Table of Abstract Book Content

Type of abstract: oral abstract

Track: Hip surveillance

O-01 A Five-Year Population-Based Study on the Radiological Outcomes of Hip Surgery on the Radiological Outcomes of Hip Surgery

Information about abstract submitter

1) Nikolaos Kiapekos, Karolinska University Hospital, Karolinska Institutet, Sweden*

The main content of abstract:

Objective
Cerebral palsy (CP) stands as the primary cause of motor impairment among children, and hip displacement is the second most prevalent skeletal deformity observed in these individuals. This study aimed to detail the radiological results of reconstructive hip surgery in CP-affected children at GMFCS levels IV and V which is fundamental for understanding the success of surgical interventions. Aimed as well to compare the radiological outcome of two hip interventions: the isolated proximal femur varus osteotomy (FO) and the combined femur and pelvic osteotomy (FPO).

Methods
This study was conducted using data from the Skåne and Stockholm regions following the Cerebral Pares Uppföljnings Program (CPUP) a national monitoring program, and included 1875 children under hip surveillance at GMFCS levels III to V. Out of these, 87 received reconstructive hip surgeries, which occurred between 2005 and 2018 and were defined as proximal femoral varus osteotomies, performed with or without concurrent pelvic osteotomy. All children who operated on with FO and/or FPO were followed up for 5 years. Radiographic measurements like migration percentage (MP), acetabular index (AI), and head shaft angle (HSA) up to five years post-reconstructive hip surgery were analyzed.

Results
During 2001–2018, 87 children (49 boys) underwent 94 femoral and/or pelvic osteotomies (40 FO, 10 bilaterally; 54 FPO, 8 bilaterally) and had a 5-year radiological follow-up; 32 and 45 children had ≥ 1 FO and/or FPO as the primary skeletal surgery, respectively. The mean preoperative MP (50%±18% for FO and 62%±17% for FPO, P=0.001) and age at surgery (6.2±2.5 years for FO and 7.3±2.8 years for FPO, P=0.014) differed between procedures. After 5 years, the mean MP was 29% for the FO group (26 children, 38 hips) and 24% for the FPO group (40 children, 48 hips). The 5-year radiological results for AI and HSA were also similar with a mean AI of 22 and 19 degrees for FO and FPO, respectively, and a mean HSA of 153 and 149 degrees, respectively.

Conclusions
Despite more severe hip subluxation in the FPO group, the radiological results after FO and FPO were similar 5 years after surgery.

Brief description of the abstract
Radiological outcomes 5 years after hip surgery in children with CP, GMFCS levels III-V. All 87

children from the Skåne and Stockholm regions. were included in the CPUP and underwent either FO or FPO between 2001 and 2018. The improvement of hip stability was studied using parameters like MP, AI, and HSA. The results showed that the FPO group starting with more severe hip subluxation and being older at the time of surgery, had comparable radiological outcomes after 5 years.

Track: Miscellaneous

O-02 An overview of the cases of spastic diplegia subtype of cerebral palsy in the Children's Clinic of Tartu University Hospital

Information about abstract submitter

1) Liis Rull, University of Tartu, Faculty of Medicine, Estonia*
2) Rael Laugesaar, Children's Clinic of Tartu University Hospital, Estonia

Funded by: Estonian Research Council PRG1912

The main content of abstract:

Objective
The developmental treatment guide for cerebral palsy (CP) in Estonia (2007) states that it is one of the most important diseases in childhood to cause disability regarding motor function, sensorimotor deficits, and developmental disorders. Furthermore, moderate to severe forms of CP cause the need for permanent developmental treatment and rehabilitation from infancy and account around two-thirds of severe mobility-related disabilities in children. Moreover, one fifth of children with CP have severe intellectual and motor deficits. Among different subtypes of CP, spastic diplegia is the most prevalent one. The prevalence of CP is around 3–4 in 1000 live births, according to studies conducted during the past decade. The most recent papers concerning this topic in the Estonian paediatric population have been published more than 15 years ago. Therefore, an up-to-date comprehensive overview provides valuable insight to this subtype of CP, covering key prenatal factors and both short- and long-term outcomes for the affected children. The objective of this study was to assess the presence of birth asphyxia and/or hypoxic-ischemic encephalopathy (HIE) and/or CP-related neuroimaging findings and functional outcome of children with spastic diplegic CP born between 2009 and 2018. Additional aim was to highlight the current shortcomings in perinatal and functional assessment and documentation in children with CP in our clinic.

Methods
CP was defined according to Tiina Talvik (1998) as "a non-progressive motor disorder caused by hypoxic-ischemic and/or haemorrhagic damage to the brain in the ante- or intranatal period". The spastic diplegia subtype of CP was defined based on the classification proposed by Hagberg (1976). The retrospective study was performed in the Children's Clinic of Tartu University Hospital. For obtaining the patient cases, a computerised medical records database for discharge diagnoses was searched using the International Classification of Diseases, Tenth Revision. The codes G80.0 and G80.1 were used. Inclusion criteria were the following: birth year between 2009-2018, recurrent diagnosis of spastic diplegia at the age of >2 years, and existing MRI (magnet resonance imaging)

scan(s) of the brain. Exclusion criteria were as follows: other forms of CP than spastic diplegia, other neurological diseases, e.g. neurological infections, brain development abnormality, and genetic diseases. The following data was gathered from medical records: 1) type and severity of motor deficit; 2) prenatal factors (prematurity; birth asphyxia (Apgar score <7 at five minutes or foetal umbilical artery pH <7.0)); 3) presence and severity of HIE; 4) findings on brain scans (MRI, ultrasound); and 5) long-term outcome: severity of disability; spasticity treatment (medical and/or surgical); and time of neurological follow-up. Follow-up period was defined as time since birth until last visit to a paediatric neurologist or a rehabilitation physician. Typically, the severity of motor dysfunction was classified in the medical records according to Talvik (1992): I (mild), II (moderate), III (severe) and IV (missing function, unspecified by the author). According to the description of the functional status described in the medical records, the severity of motor dysfunction was also classified according to the GMFCS (Gross Motor Function Classification System; Palisano 1997) by the leading author.

Results

The final cohort consisted of 46 children: 37 boys (80.4%) and nine girls (19.6%). In this group, 26 (56.5%) were premature, 16 (34.8%) born in asphyxia. HIE was inconsistently documented, necessitating retrospective evaluation. In premature children, 15 (57.7%) experienced HIE (six mild, nine moderate cases). Among 20 (43.5%) term-borns, seven (35.0%) had HIE (one mild, four moderate, two severe). During the neonatal period, 30 children (65.2%; 22 premature, eight full-term) had an ultrasound scan for brain imaging, 23 (73.7%) featured findings: subdural hematoma (n = 1; 4.4%), periventricular flare (n = 10; 43.5%), lateral ventricle asymmetry (n = 4; 17.4%); IVH was found in eight (30.8%) premature children. As for neuroimaging in later childhood, MRI scans were done at a median age of 2.6 years, showing CP-related findings (periventricular leukomalacia and/or dilation of lateral ventricles) in 33 (71.7%): 20 (60.6%) premature and 13 (39.4%) full-term. Normal MRI scans as per the reporting radiologist were seen in 13 cases (28.3%). The median follow-up period was 7.1 years (IQR = 3.5; min 2.4, max 14.5 years). The severity of motor deficiency as per Talvik was mild in two (4.3%), moderate in 12 (26.1%) and severe in five (10.9%); one child (0.5%) had missing function. Classification was absent in ten (21.7%) and incomprehensible (e.g. I-II) in 16 (34.8%) cases. The GMFCS assessment showed the following proportions across levels I-IV: 60.9% (n = 28), 21.7% (n = 10), 8.7% (n = 4) and 8.7% (n = 4); none met level V criteria. Gender disparities in severe functional impairment were observed: five (13.5%) boys and three (33.3%) of girls experienced severe mobility limitations (GMFCS III-IV). Treatment interventions to aid with spasticity and mobility included Botox injections (n = 15; 32.6%), oral baclofen (n = 6; 13.3%), and orthopaedic surgeries (n = 9; 19.6%). Three operated children (33.3%) underwent a selective dorsal rhizotomy, introduced in Estonia from 2022.

Conclusions

Proper assessment and documentation of HIE in at-risk neonates could help better understand complex issues regarding neurodevelopment in later years. A previous overview of nine CP registries (aggregating all subtypes) worldwide suggests the corresponding proportions from levels I–V to be 34.2%, 25.6%, 11.5%, 13.7% and 15.6%. The study results show a considerably milder severity of motor limitation: 82.6% of children fit into levels I-II, i.e. they walk independently. Applying the GMFCS scale based on medical histories proved to be relatively uncomplicated, whereas the common classification had often been unevenly documented (indicating assessment

difficulties) or completely dismissed. Thus, implementing the GMFCS scale into use in Estonia would be beneficial, as it is considerably more unambiguous and widespread than the current Estonian classification. The median follow-up time indicates that most children were regularly seen by a neurologist or rehabilitation physician until the usual age of starting school, but later follow-up was often sparse. Further studies could investigate other subtypes of CP to provide similar insights into the according patient populations. Other age groups of children with spastic diplegia not included in this study could be analysed as well. For congress attendees, the importance of correct documentation regarding risk factors and functional outcome in children with CP is highlighted: it provides valuable information for all consecutive professionals who encounter the child. Furthermore, using an internationally recognised assessment scale (GMFCS) creates a basis for comparing the Estonian population to others.

Brief description of the abstract

The study aims to give an overview of the cases of spastic diplegia – the most common subtype of CP, a childhood condition closely related to disability and further medical issues. Key points include implementing the GMFCS into clinical practice in Estonia and stressing the importance of properly assessing and documenting HIE. The broader scope of the research refers to both potential pre- and postnatal and long-term key moments for improved quality of life in children with spastic diplegia.

O-07 Estonian national registry of the patients with neural tube defects: 2023 update and findings

Information about abstract submitter

1) Ann Paal, Estonian Spina Bifida and Hydrocephalus Association, Estonia*
2) Ksenia Sokolova, Estonian Spina Bifida and Hydrocephalus Association, Estonia

The main content of abstract:

Objective

In 1980s in Estonia there was no overview of the number of patients with Neural Tube Defect (NTD) pathologies as such patients were considered incurable and their life expectancy was limited by infancy. As life expectancy of the patients is now approaching average life expectancy, this abstract reports the findings from analysing of Estonian SpBH Registry data.

Methods

In this study Estonian SpBH Registry data was quantitatively analysed. All the patients with NTD pathologies are cared for by a multidisciplinary team at the Tallinn Children's Hospital. Currently there are 606 patients with NTD pathologies observed from newborn to early adulthood including 313 with isolated hydrocephalus (HC) pathology, 175 with Spina Bifida (SB), 80 with central nervous system tumours.

Results

Among the patients with isolated SB pathology 10.9% need constant help in everyday life and special care, while 25.6% of the patients with isolated HC pathology needed special care 24/7. Since 2012 Estonian SpBH Assocation has lead extensive efforts for implementing folic acid

fortification program and increasing awareness. In the last two years there were only two babies born with SpB pathology compared to the year 1988 when there was the largest number of children born in Estonian history and 22 newborns had SpB.

Conclusions
Further investigation and data analysis is needed to understand the efficiency of the program of food fortification with folic acid and awareness campaigns in Estonia. The analysis into patient registry would provide valuable insights for creating systematic care system for adult patients with NTD pathologies.

Brief description of the abstract
This abstract reports the findings from analysing of Estonian SpBH Registry data. In this study Estonian SpBH Registry data was quantitatively analysed. All the patients with NTD pathologies are cared for by a multidisciplinary team at the Tallinn Children's Hospital. Currently there are 606 patients with NTD pathologies observed from newborn to early adulthood. The analysis into registry would provide valuable insights for creating systematic care system for adult patients with NTD pathology.

O-08 Fatty Acid Hydroxylase associated Neurodegeneration (FAHN): a case report and the importance of diagnostics

Information about abstract submitter

1) Alisa Rjabikova, Children's Clinical University Hospital, Latvia*
2) Gunta Kristapsone, Children's Clinical University Hospital, Latvia

The main content of abstract:

Objective
A 15-years old girl was admitted to Children's Clinical University Hospital of Riga, Latvia, in May 2022, for the course of rehabilitation. She had gait difficulties since started to walk, and diagnosed with cerebral palsy – spastic diplegia, when she was 3 years old. Previously, last time, the girl was seen at the Children's hospital, in 2017. The main complaints in 2022., were spasticity of the muscles in the legs and gait disorder, which progressed. In 15.11.2017. a patient had bilateral Vulpius surgery, transposition of musculus tibialis posterior to second cuneiform bone, due to feet deformities. A rehabilitation after the operation took place in a different rehabilitation centre. During Covid-19 pandemia, a girl had grown up fast, and didn't have any rehabilitation for at least two years, so her family assumed, that regress in her state was connected to this. According to her relatives, girl moves around the house crawling, or walks around, holding on to furniture. She has reverse 4-wheeled walker, manual wheelchair, shower chair, orthopaedic shoes. Objective state showed clear consciousness, ability to perform all verbal instructions. Girl communicates with sentences, rate of speech is slow, speech is dysarthric, there is a mild asymmetry of the face to the left. Girl has a scoliotic posture at the upper thoracic part to the left and in lumbar spine to the right, difficulties with movement coordination in her hands. Spasticity in leg muscles: both hip adductors 3, both gastrocnemius muscles 3 (modified Ashworth scale). Tendon reflexes in the arms and legs 3+, positive Babinski reflex and feet clonus was found. Contractures diagnosed in feet and knee

joints. Gross motor function measure (GMFM) showed 49 points (96%) in the "Lying and rolling" section, 39 p. (65%) in the "Sitting" section, 29 p. (69%) in the "Crawling, kneeling" section, no points in the "Standing" and "Walking, jumping, running" sections.

Methods
Neurological examination took place. Botulinum toxin injections were made in 05.2022.: Dysport 200 IU in each of gastrocnemius muscles and each of hip adductors (800 IU together), and no therapeutic effect was found. Magnetic resonance of the brain (thin layer 3D T1 with reconstructions ax, sag, cor, T2 ax, FLAIR ax, MRDW with ADC map, vena BOLD ax, SWI ax, MR spectroscopy) took place, and also consultation of geneticist. A girl has undergone next-generation sequencing (NSG) analysis for genes associated with inherited cerebellar malformations and atrophy, as well as ataxia.

Results
Brain MRI showed progressive neurodegenerative changes in the brainstem: mesencephalon, pons, medulla oblongata, changes in the vermis and cerebellum hemispheres. In NSG analysis 2 FA2H heterozygous genes were found: c.932A>G, p(Tyr311Cys) and c.822del, p.(Val275CysfsTer6), classified as probable pathogens or disease-causing. Molecular analyses results confirmed fatty acid hydroxylase associated neurodegeneration (FAHN).

Conclusions
FAHN is a rare disease with prevalence of 1 case in 1 000 000. Its onset is early, usually in first decade of life, and it can mimic other conditions with spasticity and movement disorders. MRI features and genetic analyses help to make a differentiating. It is important to be aware of symptoms, which progress in patients with seemingly different diagnosis of chronic condition, to make sure that the diagnosis is right.

Brief description of the abstract
A 15-years old girl was admitted to Children's Clinical University Hospital of Riga, Latvia, in May 2022, for the course of rehabilitation. She had gait difficulties since started to walk, and diagnosed with cerebral palsy – spastic diplegia, when she was 3 years old. Neurological, instrumental and genetic investigation took place, Molecular analyses results confirmed fatty acid hydroxylase associated neurodegeneration (FAHN).

Track: Neuromuscular diseases

O-03 Changes in Lower Extremity Kinematics with Free and Restricted Arm Swings in Children with Cerebral Palsy

Information about abstract submitter

1) Meltem Çelik, Ortopediatri, Academy of Pediatric Orthopedics, Turkey*
2) İlker Abdullah Sarıkaya, Ota Jinemed Hospital, Turkey
3) Osman Doğan, Ortopediatri, Academy of Pediatric Orthopedics, Turkey
4) Barış Görgün, Ortopediatri, Academy of Pediatric Orthopedics, Turkey

5) Ozan Ali Erdal, Private Practice, Turkey
6) Muharrem Inan, Ortopediatri, Academy of Pediatric Orthopedics, Turkey

The main content of abstract:

Objective
The spontaneous arm swing supports the movements that should occur in lower extremities in various phases of walking and provides energy conservation. Arm posture in children with hemiparetic cerebral palsy (HCP) may negatively affect lower extremity movements in walking, but there isn't specific research in the literature. Our study aimed to investigate the effect of arm swing on lower extremity kinematics in HCP.

Methods
Considering the inclusion and exclusion criteria, children with HCP who walk independently were included in the study. The children were evaluated with 3D gait analysis. Firstly, the gait of the patients in self-selected speed was recorded and then the hemiparetic arm, unaffected arm, and double arm restricted gait were recorded respectively. Restriction of arm movements was done with the help of an arm sling fixed to the trunk. Differences between gait were evaluated by Repeated Measures Anova Test and p, p-critical values and effect sizes were calculated.

Results
Totally 19 HCP were included. As a result, it was observed that pelvic obliquity and pelvic rotation values normalized when unaffected extremities of the patients were restricted, ankle dorsiflexion decreased and knee flexion increased in the swing phase (p

Conclusions
It has been shown that restriction of unaffected arm movement in HCP has a positive effect in providing neutralization of the movements of the pelvis in coronal and transverse planes. Restriction of the unaffected arm in the Constraint Induced Movement Therapy may help the normalization of lower extremity.

Brief description of the abstract
This study examines how arm swing affects lower limb movements during walking in children with hemiparetic cerebral palsy (HCP). Nineteen independently walking children with HCP were analyzed using 3D gait analysis. Restricting movement of the unaffected arm normalized pelvic movements, but restricting the hemiparetic arm showed no significant difference.

O-04 Differentiated Surgical Treatment Of Knee Flexion Contractures In The System Of Complex Orthopedic Treatment Of Children With

Information about abstract submitter

1) Paviel Rakhman, "MedGarden" Chernivtsi Private Hospital, Ukraine*
2) Oleksandr Korolkov, Lviv Regional Children Hospital, Ukraine

The main content of abstract:

Objective
Flexion contractures of the knee joint are the most biochemically complex pathology in children with cerebral palsy. Contracture of the knee joint significantly worsen the act of walking in children. To present the experience of differentiated surgical treatment of knee flexion contractures in children with cerebral palsy with I-III level of motor activity according to GMFCS

Methods
Treatment of 56 children with cerebral palsy aged 6-18 years was evaluated retrospectively. according to the GMFCS classification, were distributed as follows: in 16 patients (28.6 %) - level I, in 25 (44.6 %) – level II, and in 15 (26.8 %) - level III (the study did not include children with level IV and V GMFCS). The average follow-up period is 6.7 years.

Results
In the age group 6 to 9 years (19 patients) for correction of flexion contractures of the knee joints from 15° to 30°, and performed epiphysiodesis by two 8-plates . Correction occurred 8-12 months after the intervention. In the long – term period (5 or more years after surgery), a complete relapse of kneeflexionconttractures was observed in 3 patients (15.8%) out of 19, and a partial relapse in 7 (36.8%). In another group flexion contracture of the knee joint greater than 30° and aged 7-18 years (37 patients – 69 joints), performed open-wedge osteotomy of the femur with LCP fixation. The above-mentioned removal of extensor contractures of the knee joints in 17 patients (45.9% of cases) was performed. In the second group of patients in the long – term period (5 or more years after surgery), a complete recurrence of kneejoint was observed in 2 patients – 3 joints (15.8%), and a partial one – in 5-10 joints (36.8%).

Conclusions
In the age group 6 to 9 years - Complete correction of the kneeflexion contractures occurred 6-9 months after the intervention, which served as an indication for the removal of 8-shaped plates. At the age of 7-18 years, with knee flexion contractures greater than 30°, an extensor wedge-shaped (with a shortening of 1.5 to 4 cm) supracondylar osteotomy of the femur was performed with an LCP – plate fixation (in the cases shown, simultaneously on both sides), as well as, according to indications, a reduction of the tibial tuberosity. The obtained results allow us to conclude that a differentiated approach to the surgical treatment of his pathology allows us to adhere to the stages and sequence of treatment measures (conservative - surgical - rehabilitation), reduces the time spent in hospitals and rehabilitation centers, which reduces the cost of treatment and makes it possible to carry out social adaptation of patients in optimal terms.

O-11 Long-Term Results Equinus Deformity Treatment Of The Feet By Ulzibat And Strayer Surgery Methods In Children With Cerebral Pa

Information about abstract submitter

1) Paviel Rakhman, "MedGarden" Chernivtsi Private Hospital, Ukraine*
2) Oleksandr Korolkov, Lviv Regional Children Hospital, Ukraine

The main content of abstract:

Objective
Equinus deformity of the feet the first deformitie that are noted in children with CP. The most common method is Z-achiloplasty and Strayer's surgery, but the Ulzibat method is also quite common. To conduct a retrospective comparative assessment of the effectiveness of the Ulzibat method and Strayer's surgery in the long-term postoperative period.

Methods
125 children with CP (71 boys and 54 girls), aged 4-10, who were identical in gender, age, type of pathology: according to the GMFCS: 43 patients (34.4 %) - Level II, 47 (37.6 %) –III, and 35 (28.0 %) - IV. The average follow - up period is 4.7 years (3 -6.5 years). Two groups: I - 49 children treated by Ulzibat technique (in 17 cases – once, and in 32 - from 2 to 4 times with interval of 6-12 months.); II - 76 children with Strayer surgery.

Results
The initial assessment of the condition of children with cerebral palsy after surgical treatment of Equinus deformity in both groups was carried out 3 months after the intervention. In both groups, a correction was achieved : in 1 group - 95.6% of cases, in 2 groups – 94.9%. However, according to GMFM-88 data, it can be noted that children of II group performed motor tasks in the standing position more clearly, and walking greater duration and confidence compared to I group. At 6 and 12 months after surgical treatment: in Group 1, in 48.98% of cases, clinical and radiological data of the feet significantly worsened, in Group 2-18.4%. 24 months - shows deterioration of verticalization and walking characteristics in Group 1.

Conclusions
The data obtained give grounds to assert that the Ulzibat technique carries a high risk of complications in the separated period, after 6-12 months, despite a good immediate result (3 months)

O-13 Treatment of knee flexion deformity in cerebral palsy; surgical correction of extreme deformities

Information about abstract submitter

1) Muharrem Inan, Ortopediatri, Academy of Pediatric Orthopaedics, Turkey*
2) Sema Ertan, Ortopediatri, Academy of Pediatric Orthopaedics, Turkey
3) Barış Görgün, Ortopediatri, Academy of Pediatric Orthopaedics, Turkey
4) Ozan Ali Erdal, Private Practice, Turkey
5) İlker Abdullah Sarikaya, Ota Jinemed Hospital, Turkey

The main content of abstract:

Objective
Knee flexion deformity in children with cerebral palsy is a common deformity that leads to crouch gait and can impact standing and daily activities. Distal femoral extension osteotomy is the accepted treatment method. For severely deformed cases, the need for extreme correction arises and the fate of such cases is not fully known until now. In this study we aimed to examine the clinical and

radiological results of severe knee flexion (more than 50 degrees) operated by distal femoral extension osteotomy.

Methods
The demographic data, measurements of range of knee motion, degrees of flexion contracture, neurological examination, and crouch severity were assessed preoperatively, postoperativeley and at final follow up. The bone union time, amount of correction, physeal posterior distal femoral angles, patellar height (Koshino indices, Caton descamps ratio) were measured on standard anteroposterior and lateral radiographs of the knee joint (first day, sixth week, and final follow up).

Results
Seventeen limbs of 10 patients (6 male, 4 female) were included. The mean age was 11.4 years (9 to 15 years). The mean follow up duration was 35 months (min. 24–max. 70). The GMFCS level (2 patients GMfCS 3, 8 patients GMFCS 4) did not change after surgery. The mean flexion deformity significantly improved preoperatively from 60 degrees, postoperatively to 1,1 degrees ($p < 0.01$). The reduction of knee flexion in the stance phase (crouch severity) pre- to postoperatively was significant ($p < 0.01$). The mean preoperative, postoperative, and last follow up Koshino indices were 1.39, 1.25, and 1.32, respectively. The mean preoperative, postoperative, and last follow up CD indices were 1.45, 0.94, and 1,33, respectively. All of the patients had three cortices of callus formation at 6th week raiographies. There were no major or minor postoperative complications.

Conclusions
In our study in spastic CP patients, correction of knee flexion deformity over 50 degrees with extansion osteotmy, significant improvement was achieved both clinically and radiologically in the early postoperative period and approximately 2-year follow-up period without any complication. However, longer follow-up is required to detect the problems that may develop due to joint incompatibility.

Brief description of the abstract
This study examines distal femoral extension osteotomy results for severe knee flexion deformity (>50 degrees) in children with cerebral palsy. Seventeen limbs of 10 patients were studied over a 35-month follow-up. Significant clinical and radiological improvements were observed postoperatively without complications. Longer-term follow-up is needed to assess joint compatibility.

Track: Rehabilitation

O-05 Effects of whole-body vibration on bone mineral density of children with Down syndrome: a systematic review

Information about abstract submitter

1) Uljana Matvejeva, NRC "Vaivari", Latvia*
2) Iveta Sprugevica, NRC "Vaivari", Latvia

The main content of abstract:

Objective

Down syndrome is characterized by a range of musculoskeletal abnormalities, including lower bone mineral density compared to the general population. A combination of genetic, hormonal, nutritional, and lifestyle factors contributes to this issue. These individuals often face challenges in achieving adequate physical activity levels. As life expectancy of individuals with Down syndrome increased, it becomes important to address the issue of low bone mineral density in order to reduce risk of fractures, prevent osteoporosis and improve quality of life. Whole-body vibration demonstrates the potential to enhance bone mineral density across patients with varied diagnoses. However, the efficacy of whole-body vibration on bone mineral density in children with Down syndrome remains unclear, warranting systematic evaluation. The primary objective of this systematic review is to synthesize existing evidence to determine the impact of whole-body vibration interventions on bone mineral density in this population.

Methods

A systematic search was conducted in Medline/Pubmed, Ebsco, and Google Scholar databases on February 2024 using keywords "vibration" or "WBV" combined with "Down syndrome". Identified articles underwent screening according to the Preferred Reporting Items for Systematic Reviews and Meta-Analysis (PRISMA) guidelines. Eligibility criteria included all controlled trials assessing the effects of whole-body vibration in children with Down syndrome. Quality assessment of the selected studies was performed using the Physiotherapy Evidence Database (PEDro) scale that evaluates methodological aspects of included articles such as randomization, blinding, allocation concealment, and follow-up. Data extraction involved systematic retrieval of relevant study characteristics, participant demographics, intervention details (e.g., frequency, duration, amplitude of whole-body vibration), outcome measures used, and bone mineral density changes. Synthesis of results included a narrative summary of findings from the included studies, detailing the effects of whole-body vibration on bone mineral density in children with Down syndrome.

Results

A total of 68 articles were initially identified through database searches using predefined keywords. After removing duplicates, screening of titles and abstracts, and full-text assessment of potentially relevant articles, 4 studies that met the eligibility criteria. Among the included studies, diverse methodologies and intervention protocols were observed, including variations in whole-body vibration frequency, duration, and amplitude. The quality assessment of these studies using the PEDro scale revealed methodological variability across trials. The majority of studies (n=3) implemented a treatment regimen of three sessions per week. However, one study did not specify the frequency of treatment sessions. Regarding the control interventions, one study utilized rebounding exercises as the control group regimen, while another study employed treadmill training for the control group. Two remaining studies used either physiotherapy or daily life activities as a control condition. In the application of whole-body vibration, the regimen of three sessions per week over 20 weeks yielded statistically significant improvements in bone mineral density among adolescents with Down syndrome. Comparative analyses revealed that both rebounding exercises and whole-body vibration were effective in increasing low bone mineral density in children with Down syndrome after three months of treatment, conducted thrice weekly. Furthermore, in comparison to treadmill training, bone mineral density of the lumbar spine and femoral neck significantly improved in both study groups in favor of the whole-body vibration group following

three months of treatment sessions conducted three times a week. There was a statistically significant difference favoring the whole-body vibration combined with physical therapy group in post-treatment bone mineral density compared to the control group performing only physical therapy after the three-month treatment period.

Conclusions
The systematic review conducted on the effect whole-body vibration on bone mineral density in children with Down syndrome revealed therapeutic benefits of whole-body vibration interventions. Despite the limited number of controlled trials meeting inclusion criteria, the synthesized data suggests a positive effect of whole-body vibration interventions on bone mineral density in children with Down syndrome. The included studies exhibited diverse methodologies and intervention protocols. The majority of included studies implemented a treatment regimen of three sessions per week for at least three months, after which the positive effect on bone mineral density was observed. Comparative analyses indicated the effectiveness of both rebounding exercises and whole-body vibration in increasing low bone mineral density in children with Down syndrome after three months of treatment. Furthermore, compared to treadmill training, bone mineral density of the lumbar spine and femoral neck statistically significantly improved in both study groups following three months of treatment sessions conducted three times a week in favor of whole-body vibration group. Attendees of the Congress will gain valuable knowledge regarding the current state of research on whole-body vibration interventions in pediatric populations with Down syndrome in relation to bone mineral density outcomes. Understanding the potential impact of whole-body vibration on bone health in children with Down syndrome can inform clinical practice and intervention strategies aimed at improving skeletal health and reducing the risk of fractures and osteoporosis in this vulnerable population.

Brief description of the abstract
A systematic review investigated the effects of whole-body vibration on bone mineral density in children with Down syndrome. Out of 68 articles, 4 controlled trials met eligibility criteria. Studies exhibited methodological variability. In most cases, whole-body vibration interventions, often three times a week, applied for at least three months, showed improvements in bone mineral density compared to control interventions (physical therapy, treadmill training and daily life activities).

O-06 Enhancing Cerebral Palsy Gait Analysis with 3D Computer Vision: A Dual-Camera Approach

Information about abstract submitter

1) Elli Valla, Tallinn University of Technology, Estonia*

The main content of abstract:

Objective
This study advances cerebral palsy (CP) gait analysis by integrating a dual-camera system with advanced pose estimation algorithms to construct precise 3D gait models. It focuses on the critical question: How effectively can advanced computer vision techniques and automated keypoint extraction analyze and model the complex gait dynamics of cerebral palsy patients? The objective

of this study is two-phased. The first phase aims to develop a dual-camera markerless system for generating 3D gait models. This involves the implementation of advanced computer vision techniques to facilitate non-invasive gait analysis, reducing the need for cumbersome setup and physical markers. The second phase focuses on evaluating the ability of our markerless dual-camera setup to autonomously extract and analyze kinematic features. This includes a direct comparison with the established Vicon system to assess both the precision and accessibility of our method in clinical settings. This comprehensive approach seeks to validate the effectiveness of the new system in capturing critical gait dynamics essential for the diagnosis and management of cerebral palsy.

Methods
The study utilized two RGB cameras to capture 3D gait data in a controlled lab setting, employing frameworks like MediaPipe for real-time pose estimation. The gait analysis was conducted using a combination of machine learning algorithms and kinematic modeling, focusing on capturing essential gait metrics and joint angles. The new system was compared to the conventional Vicon system to assess accuracy and effectiveness.

Results
The markerless system demonstrated strong correlations with the Vicon system for large joint angles such as knee flexion/extension, but showed limitations in accurately capturing smaller angles like hip abduction/adduction. The system effectively measured four clinically relevant kinematic variables out of the eleven assessed, proving sufficient for basic clinical gait analysis. Furthermore, authors report a range of general gait parameters including cadence, single support, double support, final contact, step length, step width, walking speed, and limp index, calculated in close collaboration with HNRC clinicians. These parameters were obtained by projecting foot movements onto the floor plane and aligning walking trajectories along the x-axis, facilitating straightforward calculations. This method combines in-depth kinematic analysis with essential gait metrics, offering a comprehensive insight into gait mechanics crucial for enhancing the diagnosis and treatment of movement disorders.

Conclusions
The proposed markerless dual-camera system showed promise in simplifying the setup and reducing patient discomfort in CP gait analysis while retaining reasonable accuracy in capturing critical gait dynamics. Although some limitations were observed in the accuracy of smaller joint angles, the system represents a significant step toward more accessible and less cumbersome gait analysis in clinical settings, offering significant advancements in the diagnosis and treatment of movement disorders.

Brief description of the abstract
This paper discusses the development and evaluation of a markerless gait analysis system using 3D computer vision and dual RGB cameras, aimed at improving the assessment of gait abnormalities in cerebral palsy patients. By leveraging advanced pose estimation algorithms and reducing reliance on physical markers, the system seeks to simplify and enhance the diagnostic process in clinical environments.

O-12 Real-world one-year rehabilitation of cerebral palsy in Estonia: an analysis of population-wide data

Information about abstract submitter

1) Grete Elanor Palgi, Faculty of Medicine, The Institute of Sport Sciences and Physiotherapy, University of Tartu; Põlva Hospital, Estonia*
2) Pärt Prommik, Faculty of Medicine, Institute of Clinical Medicine, University of Tartu; Põlva Hospital, Estonia
3) Rael Laugesaar, Children's Clinic of Tartu University Hospital; Faculty of Medicine, Institute of Clinical Medicine, University of Tartu; Põlva Hospital, Estonia

The main content of abstract:

Objective
Cerebral palsy describes a group of permanent non-progressive disorders of the development of movement and posture, causing activity limitations that are attributed to disturbances occurring in the developing fetal or infant brain. In treating cerebral palsy, multidisciplinary care and rehabilitation are important, including physiotherapy, occupational therapy, speech therapy, psychotherapy, etc. This study aimed to evaluate one-year rehabilitation of children with cerebral palsy in Estonia.

Methods
This population-based retrospective cohort study used population-wide health data acquired from the Estonian Health Insurance Fund. The study included patients aged 2–6 primarily diagnosed with cerebral palsy (ICD-10 code G80) between January 2010 and December 2022. To be included in the study, patients had to get a rediagnosis of cerebral palsy within two years from the index diagnosis.

Results
The study included 573 patients, of which 60.4% were male. The median age was 2 (lower-upper quartile: 2-3) years. 77% received physiotherapy by a median of 10 (5-30) hours during one year. Physiotherapy started on a median of 17th day (1-58) after diagnosis and ended on 245th day (128-323). 52% received speech therapy by a median of 5 (2-14) hours. Speech therapy started on a median of 39th day (2-121) after diagnosis and ended on 245th day (132-302). 37% received psychotherapy by a median of 5 hours (5-8). Psychotherapy started on a median of 65th day (7-196) after diagnosis and ended on 202nd day (110-273). 28% received occupational therapy by a median of 7 hours (4-13). Occupational therapy started a median of 27th day (5-127) after diagnosis and ended on 273th day (194-325). 123 patients (21%) received care in a stationary rehabilitation setting.

Conclusions
Although most of the patients with cerebral palsy received rehabilitation, a relatively high proportion did not receive these services. The patients received rehabilitation services for a small number of hours and started rehabilitation relatively late, despite early intervention and regular rehabilitation being important parts of the treatment. To improve the situation system-wide improvements are needed.

Brief description of the abstract

This study aims to evaluate one-year rehabilitation of children with cerebral palsy in Estonia using administrative data from the Estonian Health Insurance Fund. The study included patients aged 2–6 diagnosed with cerebral palsy. The proportion of patients receiving rehabilitative services ranged from 28-77%, and the total received median hours ranged from 5-10. Rehabilitation was accessible for most of the patients, however, the received total amount of these therapies was relatively small.

Track: Transition

O-09 Investigation of age-related gait decline and potential mechanisms behind it in adults with cerebral palsy

Information about abstract submitter

1) Anders Gravholt, Université Jean Monnet Saint-Etienne, Lyon 1, Université Savoie Mont-Blanc, Laboratoire Interuniversitaire de Biologie de la Motricité, France*
2) Bruno Fernandez, Université Jean Monnet Saint-Etienne, Lyon 1, Université Savoie Mont-Blanc, Laboratoire Interuniversitaire de Biologie de la Motricité, France
3) Narimane Zeghoudi, Université Jean Monnet Saint-Etienne, Lyon 1, Université Savoie Mont-Blanc, Laboratoire Interuniversitaire de Biologie de la Motricité, France
4) Hugo Bessaguet, Université Jean Monnet Saint-Etienne, Lyon 1, Université Savoie Mont-Blanc, Laboratoire Interuniversitaire de Biologie de la Motricité, France
5) Loic Espeit, Université Jean Monnet Saint-Etienne, Lyon 1, Université Savoie Mont-Blanc, Laboratoire Interuniversitaire de Biologie de la Motricité, France
6) Leonard Feasson, Université Jean Monnet Saint-Etienne, Lyon 1, Université Savoie Mont-Blanc, Laboratoire Interuniversitaire de Biologie de la Motricité, France
7) Guillaume Y Millet, Université Jean Monnet Saint-Etienne, Lyon 1, Université Savoie Mont-Blanc, Laboratoire Interuniversitaire de Biologie de la Motricité, France
8) Annemieke A. I. Buizer, Department of Rehabilitation Medicine, Amsterdam UMC, Vrije Universiteit Amsterdam, Amsterdam, Netherlands
9) Thomas Lapole, Université Jean Monnet Saint-Etienne, Lyon 1, Université Savoie Mont-Blanc, Laboratoire Interuniversitaire de Biologie de la Motricité, France

The main content of abstract:

Objective

Although the brain injury in individuals with Cerebral Palsy (CP) is non-progressive, with a level of disability considered as stable at the end of growth, clinical experience and the literature suggest an evolution of mobility issues during adulthood. While functional motor ability has been reported to develop through the early years of life in children with CP and then plateau, a decline in mobility in the third and fourth decade of life is commonly observed. Self-reported outcomes indicate worsening of gait performance as well as risk and fear of falls with ageing in CP adults. Yet the existing literature is lacking when it comes to offer mechanistic background explanations. Within the Typically Developing (TD) population, gait performance is known to decrease due to a combination of decreased muscle strength, increased metabolic cost of walking (i.e. associated to

changes in gait biomechanics) together with decreased VO2-peak, and increased exercise-induced fatigability. It can therefore be speculated that such ageing-induced alterations are exacerbated in individuals with CP. To test this hypothesis, we investigated differences in gait performance, muscle strength, VO2peak, metabolic cost of walking and fatigability in young (18-25-year-old) and older (35-50-year-old) groups of CP and TD individuals.

Methods

This observational study employs a case-control design in which a comparable TD individual was included following the inclusion of an individual with CP. The study compares four different groups, a young and older group with and without CP (young: 18-25 and older: 35-50 years old). The inclusion criteria stipulated a Gross Motor Function Classification System (GMFCS) level I or II at age 18, retrospectively evaluated through medical records and patient reports. The participants visited the laboratory four times. The first visit focused on functional outcome measures: the 6-minute-walking test, timed-up-and-go test, and the 10-meter walking test at maximum speed. In addition, participants were tasked with a VO2-max test on a bike ergometer. The following visits included muscle testing to assess the strength of the knee extensor, knee flexor and ankle plantar flexor muscles of the most affected leg in the CP group and the non-dominant one in the TD group. Muscle strength was assessed isometrically and during 60 o/s and 120 o/s concentric maximal contractions. Further, oxygen consumption was assessed during the six-minute-walking test and on a treadmill using self-selected walking speed and quicker speeds. In order to investigate fatigability, participants were installed on a bike ergometer that allows for isometric force assessment through blocked pedals, those force measurements being performed at each stage and at the end of an incremental fatiguing protocol (i.e. three-minute intervals of increasing intensity (stage 1-5: +.3 W/kg, until stage 6-: +.4 W/kg) until exhaustion). Additionally, electrical stimulation of the femoral nerve allowed for interpolated twitch technique testing. The combination of maximal voluntary contractions and interpolated twitch technique allowed for an estimation of exercise-induce fatigability (i.e. decrease in maximal force) alongside with neural (i.e. voluntary activation) and peripheral (i.e. evoked force at rest) alterations.

Results

As of now, 19 participants have been included, 9 with CP (3 young) and 10 TD (3 young). Early indications have shown differences between young and older CP individuals in walking performance where such differences are not observed in the TD groups, as seen for example for the six-minute walking test performance (young CP: 542 ± 70, older CP: 372 ± 101, young TD: 640 ± 43 and older TD: 623 ± 55 m). Similar findings were observed for other functional outcomes (e.g. 10-meter walking speed, young CP: 1.8 ± 0.14 and old CP: 1.2 ± 0.27 m/s). Oxygen consumption, as a percentage of VO2-peak (VO2-peak young CP: 42 ± 7, old CP: 29 ± 11, young TD: 45 ± 2 and old TD: 36 ± 10 mlO2/min/kg) during walking trials differed between participants in the TD group and those in the older CP group when on the treadmill with higher consumption only in the older CP group. The differences seen in overground walking were in walking speed, not percentage of peak oxygen consumption at self-selected pace. Besides the fact that TD are stronger than CP individuals, strength measures indicated a larger age-related decrease in strength within the CP population (young to older with CP: -65 % vs TD: -24 % loss of normalized isometric force when pooling all tested muscular groups). A similar tendency could be seen for dynamic movements. While no differences were observed between young and older TD, the older CP group showed diminished

voluntary activation compared to the young one. Fatigability (i.e. force loss at the last common stage, young CP: - 7.2 %, older CP: - 51.7 %, young TD: - 4.1 %, older TD: - 2.2 % force lost after the fourth stage) increased with age in CP but not in TD and this was associated to greater neural alterations (changes in voluntary activation: young CP: - 31.4, older CP: - 28.72, young TD: - 2.0 and older TD: - 4.4 %-points & changes in normalized twitch amplitude: young CP: -6, older CP: -29, young TD: -17 and older TD: -29 %-points).

Conclusions
The current investigation will add to the understanding of ageing in CP adults from a movement perspective. We believe that our preliminary data can shed light on tendencies in age-related differences and the comparable differences in a neurotypically developing population. Our results indicate similarities in evolution for VO2-measures, while the clinical measures, fatigability and strength appear to decline at a faster pace in the CP group than their TD counterparts. It is of great importance to investigate if there's a common and accelerated denominator in the ageing process among ambulatory adults with CP, as that can aid in prescribing physical activity that might alleviate or postpone a decline. Given the multifaceted and broad investigation into a group of participants, we expect to offer a first estimation of potential mechanical mechanisms affecting gait.

Brief description of the abstract
Although cerebral palsy (CP) is a non-progressive brain injury, with a level of disability considered as stable at the end of growth, clinical experience and the literature suggest an evolution of mobility issues during adulthood. The aim of the current study is to investigate the differences between a young (18-25-year-old) and an older (35-50-year-old) group with and without CP on a wide spectrum of movement related measures.

Track: Body posture and stability

O-10 Investigation of the stress-strain state of the foot model before and after surgical treatment by different methods.

Information about abstract submitter

1) Paviel Rakhman, "MedGarden" Chernivtsi Private Hospital, Ukraine*
2) Oleksandr Korolkov, Lviv Ragional Children Hospital, Ukraine

The main content of abstract:

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.

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 - 4.9MPa to 7.2 MPa and on surfaces of the talo-calcaneal joint to 6.9 MPa, and on the posteriolateral 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. Significance: To determine the degree of tension in the foot with various methods of treatment. And to determine the most effective methods of treatment for different degrees of flatfoot deformity

Brief description of the abstract

To determine the degree of tension in the foot with various methods of treatment. And to determine the most effective methods of treatment for different degrees of flatfoot deformity

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