-) anteriorly to achieve isometry.

Results There were 52 female and 46 male patients operated on (2 bilateral, staged reconstructions) aged 8 – 29 y. at the time of surgery (14,7 on av.). Concomitant procedures included tibial tubercle medialization (12), distalization (1), soft rod technique for patellar ligament transposition (3), lateral release (4), sulcus deepening trochleoplasty (16). In 64 knees graft isometry/favorable anisometry through the arch of motion was achieved in the Schottle's point whereas in further 36 knees femoral entrapment had to be transferred distally (+/-) anteriorly to achieve isometry.

Conclusions In more than 1/3 of MPFL reconstructions fluoroscopically guided femoral fixation in Schottle's point results in unfavorable graft anisometry – proved most common reason for clinical failure.

OP-112 / 18:38

Quadriceps tendon turndown for MPFL reconstruction: the anatomical differences between the patellar origins of the quadriceps tendon and MPFL

Audrey Rustad¹, Aleksei Dingel², Ted Ganley³, Yi-Meng Yen⁴, Peter Fabricant*⁵, Phil Wilson⁶, Henry Ellis⁶, Marc Tompkins⁷, Kevin Shea⁸

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Level IV

Introduction and Objective Quadriceps tendon (QT) turndown is an alternative method for medial patellofemoral ligament (MPFL) reconstruction. Advantages include avoiding the use of patella bone tunnels, avoiding the use of separate incision for hamstring tendon harvest, and avoiding the use of allograft tissue. The purpose of this study was to determine whether a QT graft for MPFL reconstruction is anatomically analogous to the native MPFL origin in a skeletally immature population.

Materials and Methods Three pediatric cadaveric knee specimens (10-11 years old) were dissected to reveal the MPFL and QT patellar origins. The medial aspect of the quad tendon was reflected as far as possible in both a medial and distal position on the patella, to function as the MPFL graft. The distance was

measured between the midpoint of the patellar origin of the MPFL in the coronal plane, and the most distal aspect of the patellar origin of the reflected quad tendon.

Results In the three specimens, the distance between the midpoint of MPFL patellar origin and the QT patellar origin was 3.4cm, 4.3cm, and 3.7cm. In all cases, the QT reflected origin was at least 7mm anterior to the native MPFL origin on the medial border of the patella.

Conclusions A consistent disparity exists between the patellar origin of the MPFL and the patellar origin of the quadriceps tendon, with the patellar origin of the MPFL being more medial, more distal, and more posterior than the reflected patellar origin of the QT graft. Surgeons performing MPFL reconstructions must understand this anatomy if considering this technique. While the QT remains an acceptable graft choice for MPFL reconstruction, attachment of the QT graft at the native origin of the MPFL is needed to reproduce the anatomy of the MPFL.

OP-113 / 18:43

Current practice trends in the surgical management of patellofemoral instability: a survey of the pediatric research in sports medicine (PRISM) society

Rachel Goldstein¹; Natalya Sarkisova¹; J. Lee Pace²; Jason Rhodes³; Daniel Green⁴

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⁴Hospital of Special Surgery, New York, United States

Level III

Introduction and Objective Patellofemoral instability (PFI) in young athletes presents both diagnostic and management dilemmas for which consensus often does not exist. The purpose of this study was to identify trends in management of PFI in children and adolescents nationwide.

Materials and Methods A 27-question multiple choice survey was distributed to the members of the Pediatric Research in Sports Medicine (PRISM) Society. Clinical and imaging evaluation, methods of conservative treatment, surgical indications, and surgical techniques when treating PFI were assessed.

Results 93% (65/70) of respondents reported performing surgery for PFI more than 5 times in the past year. 86% (56/65) completed the questionnaire in its entirety. Respondent data demonstrated the large discrepancies in practice patterns that exist. 20% (11/56) obtain an MRI in patients presenting with a patella dislocation. 41% (23/56) of respondents reported that surgery for fragment refixation or loose body removal is indicated when a loose body or osteochondral fragment is evident, regardless of fragment size. If surgery is performed for an osteochondral loose body, 38% (21/56) of respondents performed an MPFL reconstruction. 59% (33/56) reported performing the MPFL reconstruction with hamstring allograft, while 30% (17/56) prefer autograft (hamstring, quadriceps). MRI was strongly preferred over CT when considering a tibial tubercle anteromedialization. For surgical recommendations in patients with significant trochlear dysplasia, 46% (26/56) reported no

surgical management in first-time surgery while 41% (23/56) also reported no surgical management in revision surgery.

Conclusions There is a lack of consensus regarding optimal diagnostic and treatment algorithms in the management of PFI, however, consistent trends have emerged among pediatric sports medicine surgeons.

OP-114 / 18:58

Conclusion

Franck Accadbled

CHU de Toulouse, Toulouse, France

Friday 05/04/2019

EPOS STUDY GROUP: HIP AND LOWER LIMB IN SKELETAL DYSPLASIA AND METABOLIC DISEASES

Chairpersons: Rudolf Ganger, Austria and Ralph J.B.

Sakkers, Netherlands

Room: Grand Ballroom B

OP-115 / 14:30

Hip and lower limb in skeletal dysplasia and metabolic diseases – etiology and clinical features

Hakan Ömeroglu

TOBB University of Economics and Technology, Faculty of Medicine, Ankara, Turkey

The incidence of all skeletal dysplasias was reported to be 25 per 100000 newborns in North America. The classification of skeletal dysplasias is based on clinical parameters as well as on the findings of molecular genetics. Almost all of these conditions are hereditary and altered stature is the most commonly seen clinical finding. Gait abnormalities, altered body proportions, chest deformity, abnormalities of ligaments, muscles and tendons, recurrent dislocations, joint contractures, altered bone density, delayed or accelerated bone maturation, epiphyseal or metaphyseal radiographic changes, upper and lower limb abnormalities or deformities and spinal problems are the other musculoskeletal clinical findings that can be seen in these patients. Mental retardation, obesity, facial abnormalities, cleft lip and palate, eye changes, hearing loss, dental problems, changes in the skin are the findings of the other systems seen in these patients. The hip joint is mostly affected in multiple epiphyseal dysplasia, trisomy 21, achondroplasia, spondyloepiphyseal dysplasia and mucopolysaccharidosis (Morquio type).

OP-116 / 14:40

Specific hip problems in skeletal dysplasia

Renata Pospischill

Consultant Paediatric Orthopaedic Surgeon, Orthopaedic Hospital Vienna Speising, Vienna, Austria

Treatment of the hip deformity in skeletal dysplasia is a challenge for orthopaedic surgeons. Some genetic disorders

affecting the hip are identified at birth (Dystrophic dwarfism, Ellis van Crefeld, Spondyloepiphyseal dysplasia congenita, Kniest dysplasia, Cleidocranial dysplasia, Larsen's syndrome), others are diagnosed in later life (Hypochondroplasia, (Spondylo-) metaphyseal dysplasia, multiple epiphyseal dysplasia, Stickler syndrome, Pseudoachondroplasia). To better understand the disease type and the impact of the chosen treatment the „origin“ of the deformity needs to be identified. The initial hip pathology in skeletal dysplasia could be presented in the acetabulum and/or in the femur - epiphyseal, metaphyseal or epimetaphyseal. Hip morphology is often characterized by a delay in the appearance of the epiphyses, irregular epiphyseal formation, metaphyseal changes, and early-onset osteoarthritis. The spectrum of the hip joint deformity ranges from mild to severe, whereas coxa vara with abnormal physis is most commonly seen. Apart from coxa vara, patients with hip involvement in skeletal dysplasia present characteristic acetabular dysplasia, failure of ossification of the superolateral femoral head, flexion contracture, coxa valga and acetabular protrusion. Surgical procedures include intertrochanteric valgus and/or extension osteotomy of the femur, Staheli acetabular augmentation, trochanteric advancement and total hip arthroplasty. Coxa vara associated with poor epiphyseal development (nonossified or fragmented epiphysis) and severe impairment of the articular cartilage has a bad prognosis even after reconstructive surgery as seen in multiple epiphyseal dysplasia, spondyloepiphyseal dysplasia congenita, spondyloepimetaphyseal dysplasia, and Kniest disease. In contrast, outcome was better in cases of coxa vara with nonepiphyseal involvement, that is, good femoral head morphology, stable physis, and good articular cartilage, as seen in cases of metaphyseal dysplasia and cleidocranial dysplasia. However, because of the inherent nature of these hip disorders, long-term follow-up of the patients is required.

OP-117 / 14:50

Epi-, metaphyseal dysplasia – disease specific obstacles during treatment (abnormal joint configuration, amount of lengthening, ...)

Salih Marangoz

Acibadem Mehmet Ali Aydinlar University, School of Medicine, Istanbul, Turkey

The morbidities in skeletal dysplasias usually are the result of the following, due to the abnormality in the formation of cartilages and bones: 1) Shortening of specific limb segments, 2) Differential growth rates between tibia and fibula, or radius and ulna 3) Joint contractures, instability and deformities, e.g. combination of generalized laxity and structural epiphyseal abnormality in the case of spondyloepiphyseal dysplasia (SED). Cervical instability is important to look for in the evaluation of such patients especially with SED, diastrophic dysplasia, pseudoachondroplasia, and chondrodysplasia punctata. The deformity in skeletal dysplasias are often multifocal and multiplanar. CT and MRI might be indicated to delineate the joint and bony anatomy in certain cases. In selected cases, a three-dimensional motion analysis might also be helpful in

analyzing dynamic deformities. Intraoperatively arthrography should be used as an essential tool in order to comprehend the extent of the joint deformity by visualizing the cartilaginous joint line and also instability. Acute correction with fibular shortening in case of varus deformity, gradual correction with external fixators or guided growth can be performed. Guided growth screw purchase has been shown to be reliable even though the epiphysis or metaphysis is not normal. Exceptionally, it was found to be difficult to insert epiphyseal screws in pseudoachondroplasia. The effectiveness of guided growth in skeletal dysplasia is dependent on the growth potential of the contralateral part of the physis and the degree of inherent ligamentous laxity of the joint. Certain types of skeletal dysplasias are prone to premature osteoarthritis, such as multiple epiphyseal dysplasia (MED), SED, pseudoachondroplasia, diastrophic dysplasia, and Morquio syndrome. MED patients usually have small and fragmented epiphyses. Arthralgia and stiffness are common. The deformities within or around the joint should be addressed appropriately. The surgeon must factor in the risks when planning deformity correction and lengthening in this patient population.

OP-118 / 15:00

Treatment of lower limb deformities in hypophosphataemic rickets

Christof Radler

Department of Pediatric Orthopaedics and Adult Foot and Ankle Surgery, Orthopaedic Hospital Speising, Vienna, Austria

Purpose To point out common patterns of malalignment and deformity in hypophosphataemic rickets patients and describe treatment principles and techniques as well as common obstacles.

Methods Deformities of the lower limb in hypophosphataemic rickets do not resolve spontaneously under metabolic control of the disease. To prevent severe deformity and joint overload in the growing child guided growth has been shown to be effective in most cases. As recurrence of malalignment is common during growth, postponing surgical correction with osteotomies until or close to skeletal maturity has been recommended.

Results The most common deformities in hypophosphataemic rickets are femur and tibia vara combined with an internal torsion deformity of the tibia. Valgus deformity is less common followed by rare cases presenting with unilateral varus-valgus (windswept deformity). Most patients present with disproportionate shortening. Acute correction of the deformities is possible. However, acute shortening for axial correction or gradual correction is necessary in case of severe bowing of the bone due to the relative lengthening of soft tissue (nerves/vessels) on the concave side of the bone. Additional torsional deformities of the tibia can be corrected using six-axis external fixation frames. In previously untreated cases with severe varus and torsional deformity we prefer to correct the legs sequentially using a six-axis frame on the femur and a bi-Level six-axis frame on the tibia to restore full anatomic alignment and torsion in one step. At the time of frame removal rushpins can be used to protect the newly formed bone.

Conclusion Guided growth might be repeatedly used until skeletal maturity to prevent severe deformity and joint over-load. After maturity six-axis frames allow for accurate correction of the most severe multiplanar and multiapical deformities. Less severe deformities and shortening can be corrected successfully with plates or lengthening nails.

OP-119 / 15:10

Multiple hereditary exostosis disease – treatment of malalignment and impingement (including hip impingement)

J. Herzenberg

Orthopaedic Department, Sinai Hospital Baltimore, Baltimore, United States

OP-120 / 15:20

Osteogenesis imperfecta – deformity correction and prevention of fractures

Robert Rödl

Department of Children Orthopedics, Deformity Reconstruction and Foot Surgery, University Clinic of Muenster, Muenster, Germany

Introduction Weakness of bones in OI-patients is determining mobility, pain and life expectancy. The genetic type of OI gives a hint how weak the bones are but the difference between genotype and phenotype is sometimes striking. Deformity correction and prevention of fractures are the keys to restore and preserve mobility and independence in these patients.

Deformity Correction The weak bones of OI patients suffer occult micro fractures. This ends in bowed bones and leads to a fracture at the apex. Correction of these deformities is mandatory as soon as possible. Waiting will lead to increased deformities and larger surgery with multiple osteotomies and shortening in severe cases. Long incisions can be avoided using percutaneous osteotomies and intramedullary implants. Torsional stability needs to be controlled to avoid femoral retroversion. The pelvis remains an unsolved problem.

Prevention of Fractures Fractures can be prevented by increasing the strength of the bone or by decreasing the load for the bones. Increasing strength is the first line treatment to prevent fractures. Conservative therapy is based on bisphosphonates, physiotherapy and power plates. Surgery is based on intramedullary nailing using telescopic nails if possible. It is limited by the diameter of the bone. To decrease the load orthoses and crutches are not really a good solution. Crutches increase the load for the upper extremities and cause additional problems there. Furthermore, OI patients have weak muscles which make it difficult to move the additional weight of the orthotic devices. The main component of a load decreasing concept is therefore a wheel chair often motorized to save the upper extremities.

Conclusion The weak bones in OI should be addressed by surgery guided by the clinical picture. Intramedullary implants are the gold standard and should be used as soon as possible when deformities or first fractures arise.

OP-121 / 15:30

Congenital pseudarthrosis of the tibia (CPT) – obtaining and maintaining of fusion (resection and compression, X-union, contralateral vascularized fibula)

Mark Eidelman

Ruth Children's Hospital, Rambam Health Care Campus, Technion Faculty of Medicine, Haifa, Israel

Congenital pseudoarthrosis of the tibia is one of the most challenging problems in pediatric orthopedics, with difficulty in achieving and maintaining union. A myriad of complications that include tibial deformities, refractures of the tibia and fibula, joint stiffness and leg shortening, and foot and ankle stiffness are all known and widely described. A recently combined approach of bisphosphonate treatment before and after surgery and Paley X-union protocol that included the creation of cross-union and intramedullary fixation of the tibia and fibula with periosteal excision was described and yielded a high rate of success. Other options to obtain union are vascular fibular graft, Masquelet and McFarland techniques.

OP-122 / 15:40

Lower limb deformities in achondroplasia

Rudolf Ganger

Orthopaedic Hospital Vienna-Speising, Department of Pediatric Orthopaedics, Vienna, Austria

Achondroplasia is the most common form of chondrodysplasia with rhizomelia, lumbar lordosis, brachydactyly and macrocephaly (incidence 2-3/100.000). Mutation of gene FGFR3 (Fibroblast Growth Factor Receptor 3) can be found, mostly by spontaneous mutation. Inheritance is autosomal dominant. Because of that mutation especially linear bone growth is attenuated. Characteristic clinical findings are short limbs with long trunk. Possible cord compression at the level of the foramen magnum and lumbar spinal stenosis must be taken into consideration. Treatment options at the lower extremities are correction of axial and rotational deformities, correction of ligament laxity and limb lengthening procedures using internal and external techniques. To correct frontal deformities guided growth using the tension band effect can be used, due to limited growth correction time is increased. External fixation is a powerful tool for uni- or biLevel correction of axial and rotational deformities. Intramedullary lengthening nails are an option after maturity. Goal is to increase quality of life and decrease late complications of the deformities.

OP-123 / 15:50

Clubfoot deformity in skeletal dysplasia

Cristina Alves

Department of Pediatric Orthopaedics - Hospital Pediátrico - CHUC, EPE, Coimbra, Portugal

Skeletal dysplasias are a heterogeneous group of heritable disorders characterized by abnormalities of cartilage and bone

growth, resulting in abnormal shape and size of the skeleton and disproportion of the long bones, spine, and head. Typical by short stature, they differ in natural histories, prognoses, inheritance patterns, and etiopathogenetic mechanisms. Several skeletal dysplasias feature alterations of the hands and feet. Clubfoot may be found in patients with Diastrophic dysplasia, Kniest dysplasia, Osteogenesis imperfecta, Spondyloepiphyseal dysplasia, Campomelic dysplasia, Pierre-Robin Syndrome, Larsen Syndrome, etc.

The prenatal diagnosis of skeletal dysplasia is often initiated by the ultrasonographic findings in the mid trimester of a short femoral length, or by the knowledge of a previous familial history of skeletal dysplasia. Ultrasonography is highly specific for predicting lethal outcome, but of limited value for providing an accurate diagnosis. However, prenatal detection of skeletal dysplasias may influence the obstetric and perinatal treatment of affected infants. Molecular diagnostic techniques have led to the identification of the underlying gene disorders in about two thirds of known skeletal dysplasias. Some of the more common include *FGFR3*, *COL1A1* and *COL1A2*, and *SOX 9* gene mutations.

Medical care for individuals with skeletal dysplasia should be directed at preventing neurologic and orthopedic complications due to spinal cord compression, joint instability, and limb deformity.

Although there is a paucity of information regarding treatment of clubfeet in patients with skeletal dysplasias, the Ponseti method is a first-line treatment for patients with syndromic clubfeet. These can be expected to respond favorably but may require more surgical when compared with idiopathic clubfeet. For patients with nonlethal skeletal dysplasias, prognosis depends on the degree of skeletal abnormalities and concomitant anomalies.

Children with skeletal disorders are best managed by a multidisciplinary approach that includes obstetricians (prior to delivery), pediatricians, neonatologists, medical geneticists, endocrinologists, neurosurgeons, otolaryngologists and orthopaedic surgeons.

Friday 05/04/2019

EPOS STUDY GROUP: MUSCULOSKELETAL TUMOURS, INFECTIONS & ARTHRITIS GROUP SYMPOSIUM: WHAT IS HOT IN BONE & JOINT INFECTIONS?

Chairpersons: Dimitri Ceroni, Switzerland and Marta Salom, Spain

Room: Grand Ballroom B

OP-124 / 17:00

Presentation and introduction

Marta Salom

La Fe University and Polytechnic Hospital, Valencia, Spain

Bone and joint infections are frequent in children and although management of this pathology has improved a lot during the last few years, still some controversial issues regarding diagnosis and treatment remain unsolved.

The aim of this symposium is to discuss some of these controversial issues. Therefore, to this end, we will have an excellent representation from experts from different parts of Europe and America, who will give us their perspective in order to improve our knowledge, thus also improving our clinical practice.

Diagnosing a septic arthritis or an acute osteomyelitis is not always easy, but it is crucial in order to treat them promptly and adequately to avoid sequelae. Cristina Alves from Portugal will help in this task. To identify the causative germ, obtaining an oropharynx swab can help us. Dimitri Ceroni from Switzerland will defend the utility of this procedure. Septic arthritis can complicate with an osteomyelitis and a pyomyositis, the MRI being the best imaging test for diagnosis. Manoj Ramachandran from England will discuss when such a test should be run. To complete the first part about diagnosis, Deborah Eastwood from England will help us to establish the indications of a biopsy in an acute osteomyelitis.

In the second part, Ignacio Sanpera and Ana Fernández from Spain will deal with the controversial topic of the surgical treatment of septic arthritis. Without question, antibiotic treatment is key in bone and joint infections, but some questions remain unanswered. Nusret Köse from Turkey will try to answer them. Despite the improvement in diagnosis and treatment, bone and joint infections produce sequelae, the treatment of which will be discussed by Mark Eidelmann from Israel. To close the session, we will have Pablo Castañeda from New York, USA, demonstrating how we can apply new technologies to improve the treatment of infections.

OP-125 / 17:05

How to diagnose septic arthritis and acute osteomyelitis in 2019?

Cristina Alves

Department of Pediatric Orthopaedics - Hospital Pediátrico - CHUC, EPE, Coimbra, Portugal

Acute osteomyelitis and septic arthritis can occur alone or in combination and are primarily caused by bacterial infection. Incidence is 8-13 cases: 100 000 children per year, with higher prevalence in males before 5 years of age. Hips, knees, and ankles are the most frequently involved joints. The pathogenesis of acute osteomyelitis and septic arthritis may involve dissemination via the blood, extension by contiguity, or penetration of the infectious agent. Hematogenic dissemination is the most frequent in children, with *Staphylococcus aureus* being the most frequent pathogen. *Kingella kingae* affects children between six months and four years of life, being difficult to isolate. Aerobic blood culture vials or real-time polymerase chain reaction (PCR) should be considered for this. In addition to a complete history, physical examination may reveal localized signs and symptoms (70%), reduced range of motion (50%), and reduced weight-bearing (50%). Laboratory studies, including a complete blood count with differential, blood chemistries, ESR, CRP levels, and blood cultures, should be obtained. If there is concern for a septic joint, a synovial fluid analysis via joint aspiration

is helpful. The diagnosis of infection is favored by cloudy or purulent synovial fluid appearance; a white blood cell count greater than 100 000 cells/mL with more than 90% polymorphonuclear neutrophils; and a glucose level 50 mg/dL less than serum glucose levels. Radiographs should be obtained. Ultrasonography may help identify soft-tissue swelling, subperiosteal abscess, and joint effusion as well as aid in joint aspiration. MRI can reveal fluid collections, effusion, or other potential bone involvement and can help rule out concomitant pathology.

Many signs and symptoms of musculoskeletal infection are non-specific, and the differential diagnosis is broad. Three differential diagnoses should be considered: transient synovitis, juvenile idiopathic arthritis, and neoplastic conditions. Early diagnosis is essential to avoid sepsis, joint destruction and growth disturbance.

OP-126 / 17:15

Should we get oropharynx swabs for every child with a possible diagnosis of bone or joint infection?

Dimitri Ceroni

University Hospital of Geneva, Geneva, Switzerland

Recent studies have provided strong evidence that *Kingella kingae* has become the most common pathogen causing osteoarticular infections in children less than 4 years, and have highlighted the need to use specific real-time quantitative polymerase chain reaction (qPCR) assays targeting this pathogen to recognize efficiently infections. In fact, diagnosis of *K. kingae* osteoarticular infections in young children is still now frequently missed, because they are often characterized by a mild to moderate clinical and biological inflammatory response.

It is also currently admitted that osteoarticular infections in young children are, from a physiopathological point of view, frequently caused by organisms carried asymptomatically in the respiratory tract, such as *Staphylococcus aureus*, *Streptococcus pneumoniae*, *Streptococcus pyogenes*, or *Kingella kingae*. Since *K. kingae* must first colonize imperatively the oropharynx before spreading to distant sites by hematogenous means, any prospective studies investigated this mode of contamination and demonstrated that the detection of *K. kingae* in the oropharynx of children aged between 6 and 48 months with suspected osteoarticular infections had a positive predictive value of 90.5 % to diagnose *K. kingae* disease. Although it may be controversial, this approach suffers only a few limitations represented by the possible, however exceptional infections caused by either others, or multiple organisms, as well as the necessity to obtain valid oropharyngeal specimens and optimal extraction of bacterial DNA. Thus, it is debatable whether recognition of *K. kingae* on oropharyngeal swab may constitute a viable indirect diagnostic test to better recognize osteoarticular infections due to *K. kingae*, to discriminate quickly these infections from those due to pyogenic microorganisms, and to try to avoid invasive procedures such as synovial/bone biopsy. This indirect diagnostic method is particularly useful to unravel any conditions such

as spondylodiscitis, primary epiphyseal osteomyelitis, or tenosynovitis affecting small joints, since punctions or biopsies are considered too intrusive in these conditions.

OP-127 / 17:25

Are we getting enough MRIs in children with septic arthritis of the hip?

Manoj Ramachandran

London, United Kingdom

Along with clinical suspicion, specific hip imaging is helpful in making the correct diagnosis of septic arthritis in the paediatric hip. MRI is the most specific and sensitive imaging modality but access, especially during out-of-hours, expertise and the need for general anaesthesia in the very young, are some of the factors that may preclude obtaining this imaging.

This short presentation will cover indications, existing guidelines and recommendations for use of MRI in the diagnosis of septic arthritis in children. Differential diagnoses that may be evident on MRI will also be explored.

Finally, it will also cover the latest research developments in this field and relevance to other diagnostic modalities and criteria used in this clinical condition. Controversial areas such as whether MRI should be the first port of call in diagnosis will be put forward.

OP-128 / 17:35

Biopsy in acute osteomyelitis: never, sometimes or always?

Deborah Eastwood

Orthopaedics, Great Ormond St Hospital, London, United Kingdom

Usually, if a child presents as unwell with a symptoms and signs of infection, the job of the doctor is to identify the organism concerned by obtaining a sample of the infected tissue, for example urine, sputum or CSF. When the infection is in the bone, this does not take place. Why not? Although blood cultures are part of our routine investigation of a child with osteomyelitis and swabs would be taken of any open wounds that might have led to the bone infection, obtaining an aspirate or biopsy of the bone itself does not take place even when the neighbouring joint has an effusion, this may be aspirated without any bone biopsy. Bone biopsy does take place when the differential diagnosis includes tumour, when a haematological malignancy is a possibility and sometimes in an immunocompromised patient if it is likely that an unusual bacterium might be to blame. An inadequate or unexpectedly poor response to treatment might also lead to a biopsy. Perhaps these attitudes are outdated? Should we be re-thinking the indications for biopsy in acute osteomyelitis. This talk will present a review of current evidence and philosophy.

OP-129 / 18:00

What is the best treatment for septic arthritis: aspiration, arthroscopy or arthrotomy?

Ignacio Sanpera, Ana Fernández

Hospital Universitari Son Espases, Palma de Mallorca, Spain

Although, general agreement exist that most uncomplicated septic arthritis can be treated by simple aspiration and antibiotic therapy, the approach to hip septic arthritis remains controversial. Traditionally, it has been considered a surgical emergency, because, may result in cartilage destruction, due to the accumulation of toxic products of degradation of white blood cells and Inteleukine-1 (IL-1). Besides, the increase of pressure into the capsule joint may lead to an avascular necrosis due to a tamponade effect. However, no study has ever demonstrated the superiority of this approach.

Studies from Israel, Finland and France have questioned this way of treatment, showing that in fact, hip septic arthritis can be safely treated, in a majority of cases, by simple aspiration combined with antibiotic treatment. However, these studies have showed that although, a viable alternative, surgical drainage may be still needed in a percentage of patients ranging from 10-22%. Factors associated to failure of treatment by aspiration includes: the old age, delayed presentation, association of osteomyelitis to septic arthritis and the inflammatory markers highly raised on presentation.

Arthroscopic drainage of the hip combines the advantage of being a less invasive procedure with the possibility to explore the joint and obtain a biopsy. Studies have proven prospectively, to be at least, equally effective than surgical drainage. Studies at skeletal maturity have showed its security and good long-term results even in situations associated with treatment failure by needle aspiration.

On the other hand, neonatal hip septic arthritis still remains a challenge, probably due to the paucity of symptoms and its delayed presentation. Studies on aspiration and arthroscopy have excluded this group of patients probably because of its poor prognosis and the technical difficulties implied in the method.

OP-130 / 18:10

Antibiotic treatment in bone & joint infections: what, how and lead by whom?

Nusret Köse

Eskişehir Osmangazi University, Turkey

Pediatric Bone and Joint Infections are important, can be life-threatening and cause lifelong injury. These infections are not a rare disease in childhood and can still lead to diagnostic and therapeutic difficulties. Differential diagnosis includes soft tissue infection, trauma, tumors, arthritis and autoimmune disorders. Early diagnosis and rapid treatment are necessary to prevent complications. The initial management includes the adequate drainage of pus, collection of samples for culture and other microbiological studies, including antibiotic susceptibility testing, and initiation of empirical antibiotic therapy. The aim of treatment is to prevent complications such as metastatic infection in other regions, permanent joint damage, growth disturbance or chronic OM. The selected antibiotics depend on the identified pathogen (after discussion

with ID). In the literature, there is evidence that short intravenous courses are effective when combined with ongoing oral antibiotics in uncomplicated infection. Adopting a multidisciplinary, integrated evidence-based approach, provide optimized quality clinical care for these patients. Children with suspected bone or joint infections should be admitted under orthopaedic team for assessment in the first instance. All children with bone and joint infections should be managed by Paediatric Orthopaedics and Paediatric ID. Long-term intravenous antibiotic therapy should continue with Pediatric ID involvement.

OP-131 / 18:20

Sequelae of bone & joint infections: what can we do?

Mark Eidelman

Ruth Children's Hospital, Rambam Health Care Campus, Technion Faculty of Medicine, Haifa, Israel

Despite recent advances in the treatment of bone and joint infection, significant morbidity is still present and the incidence of permanent disability remains at about 6%. Delay in diagnosis and treatment may cause avascular necrosis and cartilage destruction, chronic osteomyelitis and bone deformities. Treatment of bone and joint infection sequelae might be a challenging task; however, despite the complexity of problems, we can effectively treat many of them: joint preservation procedures, osteotomies, bone lengthening, correction of deformities, and/or arthrodiastasis are only some of the solutions in the arsenal of pediatric orthopedic surgeons

OP-132 / 18:30

On the horizon of technology in musculoskeletal infections in children

Leon Moscona-Mishy, Pablo Castañeda

¹NYU School of Medicine, New York, United States, ²NYU Langone Health/Hassenfeld Children's Hospital, New York, United States

Morbidity from musculoskeletal infection in children remains a challenge because of increasing incidence and pathogen virulence. Specific microbiologic diagnosis can be difficult, and have major implications on treatment. Periarticular infections are more common than previously thought and subclinical infections are by their very nature difficult to identify and treat. *S. Aureus* remains the most frequent causal agent, with methicillin-sensitive *S. Aureus* (MSSA) comprising approximately one third of cases and methicillin-resistant *S. Aureus* (MRSA) another third.

Currently, the diagnostic standard of care combines the use clinical markers, laboratory tests and imaging modalities; all of which are diagnostic clues, but none is as determinant as a positive culture. Unfortunately, cultures infrequently yield a specific pathogen, as approximately 90% of pathogenic bacteria do not grow on cultures.

Two emerging technologies will be discussed focusing on their clinical application and current status:

1. Rapid sequence acquisition whole body MRI The specific location and extent of an infection can be difficult in infants; however, it can significantly alter the clinical management by extending the duration of antibiotic therapy or revealing a source requiring surgical intervention. Compared with commonly used first-line imaging techniques such as radiographs and ultrasounds, MRI has a higher sensitivity for identifying invasive infections and allows for simultaneous evaluation of multiple foci. The safety and feasibility of rapid sequence acquisition T1 and T2 weighted MRI will be shown in 2 cases where other modalities failed to determine a location. Rapid sequence acquisition whole body MRI will soon become the first-line imaging method for the diagnosis of MSK infections in children.

2. Shotgun metagenomics is the untargeted sequencing of all genomes present in a sample, it does not depend on the pathogen growing on cultures for its identification. Next-generation sequencing (NGS), also known as massively parallel or multiplex cyclic sequencing, NGS relies on high-throughput DNA sequencing technologies, obtaining millions of DNA strands while minimizing the need for the fragment-cloning methods used in other genome sequencing methods. Using NGS, we reviewed the charts of 440 episodes in 383 patients. There were only 30 episodes where a pathogen was found on cultures, however NGS determined the presence of MSSA in 175 episodes, with three distinct strains which demonstrated increasing virulence as determined by a longer length of stay, and a higher number of surgical interventions. NGS also determined the presence of MRSA in 110 episodes with multiple genomic strains and no specific virulence pattern amongst them. There were 155 episodes where NGS identified other pathogens.

The use of these modern technologies has already improved our ability to detect and treat musculoskeletal infections in children and will rapidly become a part of the clinical acumen.

OP-133 / 18:55

Conclusions

Marta Salom

La Fe University and Polytechnic Hospital, Valencia, Spain

Saturday 06/04/2019

Upper Limb

OP-134 / 08:00

Normal glenoid ossification in pediatric and adolescent shoulders mimics Bankart lesions: an MRI-based study

Peter Fabricant*¹; Harry Greditzer¹; Joash Suryavanshi¹; Sreetha Sidharthan¹; Madison Heath¹; Daniel Green¹

¹Hospital for Special Surgery, New York, United States

Level III

Introduction and Objective Secondary glenoid ossification centers can lead to difficulty differentiating normal

skeletal development from pathoanatomy. To that end, this study aims to define the typical development pattern of glenoid ossification using magnetic resonance imaging (MRI).

Materials and Methods Picture archiving and communication system (PACS) records from 1992 to 2017 were queried for shoulder MRI in a tertiary-care orthopedic facility. MRI examinations in male patients 9 to 18 years old (n=138) were evaluated by a musculoskeletal radiologist for ossification patterns at the anterior and superior glenoid rim. The superior ossification center is associated with the upper 75% of the glenoid articular surface while the anterior secondary ossification center is associated with the inferior 25%, extending from 3 to 6 o'clock on the glenoid clock face. Growth at these sites was characterized by stage of ossification: cartilage anlage, ossified, or fused (fully developed).

Results The anterior glenoid rim lags behind the superior glenoid rim in ossification and fusion throughout development. On average, superior glenoid ossification peaks around age 12 to 13 while anterior glenoid ossification is present from age 13-16. Anterior glenoid ossification appeared in the typical Bankart location and had similar appearance. Initiation of fusion begins soon after ossification at these two anatomic sites. In the majority of these male patients, fusion is complete by age 15 at the superior glenoid and age 18 at the anterior glenoid.

Conclusions Glenoid ossification at the anterior and superior glenoid rim progresses in a predictable manner. This pattern should be used as a guideline when interpreting pediatric shoulder MRI. In particular, the anterior ossification center should not be confused with a Bankart lesion.

Saturday 06/04/2019

Upper Limb

OP-135 / 08:05

Complications after toe to hand transfers in children with pathology of the hand

Tatiana Tikhonenko¹, Sergey Golyana*²

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Level II

Introduction and Objective There is no common approach to treatment complications after microsurgical toe to hand transfer, which is an actual problem. The aim of the study was to analyze ischemic complications after the microsurgical operations in children with a pathology of the hand to improve the quality of surgical treatment.

Materials and Methods From 2007 to 2016, we did 210 microsurgical toes to hand transfer (306 transplants). And 267 (87.3%) of these, in patients with congenital pathology and 39 (12.7%) with posttraumatic deformities of the hand. In total, 352 fingers were reconstructed. From 2007 to 2016, we did 210 microsurgical toes to hand transfer

(306 transplants). And 267 (87.3%) of these, in patients with congenital pathology and 39 (12.7%) with posttraumatic deformities of the hand. In total, 352 fingers were reconstructed.

Results According to our study, the blood supply disturbance of the toes transplants was in 19 (6.2%) cases of 306. The most of them caused in the early postoperative period (73.7%). The main cause of microcirculatory disorders was thrombosis of the venous or arterial trunks (8 cases). In 6 patients, the blood supply disturbance occurred as a result of thrombosis of venous insertions. Two patients had necrectomy at 7 and 18 days because treatment was not successful.

Conclusions The method of choice for the appearance of the first signs of the blood supply disturbance in transfer toe is conservative therapy, which includes disaggregants, anticoagulants. The effect of conservative therapy should be performed in 3 hours from the beginning of ischemia, if it is absent, the patient must be operated. The operation includes soft tissue decompression, the mechanical pumping across of vascular anastomoses, and if it necessary, excision of abnormal part of the vessel with subsequent autoplasty.

Saturday 06/04/2019

Upper Limb

OP-136 / 08:10

Triangular fibrocartilage complex repair in pediatric patients

Alex Balboa*¹; Kendra Eckstein¹; Kevin Little²

¹Cincinnati Children's Hospital Medical Center, Cincinnati, United States, ²Orthopedic Surgery, Cincinnati Children's Hospital Medical Center, Cincinnati, United States

Level IV

Introduction and Objective Triangular fibrocartilage complex (TFCC) injury is a common cause of ulnar-sided wrist pain in pediatric patients. Pediatric patients present with TFCC pathology secondary to acute trauma, physal arrest, or chronic, repetitive damage. TFCC repair (arthroscopic or open) can be definitive treatment for those with persistent pain and functional limitations. The outcomes following surgical TFCC repair in a pediatric population are reported.

Materials and Methods Medical records of pediatric patients who underwent TFCC repair at an academic pediatric hospital between 2004-2018 were reviewed for demographics, operative reports, clinical/occupational therapy notes and imaging reports. Patient outcomes were analyzed according to Palmer classification, ROM, grip strength, and PODCI scores.

Results 89 patients (40:49, 14.6(9.5-28.7); M:F, age(range)) diagnosed with TFCC injury underwent 88 arthroscopic and 7 open operations. The mean follow-up time was 16.5 months (1-68). 38 children (43%) had associated distal radius and/or ulna fractures. 82 patients (92%) had diagnostic MRI prior

to surgery with only 7 patients (8.5%) having false negative MRI findings. Palmer classification 1B (67%) and 1D (11%) were most common. 32 patients (36%) were simultaneously treated for ulnar impaction/abutment and/or distal radial growth arrest. Grip strength increased 21.2 kg ($p<0.05$). 74 patients (83%) recovered full ROM. PODCI Upper Extremity function & pain scores increased 30 and 42 following surgery, respectively ($p<0.05$).

Conclusions MRI imaging was a useful diagnostic tool in identifying TFCC pathology (91.4% sensitivity). Palmer Classification 1B (67%) and 1D (11%) were the most common TFCC injuries encountered. Surgical TFCC repair led to significant increases in PODCI function & pain scores, ROM, and grip strength.

Saturday 06/04/2019

Upper Limb

OP-137 / 08:25

Changes on computed tomography after arthroscopic debridement and microfracture for osteochondritis dissecans of the capitellum

Rens Bexkens¹; Christiaan van Bergen*¹; Michel van den Bekerom²; Gino Kerkhoffs³; Denise Eygendaal¹

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Level IV

Introduction and Objective Arthroscopic debridement and microfracture are considered the primary surgical treatment for capitellar osteochondritis dissecans (OCD). The subchondral bone plays an essential role in cartilage repair. The objective of this study was to analyze subchondral bone healing and defect size changes with computed tomography (CT) after arthroscopic debridement and microfracture for capitellar OCD.

Materials and Methods Between 2009 and 2016, 54 of 67 patients (81%) who underwent arthroscopic debridement and microfracture for advanced capitellar OCD were included with pre- and postoperative CT scans (at 29 ± 9.0 months). OCD defect size was assessed by measuring the largest diameter in 3 directions. Healing of the subchondral bone was divided into 3 categories: good - complete osseous union or ossification; fair - incomplete osseous union or ossification but improved; poor - no changes between pre- and postoperative scans. Postoperative clinical outcome was assessed with the Oxford Elbow Score (OES) at the same time as the postoperative CT scan.

Results There were 30 girls and 24 boys (age, 15.7 ± 3.2 years). Defect size decreased ($P<.001$) in all 3 directions (medial-lateral \times anterior-posterior \times depth): preoperatively, $7.9\pm 2.8 \times 8.0\pm 3.2 \times 4.1\pm 1.5$ mm; postoperatively, $3.5\pm 3.3 \times 4.0\pm 3.5 \times 1.6\pm 1.4$ mm. Healing of the subchondral bone was graded as good in 19 defects (35%), fair in 27 (50%), and poor in 8 (15%). The mean postoperative OES score was 40 ± 8.4 .

Neither postoperative defect size nor healing grade correlated with the OES ($P > .05$).

Conclusions Arthroscopic debridement and microfracture for advanced capitellar OCD result in improved (ie, decreased) defect size at a mean follow-up of 29 months. Healing of the subchondral bone was either good or fair in 85%. CT findings did not correlate with clinical outcomes.

Saturday 06/04/2019

Upper Limb

OP-138 / 08:30

Prediction and classification of radial head subluxation and forearm deformity in MHE

Jaroslaw Michal Deszczynski*¹; Tomasz Albrewczynski²; Aaron Huser³; Melih Civan⁴; Dror Paley³; David Feldman³

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Level III

Introduction and Objective Deformities involving the upper limb occur in greater than 80% of patients with MHE. Deformities of the forearm may lead to radial head dislocation in approximately 20-30% of patients. The purpose of this study was to determine if any deformities based on radiographs, were predictive for radial head dislocation.

Materials and Methods We reviewed patients diagnosed with MHE and forearm deformities. Radiographs of forearms were evaluated prior to any operative treatment. Degree of total ulnar bow, radial articular angle, radial bow, radial length, ulnar length, and percentage ulnar/radial length were measured and compared between radiographs with dislocation and those without. We used a Mann Whitney-U to compare differences between groups. Logistic regression was performed to determine the likelihood of dislocation.

Results A total of 43 patients, 73 forearms were included in the study. The median age was 14.7 years. Seventeen forearms had radial head dislocation. Mann Whitney-U test demonstrated significant differences between the two groups comparing degree of total ulnar bow ($p < .001$), radial articular angle ($p = .042$), radial bow ($p < .001$), ulnar length ($p < .001$) and percentage ulnar length/radial length ($p < .001$). The logistic regression model combining total ulnar bowing and percent ulnar length was able to correctly predict whether or not the radial head would dislocate in 95% of the cases. In our series, all patients that presented with dislocated radial heads had a total ulnar bow > 19 degrees.

Conclusions MHE forearm deformities may lead to radial head subluxation or dislocation. We found that ulnar bowing and percentage ulnar length are independent risk factors for radial head dislocation and these two measures correctly predicted radial head behavior in 95% of the cases in our series.

Saturday 06/04/2019

Upper Limb

OP-139 / 08:35

Preliminary results of physiolsysis and Vicker's ligament excision of Madelung deformity in Léri-Weill dyschondrosteosis

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Level IV

Introduction and Objective Limited literature is available for early treatment of Madelung deformity since Vicker's description. Aim of this series was to report the outcome of excision of the Vicker's ligament (VL) and physiolsysis and if it has altered the natural history

Materials and Methods 16 children with Léri-Weill dyschondrosteosis (LWD) with Madelung deformity were retrospectively reviewed. Children who underwent only VL excision and physiolsysis of distal radius with minimum one year follow up was assessed. Range of wrist movements (ROM), pain or functional limitation was analysed. Radiological evaluation included postoperative increase in distance between metallic markers across the physis to monitor the growth, ulnar tilt, lunate subsidence, lunate fossa angle, radial height, lunate-covering ratio and ulnar head dorsal translation index.

Results Eight wrists in 4 children underwent the index procedure at mean age of 9.3 years. At mean follow up of 48.3 months, all 4 children had satisfactory outcome with improved ROM. None of these children had limitation of activities of daily living or pain or need of further osteotomies due to acceptable surgical outcome. Growth at distal end radius was evident from metallic markers distance improving from mean 5.6 to 15.7 mm. Ulnar subsidence was maintained at 1.01 to 0.8 mm. Lunate fossa angle improved from 29.6° to 46.5°. Ulnar tilt corrected to 66.4° from 57.2°. Lunate covering ratio improved from 76 to 89%. Ulnar head dorsal translation index improved from the 5.5 mm to 4 mm.

Conclusions Treatment of Madelung's deformity in children with LWD with excision of the VL and physiolsysis can alter the natural history to improve the shape of distal end radius and hopefully avoid the need for complex osteotomies in adolescence.

Saturday 06/04/2019

Neuromuscular

OP-140 / 08:50

Is the gothic arch a reliable radiographic landmark for the migration percentage in children with cerebral palsy?

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Level II

Introduction and Objective Hip dislocation results from progressive hip displacement in children with cerebral palsy (CP). Reimer's migration percentage is the gold standard for measuring hip displacement. In patients, where the dysplastic superior acetabulum forms a "Gothic arch", Hip surveillance registries have proposed this as a reference for measurement as opposed to Reimer's method of the lateral edge of the acetabulum, as femoral head coverage may be underestimated and delay treatment. This study aims to assess both inter- and intra-observer reliability of the Modified method (MM) versus the Classical method (CM) using digital templating software.

Materials and Methods We performed a retrospective radiographic review of children with CP and included fifty hip radiographs of children with a mean age of 8.4 (SD 2.9) years. Four observers measured the migration percentage using the CM and MM for each hip at baseline and then at one week later. Interclass co-efficient was used to estimate inter and intra-observer reliability. This amounted to a total of 200 measurements per observer.

Results Inter-observer reliability was excellent for the CM with ICC 0.96 (95% CI 0.94-0.97) and good for the MM, ICC 0.78 (95% CI 0.51-0.89) $p < 0.001$. Intra-observer reliability was excellent for both methods ranging from ICC 0.94-0.99 for the CM and ICC 0.89-0.95 for the MM. The mean migration percentage for the CM percentage was 19% and 28% ($p < 0.001$) for the MM.

Conclusions The CM for calculating the migration percentage has an excellent inter and intra-observer reliability when compared to the MM. However, we found that the CM underestimated femoral head coverage by 9%. We suggest the use of the CM for calculating the hip migration percentage and for the clinician to consider a 9% underestimation-error when a Gothic arch is present on the hip radiograph.

Saturday 06/04/2019

Neuromuscular

OP-141 / 08:55

Impact of hip displacement on health-related quality of life in children with cerebral palsy

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Level II

Introduction and Objective Children with CP are at high risk for hip displacement, which might be associated with pain and contractures affecting health-related quality of life (HRQL). This study evaluates the impact of hip displacement measured by Migration Percentage (MP), on the HRQL of children with CP using the CPCHILD questionnaire validated for this purpose.

Materials and Methods The CHOP study is a prospective multi-center (26 sites/11 countries) cohort study of comparative effectiveness of different hip interventions in CP to the natural history. Untreated children with severe CP (GMFCS IV-V), 2-18 years old, and MP \geq 30% were enrolled. At baseline, demographics, radiographic measures, presence and severity of co-morbidities, presence of hip-related symptoms (contracture interfering with care &/or pain), and CPCHILD were recorded in REDCap. Multi-linear regression was done with CPCHILD scores as the outcome and MP and other covariates as explanatory variables. Logistic regression was used to predict the probability of becoming symptomatic as MP increases.

Results 462 children, mean age of 7.8 yrs (\pm 3.6) had mean CPCHILD total score 51.2 (\pm 14.9). GMFCS level, seizure status, g-tube feeding, higher MP, and parent-reported hip pain negatively correlated with total CPCHILD score ($p < 0.001$) in univariate analyses. Multivariate analysis showed that 26% of the variance in CPCHILD total score was explained by GMFCS level, seizure status, and presence of hip-related symptoms, with MP no longer significant. However, for every 5% increase in MP, the odds of becoming symptomatic increases 17% (95% CI: 11.4% - 23.1%).

Conclusions MP is highly associated with parent reports of hip symptoms. Hip symptoms contribute to decreasing CPCHILD scores. Hip displacement's impact on children's HRQL is driven by associated symptoms rather than MP magnitude alone.

Saturday 06/04/2019

Neuromuscular

OP-142 / 09:00

The value of tranexamic acid in children with cerebral palsy undergoing proximal femoral varus derotational osteotomies

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Level III

Introduction and Objective The aim of this study was to investigate the safety and efficacy of intra-operative TXA administration in reducing blood loss and transfusion requirements for children with CP undergoing a proximal femoral varus derotational osteotomy (VDRO).

Materials and Methods A retrospective review of 237 children with CP who underwent VDRO was performed between 2004

and 2017. 32 subjects underwent VDRO surgery with administration of intravenous TXA and 205 subjects underwent VDRO without administration of TXA. TXA was administered at a loading dose of 50mg/kg and a maintenance dose of 5-10mg/kg/hour at the discretion of the anesthesiologist. Major complications including venous thromboembolic events (VTE) were recorded. Outcome measures including blood loss and transfusion requirements were compared between groups.

Results Significantly fewer patients in the TXA group required allogenic blood transfusions in the peri- and post-operative period compared to the non-TXA group (3.1% vs 16.1%, $P=0.03$). Estimated intra-operative blood loss was similar between TXA and groups: averaged 121mL for the TXA group and 143mL for the non-TXA group ($P=0.38$). Initial post-operative hemoglobin (TXA: 9.7, no TXA: 9.4, $P=0.48$) and hematocrit (TXA: 29.2, no TXA: 27.9, $P=0.28$) levels were similar. No major VTEs were reported in either group.

Age at surgery, feeding status, seizure medication use, concomitant surgeries, distribution of Gross Motor Function Classification (GMFCS) levels, pre-operative hemoglobin and hematocrit levels, operative time and tourniquet use were similar between groups.

Conclusions The use of tranexamic acid was effective in decreasing blood transfusion rates in children with CP undergoing VDRO and was not associated with adverse outcomes.

Saturday 06/04/2019

Neuromuscular

OP-143 / 09:15

Comparison of the results of primary versus repeat hamstrings surgical lengthening in cerebral palsy

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Level III

Introduction and Objective Repeat hamstrings surgical lengthening (HSL) can be an option for the management of recurrent knee flexion deformity (KFD) in cerebral palsy (CP), but the results of this approach still controversial. The purpose of this study was to compare the results of primary and repeat HSL in CP.

Materials and Methods Patients with spastic diplegic CP, GMFCS I-III and underwent bilateral medial HSL were included in the study. 229 patients matched inclusion criteria and they were divided in two groups: Group-A, formed by those who received medial HSL for the first time (185), and Group-B composed by patients underwent to repeat HSL (44). Demographic data, clinical and kinematic parameters were evaluated before and after intervention, and the results compared.

Results The groups matched regarding demographics. Popliteal angle (PA) and knee flexion at initial contact (KFIC) were reduced in both groups. Reduction (24.9 to 17.5°, $p<0.001$) of minimum knee flexion in stance phase (MKFSt) and improvement (52.9 to 60.2, $p<0.001$) of Gait Deviation Index (GDI) occurred only in Group-A. Anterior pelvic tilt (APT) increased in groups A (from 17 to 19.5°, $p<0.001$) and B (from 14.9 to 19.4°, $p<0.001$) after treatment. Finally, in the comparison between groups, we observed that the reduction of PA, KFIC and MKFSt, and the improvement of GDI, were more significant in Group-A whereas the increase of APT was higher in Group-B.

Conclusions In the present study, the results of repeat HSL regarding the improvement of knee extension during gait were modest. In addition to this, the repeat HSL related to higher increase of APT after intervention. As a consequence of it, other surgical options should be considered for management of recurrent KFD in CP.

Saturday 06/04/2019

Neuromuscular

OP-144 / 09:20

Monopolar latissimus dorsii transfer for restoration of elbow flexion in children with arthrogryposis

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Level II

Introduction and Objective Elbow deformity is one of the most widespread pathologies in patients with arthrogryposis. This anomaly occurs in 95 % of cases. Most of the children have limitation of active movements in elbow due to absence of m.biceps brachii and m.brachialis. The choice of donor area for children with arthrogryposis for reconstruction of elbow active flexion is extremely limited. Latissimus dorsii is one of the most frequently used muscles for this purpose.

Materials and Methods From 2011 to 2018 we performed restoration of elbow active flexion via latissimus dorsii transfer to biceps brachii in 30 patients with arthrogryposis (44 upper limbs). We used clinical, neurology examinations. The age of patients was from 1 to 14 years old (3.98 ± 2.35).

Results The follow-up period was 3.15 ± 1.9 months. The follow-up results we estimated in 26 patients (30 upper limbs). The active postoperative elbow motion was $90.5\pm 14.86^\circ$. Limitation of elbow extension was in 51% cases ($12.77\pm 4.27^\circ$) without problem in daily living. Good results were in 55.6%, satisfactory in 33.3%, poor 11.1%.

Conclusions We suggest pedicle monopolar latissimus dorsii transfer as a reliable therapeutic option to restore active elbow

flexion in patients with arthrogyrosis in cases with passive elbow flexion 90° and more before operation and donor muscle strange grade 4 and more.

Saturday 06/04/2019

Neuromuscular

OP-145 / 09:25

The effect of selective dorsal rhizotomy on hip displacement in children with cerebral palsy: a long-term follow-up study

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Level III

Introduction and Objective Children with cerebral palsy (CP) have increased risk of progressive hip displacement. While the cause remains unclear, spasticity and muscle imbalance are felt to be major factors. Selective dorsal rhizotomy (SDR) reduces spasticity, but, its impact on hip displacement is unknown. Past studies do not provide clear indication of this effect; thus, the purpose of this study was to determine the influence of SDR on hip displacement in children with CP at least 5 years post-SDR.

Materials and Methods Pre- and ≥5yr post-SDR radiographs of patients who underwent an SDR before Jan. 1, 2013 at a tertiary care facility were reviewed. Hip displacement was evaluated via change in MP between pre-SDR and ≥5yr post-SDR radiographs, or until orthopaedic hip surgery.

Results In total, 77 participants (45 male, 32 female) at GMFCS levels I (1), II (11), III (22), IV (35) and V (8) were included. Mean age at SDR was 5.0yr (2.8–11.6yrs). Pre-SDR mean MP of the 154 hips was 29% (0-100%). Post-SDR, 67 (43.5%) hips in 35 children had soft tissue, reconstructive, or salvage hip procedures at an average 4.9 years (0.5-13.8yrs) post-SDR and average MP of 46% (11-100%). Additionally, 7 hips (5%) had MP ≥40% (40-100%) at most recent radiographic review (average 11.0 years [5.6-18.6yrs]). In total, 0 (0%), 0 (0%), 20 (45%), 22 (59%) and 5 (81%) patients at GMFCS levels I-V, respectively, had MP >40% or had surgical hip intervention.

Conclusions This study is the largest long-term follow-up investigating hip displacement post-SDR. The incidence of hip displacement in children with CP post-SDR did not substantially differ from the overall incidence reported in the literature, suggesting that SDR does not impact hip displacement in CP. Further prospective study will be required to strengthen the evidence in this regard.

Saturday 06/04/2019

Neuromuscular

OP-146 / 09:30

Outcome of bilateral hip reconstruction in unilateral subluxated hip in cerebral palsy: comparison to unilateral hip reconstruction

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Level IV

Introduction and Objective This study evaluated the outcome of bilateral hip reconstruction in unilateral subluxated hip and compared with those patients underwent unilateral hip reconstruction.

Materials and Methods A retrospective review was performed of all diplegic and quadriplegic patients with unilateral hip displacement treated with either bilateral or unilateral hip reconstructive surgery. Evaluation was done according to radiographic parameters [migration percentage (MP), pelvic obliquity angle (POA) and migration percentage difference (MPD) for pelvic symmetry] and changes in functional ability (sitting, standing and walking). Failure was defined as post-operative MP>40%, POA>5° and MPD>30%. All parameters were compared between the 2 groups.

Results Eighteen patients had unilateral hip reconstruction and 42 patients had bilateral hip surgery. Mean age of 87 months and 90 months; and mean follow-up of 38 months and 40 months respectively. Improvement of post-operative MP was significant in both groups. However, of 18 patients in unilateral hip surgery, 33.3% of patients had contralateral hip failure and 22.2% of patients had ipsilateral hip failure; only 1 of 42 patients had recurrent ipsilateral hip failure in bilateral group and no contralateral hip failure. For assessment of pelvic symmetry, MPD was significant in both group but improvement in POA was only significant in bilateral group. Overall functional improvement was significant in bilateral hip reconstruction compared to unilateral group.

Conclusions Bilateral hip reconstruction in unilateral displacement had shown to have better outcome in correcting unstable hip and pelvic asymmetry, thus provide good sitting balance and improvement in overall functional outcome.

Saturday 06/04/2019

Congenital

OP-147 / 11:30

Molecular diagnostics of skeletal dysplasias by next generation sequencing – first experience of a single genetic outpatient department from Serbia in the pilot phase prior to establish of the skeletal dysplasias center

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Level III

Introduction and Objective Skeletal dysplasias are heterogeneous group of genetic disorders. Timely diagnosis of rare skeletal dysplasia allows clinical monitoring of expected skeletal and other complications and correct treatment decision. The aim is to present our first experience in diagnostic approach and results for patients with suspected skeletal dysplasias.

Materials and Methods In the three year period, 36 probands with suspected skeletal dysplasia were referred to the Department of Medical Genetics at University Children's Hospital in Belgrade. Exome sequencing was performed for all. The analysis included few dozen to several hundred genes associated with skeletal dysplasias, depending of clinical suspicion. Patients with suspected monogenic skeletal dysplasia (e. g. achondroplasia or Marfan syndrome) were excluded.

Results Detection rate in our study is extremely high as much as 75% (n = 25). We have diagnosed patient(s) with Otopalatodigital Spectrum Disorder, Dyggve-Melchior-Clausen syndrome, Acromesomelic dysplasia, Spondyloepimetaphyseal dysplasia with joint laxity type 2, Osteogenesis imperfecta, Hypochondroplasia, Mucopolypidosis type IV, Mucopolysaccharidosis type IIIA, Craniosynostosis type 3, Corneli-de-Lange syndrome, Short stature – brachydactyly – intellectual developmental disabilities – seizures syndrome, 3MC syndrome, Trichorhinalphalangeal syndrome and other rare skeletal disorders. In five cases we performed prenatal diagnosis for skeletal dysplasia.

Conclusions With growing number of patients and experience in the field of skeletal dysplasias we plan to establish the Skeletal Dysplasias Center for multidisciplinary monitoring and treatment of the patients. In the process of genetic testing and genetic counselling the role of clinical geneticist as a team member within Center is crucial.

Saturday 06/04/2019

Congenital

OP-148 / 11:35

Gait analysis in children with proximal femoral focal deficiency

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Level II

Introduction and Objective This study evaluates classification, treatment, gait analysis, oxygen consumption, and overall

function in proximal femoral focal deficiency (PFFD) prosthetic patients.

Materials and Methods We performed gait analysis on 19 patients with unilateral PFFD, including 6 equinus prostheses (EQ), 6 rotationplasty (RP), and 7 Syme amputations (SA) with above-knee prostheses. We recorded PFFD classification and prior surgeries, cadence parameters, kinematics, kinetics, gait deviation index (GDI), and oxygen consumption. Participants completed the Pediatric Outcomes Data Collection Instrument (PODCI).

Results At 11.8 years in the EQ group, RP 11.3 years, and SA 11.9 years (p>0.965), RP patients had undergone more surgeries (3.3) than SA (1.7, p=0.015) or EQ (0.7, p=0.006). Neither abductor impulse nor oxygen consumption differed between groups, all requiring greater energy expenditure than age normal (EQ 156%, RP 144%, SA 154%, p>0.824). SA had greater hip power than EQ (0.75 vs 0.02, p=0.013) or RP (-0.1, p=0.006), and SA had improved kinematics over RP (GDI 69 vs 61, p=0.018). EQ walked faster than RP (99% vs 84% age normal, p=0.012). There were no differences in PODCI subscales of pain, happiness, sport, and global function. Mobility improves with age (Spearman 0.526, p=0.030), but no other correlations between classification, treatment, gait, or PODCI scores were significant.

Conclusions RP patients required the most surgery with no benefit in walking speed, kinematics, power, oxygen consumption, or patient-reported outcomes. EQ patients walk the fastest albeit unconventionally, while SA patients have improved power and kinematics over RP despite fewer surgeries. In conclusion, RP provides no benefit over other prosthetic treatment options in PFFD. These findings contradict prior reports of rotationplasty for PFFD.

Saturday 06/04/2019

Congenital

OP-149 / 11:40

Radiologic outcomes of containment surgery for dysplastic hips in Morquio IVA syndrome

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Level IV

Introduction and Objective Untreated hip subluxation leads to early arthrosis. Outcomes on hip containment in Morquio A syndrome are lacking. The purpose of this study was to determine survival of shelf osteotomies in mid to long-term follow-up.

Materials and Methods Radiologic data of 28 Morquio IVA patients undergoing hip containment between 1997-2015 was reviewed. All patients had bilateral femoral varus derotation osteotomy and stabilization with blade plate & shelf procedure. Radiographs assessed for [Neck shaft angle (NSA), acetabular index (AI), Sharp angle, Centre-edge angle (CE

angle), femoral head coverage (FHC)], Shenton's line and status of hip (contained/located, subluxated, dislocated). Radiographs compared at 3 time points: Pre-operative, immediate post-operative and last available x ray.

Results Male:Female ratio 12:16. Mean age of surgery 9.09 years (3.78-16.77 years). Mean post-operative follow up 6.81 years (1.6 years-19.1 years). Mean age 15.89 years (5.52 years-26.67 years) at last follow. Intraoperatively, Shenton's line was restored in 47/56 patients but was lost in 41 at the last follow-up. Significant improvement seen (p value <0.05) in the NSA, CE angle, FHC, hip status and sharp angle. Good containment was achieved in 53/56 hips. 39 remained contained, 16 subluxated and 1 dislocated at the last visit. Twenty three patients were independent for indoor ambulation at last visit.

Conclusions Containment surgery helps contain hip in medium to long term follow up with significant improvement in radiologic parameters and improved function. Shelf acetabuloplasty is a reliable method to address the dysplasia. Follow up study in the same patients after total hip replacement is required to confirm the benefits of improved acetabular morphology.

Saturday 06/04/2019

Congenital

OP-150 / 11:55

Humeral deformity correction, intramedullary stabilisation and complications in severe osteogenesis imperfect

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Level IV

Introduction and Objective Surgical correction of upper limb deformities in severe osteogenesis imperfecta (OI) is technically difficult. We aimed to analyse the outcome and complications of rodding the humeri in severe OI.

Materials and Methods Retrospective analysis of consecutive humeral roddings only in severe OI in last 3 years was conducted. Surgical technique included retrograde nailing (female or both components telescopic rods) with olecranon fossa entry, exploration of radial nerve followed by osteotomies. Deformities were quantified with angle and classified with Level of deformity. Variables included number of osteotomies, radiological union, functional improvement for wheelchair, range of movements (ROM) and complications.

Results Total 26 humeral nailings (23 primary +3 revision) in 14 patients with type III OI with mean age of 8.9 years were performed. Radiological union was achieved at mean 6.7 weeks. Improvement in the mean ROM was observed especially for shoulder flexion (23°). Objective functional analysis

in 12 out of 14 children revealed the improvement for push and transfer to and from wheelchair in 9 children. Total 9 complications (34.6 %) were reported within mean 12.4 months follow up. Five segments (19.2 %) had intraoperative fractures at distal third of the humerus while negotiating the nail, all of them uniting well. Intraoperative complications were associated with upper third Level deformities, deformities $>90^\circ$. Other complications included implant prominence and migration.

Conclusions This is the only homogenous cohort reported so far for severe OI using retrograde technique. Humeral nailing for severe OI is justified by ROM and functional improvement despite the complications. Meticulous surgical planning and execution is advised with awareness of complications which are inherent to the pathology.

Saturday 06/04/2019

Congenital

OP-151 / 12:00

Intramedullary nailing with supplemental plate and screw fixation of long bones of patients with osteogenesis imperfecta: short-term follow-up

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Level IV

Introduction and Objective Osteogenesis imperfecta (OI) is a heritable disorder characterized by bone fragility, fractures and long bone deformity. Although intramedullary fixation is the mainstay for OI bone, it often lacks rotational and length stability. A supplemental plate is one form of adjunctive fixation. The purpose of this study is to report on early results of supplemental plate and screw fixation in the setting of OI with minimum of one-year follow-up.

Materials and Methods This is a retrospective review of patients with OI undergoing realignment and intramedullary fixation from January 2012-October 2018. Supplemental plate and screws were used to provide rotational or length stability or to treat a nonunion. The supplemental constructs included locking plates with the screws placed after rodding to avoid the intramedullary implant.

Results 142 long bone segments in 48 patients with OI underwent realignment and intramedullary rodding. Supplemental plate and screw fixation were used in 16 patients and 23 segments - 14 femurs, 4 tibias, 4 humeri, 1 forearm. The mean age was 11.6 years (range 3-21). The mean follow-up was 30.6 months (13-50). Eleven patients have Type III, 4 have Type IV and 1 has Type V OI. All 16 patients have received bisphosphonate treatment. The average time to union was 8.7 weeks (6-17). One patient sustained a nondisplaced fracture at the distal aspect of an ulnar supplemental plate which healed nonoperatively. None of the supplemental plates have currently been removed.

Conclusions The use of a small locking plate and screw construct as supplemental fixation in the setting of long bone realignment and intramedullary rodding is a useful form of adjunctive fixation in the challenging bone quality in OI patients. The long-term fate of the supplemental fixation is not yet known and must be followed.

Saturday 06/04/2019

Congenital

OP-152 / 12:05

Prevalence of vitamin D deficiency in pediatric limb lengthening patients

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Level III

Introduction and Objective Low vitamin D is a common nutritional deficit which has been associated with fracture risk and poor bone health. Serum 25-hydroxyvitamin D [25(OH)D] levels less than 20 ng/mL are inadequate for bone health and levels less than 30 mg/mL are considered insufficient. The objective of this research was to determine the prevalence of vitamin D deficiency in pediatric patients undergoing limb lengthening.

Materials and Methods Retrospective study of pediatric patients undergoing limb lengthening by magnetic internal lengthening nail at a single, referral center between 2014 and 2018. Age, sex, race, diagnosis, and peri-operative 25(OH)D and serum calcium levels were collected and descriptive statistics presented.

Results Eighty-four subjects had serum 25(OH)D peri-operative results available. Forty-five subjects (54%) were female; 70 (83%) were Caucasian. The mean age was 13.6 ± 2.2 years. Most subjects (57/84, 68%) underwent lengthening for congenital diagnoses while nine (11%) did so for dwarfism, six (7%) for post-traumatic growth arrest, five (6%) for post-infectious growth arrest, and seven (8%) for miscellaneous diagnoses. The mean peri-operative 25(OH)D Level was 33.0 ± 19.6 ng/mL [range 13.1-103.5 ng/mL]; 23/84 (27.4%) of subjects had levels < 20 ng/mL (deficient) and 29/84 (34.5%) of subjects had levels < 30 ng/mL (insufficient). A minority (37.1%) had adequate 25(OH)D levels (> 30ng/mL). Calcium levels were low to normal [mean 8.3 ± 0.4 , range 7.6-9.5 ng/mL].

Conclusions Limb lengthening requires optimal bone health to achieve healing of the new regenerate bone. Given the high prevalence of vitamin D insufficiency in these patients, vitamin D measurement and replacement "pre-habilitation" may help prevent prolonging lengthening time, delays in regenerate healing, and regenerate fracture.

Saturday 06/04/2019

Congenital

OP-153 / 12:20

Complex treatment of CPT

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Level III

Introduction and Objective CPT due to neurofibromatosis causes 0.5-1% of all congenital skeletal problems. There are many proposed methods of treatment, but, up to now 20-50% of attempts fail.

Materials and Methods In this study, we compared results of two groups treated by 2 different methods. In group I, 17 patients were treated by Ilizarov method and its modifications with the use of some types of ExFix with axial and counter-lateral compression with bone grafting. Group II, 15 patients treated by D. Paley protocol with infusion bisphosphonates before surgery, intramedullary telescopic fixator (ITF), which is a new custom made (Ukraine) modification of the Fassier-Duval nail. Also, supraacetabular combined bone transplant was used.

Results In group I, we obtained 35% (6 patients) of non-union or recurrence of pseudarthroses during 2 years' observation. Moreover, the treatment process was long, painful and associated with a large number of complications, like wire and pin tract inflammation and infection. In group II, we observed union in all the cases. Complication rate was 20% (3 patients). Two cases – (technical problems with fixator - breakage of locking elements) were eliminated by replacing the broken ones. In one case (unsuccessfully treated 3 times before with ExFix) we got an infection. That patient was treated by ITF reinsertion with cleaning bony canal, fistulectomy and antibiotic rich cement at the fistula level. We observed this case for 2 years after infection cleaning: no signs of infection, pseudarthrosis fusion, now tibia is 4 cm shorter, but growing.

Conclusions We still do not have a "fire and forget" method, but the difference in number and severity of complication is impressive. New complex method (group II) looks promising and reliable.

Saturday 06/04/2019

Congenital

OP-154 / 12:25

Combined technique with hydroxyapatite coated intramedullary nails in treatment of anterolateral bowing of congenital pseudarthrosis of tibia

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Level IV

Introduction and Objective The goal of this study is to evaluate the treatment outcomes of anterolateral bowing and residual deformities of distal tibia in patients with congenital pseudarthrosis of tibia (CPT) using circular external fixation and hydroxyapatite coated flexible intramedullary nailing (HA-FIN) without excision of affected part of tibia.

Materials and Methods Six patients (age 12.4±4.1 years) were included in the study. Mean follow-up is 2.1 years. In 4 patients with early onset of disease initial surgical treatment was dysplastic zone or pseudarthrosis resection with proximal metaphyseal osteotomy for bone transport. Children with unbroken bowed tibia (2 cases of type II according to Crawford classification) had no previous surgery. Neurofibromatosis type I was diagnosed in 4 cases. Surgical technique for residual deformity correction consisted of percutaneous osteotomy, application of circular external frame and HA-FIN.

Results Mean external fixation time was 95.3±17.5 days. All patients never get fractured after frame removal. At the present time, they are considered to be healed, in 2.1 years, in average, without fractures or deformity recurrence. Mean lower limb length discrepancy varied from 2 to 10 mm at the latest follow-up control. After realignment procedure, patients didn't require additional surgery but one. Intramedullary nails were removed in two years after deformity correction for individual reason.

Conclusions Correction of anterolateral bowing in children with CPT is indicated. Association of external fixation with intramedullary nailing left in situ after frame removal ensures stability and accuracy of deformity correction. Biological methods of stimulation of bone formation in dysplastic zone are obligatory to ensure bone union. HA-FIN provides mechanical and biological advantages in patients with CPT.

Saturday 06/04/2019

Congenital

OP-155 / 12:30

Congenital generalized ligamentous laxity increases the rate of residual instability and re-dislocation after patellar realignment in children and adolescents. Results from a retrospective study on a cohort of 78 children

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Level III

Introduction and Objective To assess the impact of the congenital generalized ligamentous laxity (CGLL), in a cohort of children and adolescents affected by patellar instability, undergoing patellar realignment by a three-in-one soft tissues proximal and distal realignment.

Materials and Methods We conducted a retrospective case-control study in a cohort of 56 children (78knee) with patellar instability. Among them 20 children (28 knees) had patellar instability associated with CGLL, while 36 children (50 knees) had idiopathic patellar instability. Demographic, clinical and radiographic data were collected at the baseline, and the Dugdale score was used to assess the severity of instability. All the patients underwent a three-in-one procedure (Roux-Goldthwait procedure; lateral release; advancement of the vastus medialis obliquus). Patients were followed for at least two years. The Kujala score was used to assess the clinical and functional outcome.

Results The mean follow-up was 5 years (2-12). We observed residual instability in 17 cases (21%), with 7 cases (9%) requiring further surgery for patellar realignment. Logistic regression showed that CGLL was an independent predictor of recurrent instability (odds ratio 5.1; c.i.: 95%, 1.3-18.5; p=0.01). At the latest follow-up the Kujala score averaged 89 points with 73% of patients showing good or excellent results (Kujala score≥85).

Conclusions The CGLL was associated with a five-fold increased risk of recurrent instability after patellar realignment. This information may be helpful for redefining the prognosis of surgical treatment in this rare condition.

