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Interventions and Management

1. Protocol and Feasibility-Randomized Trial of Telehealth Delivery for a Multicomponent Upper Extremity Intervention in Infants With Asymmetric Cerebral Palsy

Lindsay Pietruszewski, Stephanie Burkhardt, Paul J Yoder, Jill Heathcock, Dennis J Lewandowski, Nathalie L Maitre

Background: Past work showed that an in-person, therapist-guided, parent-implemented multicomponent intervention increased the motor functioning of the more affected upper extremity (UE) in infants with asymmetric cerebral palsy. The authors document treatment fidelity and provide initial testing of telehealth intervention delivery in a new subject sample. Methods: The authors adapted the intervention manual used in the previous trial for telehealth. Infants (6-24 months) were randomly assigned to intervention (n = 7) or waitlist (n = 6). The intervention prescribed soft-constraint wear on the less affected UE for 6 hours, 5 d/wk, and exercises. After an initial in-person training session, three 15- to 45-minute telehealth sessions were performed. Results: Median weekly constraint wear was 21 hours (interquartile range = 10.3-29.7); average parent-treatment fidelity was 95.7% (SD 11.2). A significant large (Cohen d = 0.92) between-group differences occurred on fine motor functioning of more affected UEs. Conclusion: The telehealth intervention was feasible and potentially effective, but a larger trial is needed to evaluate efficacy.

PMID: 33015220

2. Feasibility and effectiveness of home-based therapy programmes for children with cerebral palsy: a systematic review

Laura W M E Beckers, Mellanie M E Geijen, Jos Kleijnen, Eugene A A Rameckers, Marlous L A P Schnackers, Rob J E M Smeets, Yvonne J M Janssen-Potten

Objective: To assess the feasibility and effectiveness of home-based occupational therapy and physiotherapy programmes in children with cerebral palsy (CP), focusing on the upper extremity and reporting on child-related and/or parent-related outcomes. Design: Systematic review. Data sources: Electronic searches were performed in MEDLINE, EMBASE, CINAHL, PsycINFO, OTseeker and PEDro, and in ICTRP and CENTRAL trial registers, from inception to 6 June 2019. Eligible criteria: The review included all types of original studies concerning feasibility or effectiveness of home-based therapy in children aged <18 years with any type of CP. No language, publication status or publication date restrictions were applied. Data extraction and synthesis: Study and intervention characteristics and the demographics of participating children and their parents were extracted. Feasibility was assessed by outcomes related to acceptability, demand, implementation, practicality, adaptation, expansion or integration. Regarding effectiveness, child-related outcome measures related to any level of the International Classification of Functioning, Disability and Health, or parent-related outcomes were investigated. Two authors

independently extracted the data. Risk of bias was assessed using the Downs and Black checklist and the Joanna Briggs Institute Critical Appraisal Checklist. Results: The search resulted in a total of 92 records: 61 studies and 31 conference abstracts. Feasibility studies reported mainly on acceptability and implementation. Overall compliance to home-based training programmes (implementation) was moderate to high, ranging from 56% to 99%. In the effectiveness studies, >40 different child-related outcome measures were found. Overall, an improvement in arm-hand performance within group across time was shown. Only two studies reported on a parent-related outcome measure. No increase in parental stress was found during the intervention. Conclusions: Based on the results of the included studies, home-based training programmes seem to be feasible. However, conclusions about the effectiveness of home programmes cannot be made due to the large variability in the study, patient and intervention characteristics, comparators, and outcome measures used in the included studies. Prospero registration number: CRD42016043743.

PMID: 33028544

3. Progressive age and other factors affecting scoliosis severity in cerebral palsy patients
Ryoko Takeuchi, Hirotaka Mutsuzaki, Yuki Mataki, Hiroshi Kamada

J Rural Med. 2020 Oct;15(4):164-169. doi: 10.2185/jrm.2020-013. Epub 2020 Oct 1.

Objective: This study aimed to investigate the age at which scoliosis progresses to a severe condition and identify the factors related to severe scoliosis in patients with cerebral palsy. Patients and Methods: This retrospective study included 51 patients aged ≥15 years. The Cobb angle was measured over time using radiographs. Patients were divided into the following groups according to their final Cobb angle: <60°, 60°-100°, and ≥100°. The age at which the Cobb angle was ≥20° in the patients was compared among the groups. Moreover, the age at which a significant difference in the Cobb angle occurred in the groups was considered the age at which the scoliosis worsened. Association of the final Cobb angle with factors such as the location of curve, Gross Motor Functional Classification System (GMFCS), capability of turning over, orthosis use, hip dislocation, tracheotomy, and gastric fistula was examined. Results: The mean age at which the Cobb angle was ≥20° was significantly lower in the ≥100° group. From 9 years of age, a significant difference was noted in the Cobb angle between the <60° group and ≥100° group. Between 13-19 years, a significant difference in the Cobb angle was observed among the three groups. Furthermore, GMFCS, capability of turning over, hip dislocation, and gastric fistula were the factors showing a significant difference among the three groups. Conclusion: Scoliosis progressed to the severe form (Cobb angle ≥100°) at 9 years of age. Moreover, scoliosis is aggravated during the growth period. Severe cerebral palsy with low motor function levels and problems with internal functions was considered the cause of scoliosis deterioration.

PMID: 33033536

4. Lordoscoliosis and hyperlordosis in quadriplegic cerebral palsy
Chanan Vivek Goyal, Waqar Mohsin Naqvi

Pan Afr Med J. 2020 Aug 4;36:242. doi: 10.11604/pamj.2020.36.242.24971. eCollection 2020.

PMID: 33014238

5. Sustained involuntary muscle activity in cerebral palsy and stroke: same symptom, diverse mechanisms
Christian Riis Forman, Christian Svane, Christina Kruuse, Jean-Michel Gracies, Jens Bo Nielsen, Jakob Lorentzen

Brain Commun. 2019 Nov 25;1(1):fcz037. doi: 10.1093/braincomms/fcz037. eCollection 2019.

Individuals with lesions of central motor pathways frequently suffer from sustained involuntary muscle activity. This symptom shares clinical characteristics with dystonia but is observable in individuals classified as spastic. The term spastic dystonia has been introduced, although the underlying mechanisms of involuntary activity are not clarified and vary between individuals depending on the disorder. This study aimed to investigate the nature and pathophysiology of sustained involuntary muscle activity in adults with cerebral palsy and stroke. Seventeen adults with cerebral palsy (Gross Motor Function Classification System I-V), 8 adults with chronic stroke and 14 control individuals participated in the study. All individuals with cerebral

palsy or stroke showed increased resistance to passive movement with Modified Ashworth Scale >1. Two-minute surface EMG recordings were obtained from the biceps muscle during attempted rest in three positions of the elbow joint; a maximally flexed position, a 90-degree position and a maximally extended position. Cross-correlation analysis of sustained involuntary muscle activity from individuals with cerebral palsy and stroke, and recordings of voluntary isometric contractions from control individuals were performed to examine common synaptic drive. In total, 13 out of 17 individuals with cerebral palsy and all 8 individuals with stroke contained sustained involuntary muscle activity. In individuals with cerebral palsy, the level of muscle activity was not affected by the joint position. In individuals with stroke, the level of muscle activity significantly ($P < 0.05$) increased from the flexed position to the 90 degree and extended position. Cumulant density function indicated significant short-term synchronization of motor unit activities in all recordings. All groups exhibited significant coherence in the alpha (6-15 Hz), beta (16-35 Hz) and early gamma band (36-60 Hz). The cerebral palsy group had lower alpha band coherence estimates, but higher gamma band coherence estimates compared with the stroke group. Individuals with increased resistance to passive movement due to cerebral palsy or stroke frequently suffer sustained involuntary muscle activity, which cannot exclusively be described by spasticity. The sustained involuntary muscle activity in both groups originated from a common synaptic input to the motor neuron pool, but the generating mechanisms could differ between groups. In cerebral palsy it seemed to originate more from central mechanisms, whereas peripheral mechanisms likely play a larger role in stroke. The sustained involuntary muscle activity should not be treated simply like the spinal stretch reflex mediated symptom of spasticity and should not either be treated identically in both groups.

PMID: 33033798

6. How can we improve clinical practice of spastic hip dislocation in cerebral palsy?
Marek Jóźwiak

Dev Med Child Neurol. 2020 Nov;62(11):1229. doi: 10.1111/dmcn.14534.

PMID: 33015838

7. Evaluation of infrapatellar tendon plication in spastic cerebral palsy with crouch gait pattern: a pilot study
Mohamed Tageldeen Mohamed, Mohamed Elsobky, Mohamed Hegazy, Hassan M Elbarbary, Mohamed Mostafa Abdelmohsen, Mostafa Elsherbini, Ahmed Samir Barakat, Nader M Diab

SICOT J. 2020;6:40. doi: 10.1051/sicotj/2020037. Epub 2020 Oct 8.

Objective: In order to substantially improve crouch pattern in cerebral palsy, the existent patella alta needs to be addressed. This pilot study evaluates the effectiveness of a previously described infrapatellar tendon plication for the treatment of patella alta in crouch gait pattern in skeletally immature spastic cerebral palsy patients. Methods: In 10 skeletally immature patients (20 knees) with spastic diplegia and crouch gait, the previously described technique by Joseph et al. for infrapatellar tendon plication was evaluated within the setting of single event multilevel surgery (SEMLS). Outcome measures included knee extension lag, Koshino's radiological index for patella alta, and the occurrence of complications. Patients were followed-up for a minimum of 12 months. Results: The extensor lag improved and was statistically significant in all cases of the study with no incidence of tibial apophyseal injury at the latest follow-up. Radiographic Koshino index normalized and was maintained all through the follow-up period except in one patient (5%) who was overcorrected. Two patients (4 knees, 20%) showed postoperative knee stiffness due to casting which resolved with physiotherapy within six weeks. One knee (5%) developed a superficial infection which also resolved uneventfully with repeated dressings. Conclusion: The described infra-patellar plication technique in skeletally immature spastic diplegics appears effective, safe, and reproducible.

PMID: 33030425

8. Outcomes of isolated soft tissue surgery for in-toeing gait in patients with ambulatory cerebral palsy
Bruno Dohin, Elie Haddad, Bérénice Zagorda-Pallandre, Marion Zemour

Orthop Traumatol Surg Res. 2020 Sep 29;S1877-0568(20)30246-2. doi: 10.1016/j.otsr.2020.06.008. Online ahead of print.

Background: Soft tissue surgery to address in-toeing gait in young cerebral palsy (CP) patients may be an alternative in some cases to femoral derotation osteotomy (FDO), which is the currently accepted treatment. The relative contribution of muscular contracture, spasticity and bone deformity is still controversial. In this study, we determined the outcomes of soft tissue surgery on hip internal rotation (HIR) when femoral anteversion was less than 45° and the soft tissues were identified as being the cause. Methods: This prospective study included select adolescent patients who were operated in the context of single-event multilevel surgery. The soft tissues' contribution to the HIR was identified beforehand. The surgical procedures focused on the hamstrings, adductor magnus and gluteus minimus muscles. Results: Over a 6-year period, 21 patients (mean age 14 years) and 25 lower limbs were treated. The HIR improved by an average of 17.4°±4.8° (95% CI). The gait deviation index and gait profile score also improved significantly. At a mean follow-up of 36 months, no loss of correction had occurred. Discussion: In -toeing gait in CP patents is due to the action of retracted and/or spastic muscles and the presence of excessive bone torsion. When femoral anteversion<45°, confirming soft tissue involvement allows us to do a surgical procedure on the soft tissues only to correct the dynamic aspect of HIR. Our findings suggest that, under the right conditions, soft tissue surgery can improve in-toeing gain in the long term. This technique has its place alongside FDO in certain CP patients who do not have severe femoral anteversion.

PMID: 33008781

9. Therapeutic Effects of an Anti-Gravity Treadmill (AlterG) Training on Neuromuscular Abnormalities Associated with Spasticity in Children with Cerebral Palsy

Sh Noroozi, R Mehrabi, M Lotfian, F Nooshiravan, A Shahroki, A Irani, M M Mirbagheri

We aimed to characterize the therapeutic effects of Anti-Gravity Treadmill (AlterG) Training on neuromuscular abnormalities associated with spasticity in children with cerebral palsy (CP). Eighteen subjects were divided into two groups; AlterG and control. All subjects received up to 40 minutes of training 3 times a week for 8 weeks. The control group received conventional occupational therapy. The advanced parallel-cascade system identification technique was used to characterize the neuromuscular abnormalities associated with spasticity and separated its intrinsic and reflex components. Reflex stiffness gain (GR) and intrinsic stiffness gain (K) were used to track the therapeutic effects of training on neural and muscular abnormalities. Both K and GR were strongly positioned dependent; they varied linearly with the ankle angle at dorsiflexion. Their position dependence was quantified by fitting a linear model to K and GR over dorsiflexion positions. The evaluations were performed at four-time points; i.e. the baseline (before starting the training), 1 and 2 months after starting the training, and 1 month after the completion of the training to assess the persistent effects. We determined the changes in K and GR intercept and slope parameters over these 3 months to evaluate the therapeutic effects of training on neuromuscular abnormalities. The results revealed that all K and GR parameters decreased substantially following using AlterG training and these changes were greater than those observed in the control. The results also showed that these therapeutic effects were persistent to a high extent, particularly in the AlterG group. Our findings suggested that AlterG training could be considered as a robust therapeutic intervention to reduce neuromuscular abnormalities and manage spasticity.

PMID: 33018842

10. Measurement of Bone Mineral Density in Children with Cerebral Palsy from an Ethical Issue to a Diagnostic Necessity

Jasmin S Nurković, Pavle Petković, Danijela Tiosavljević, Radiša Vojinović

Introduction: Due to concerns about cumulative radiation exposure in the pediatric population, it is not standard practice to perform dual-energy X-ray absorptiometry (DXA) analysis in the diagnostic process of musculoskeletal disorders, such as cerebral palsy (CP). This study aimed to evaluate the bone mineral density (BMD) in children with CP and the ethical justification of applying DXA analysis in these children. Material and Methods. In this monocentric retrospective analysis, data were collected from children and adolescents with CP who were treated for a primary illness for three years. A clinical examination, which included a DXA analysis, recommended by the multidisciplinary team, was performed. After applying inclusion and exclusion criteria, 60 scans remained for statistical analysis. BMD and Z-scores for the lumbar spine (LS), and hip right and left femoral neck (RFN and LFN, respectively), and total hip (TH) were recorded. Results: The average age of children with CP when DXA analysis was first performed was about 7 years. The BMD (mean ± SD) at LS (LS-BMD) of all

patients was 0.612 ± 0.12, at RFN 0.555 ± 0.11, at LFN 0.572 ± 0.1, and at TH (TH-BMD) 0.581 ± 0.13. The values of the Z-score (mean ± SD) at LS of all patients were -2.5 ± 0.22, at RFN -2.2 ± 0.21, at LFN -2.25 (SD = 0.2), and at TH -2.3 (SD = 0.23). There was no statistical significance between age and gender; however, BMI, walking ability, fracture history, and pattern of CP had a significant impact on BMD and Z-score values of these children. Conclusion: The results of our study clearly indicate that children with CP have a higher risk of low BMD, osteoporosis, and bone fractures, which makes it ethically justifiable to perform the DXA analysis in these children.

PMID: 33015177

11. [Classification systems for children and adolescents with cerebral palsy: their use in clinical practice][Article in Spanish]

Maria de Las Mercedes Ruiz Brunner, Johana Escobar Zuluaga, María Elisabeth Cieri, Carolina Ayllón, Eduardo Cuestas

Introduction: Classification systems are internationally used tools to characterize the functions of children and young people with cerebral palsy (CP), for clinical and research use. The aim of this study was to characterize the different classification systems available and describe the usefulness of each of the classifications, describing their use in clinical practice. Methods: An exhaustive bibliographic revision was performed using the Cochrane Database, MEDLINE, LILACS y Google Scholar databases. The search period was from 1997 to 2019 using key words. Classification systems were included that focused on functions and body structures, considered the International Classification of Functioning, Disability and Health, were validated and in English and Spanish. The quality of the works was assessed according to the AGREE reporting checklist. Results: Six classification systems were found for children with CP regarding their functions and body structures. Each of the systems focuses on a specific function or skill, which are: gross motor function, manual skills, communication functions, eating and drinking skills, MRIs, and visual functions. Main conclusion: All systems have been validated, standardized and used internationally. They serve to more fully describe the functional levels and body structure of children with CP both at the clinical, population and research levels.

PMID: 32991108

12. Effect of low dose robotic-gait training on walking capacity in children and adolescents with cerebral palsy

Yosra Cherni, Laurent Ballaz, Josiane Lemaire, Fabien Dal Maso, Mickael Begon

Objective: Robotic gait training presents a promising training modality. Nevertheless, evidence supporting the efficacy of such therapy in children with cerebral palsy remains insufficient. This study aimed to assess the effect of robotic gait training in children/adolescents with cerebral palsy. Methods: Twenty-four children/adolescents with bilateral cerebral palsy (12 female, 10.1 ± 3.1 years, Gross Motor Function Classification System II to IV) took part in this study. They received two 30-45 min sessions/week of Lokomat training for 12-weeks. Muscle strengths, 6-min walk exercise and gait parameters were evaluated pre- and post-training and at 6-months-follow-up. Training effect according to the level of impairment severity (moderate vs severe) was analyzed using a change from the baseline procedure. Results: A significant increase in muscle strength was observed after training ($p \leq 0.01$). Hip flexors and knee extensors strength changes were maintained or improved at follow-up ($p < 0.05$). Comfortable walking speed was significantly increased by +20% after training with a slight reduction at follow-up compared to post-training condition (-2.7%, $p < 0.05$). A significant step length increase was observed after training (14%, $p \leq 0.001$). The distance covered in 6 min was higher in post-training (+24%, $p \leq 0.001$) and maintained at follow-up compared to pre-training conditions. No significant changes in kinematic patterns were observed. The analysis by subgroup showed that both groups of children (with moderate and severe impairments) improved muscle strength and walking capacities after Lokomat training. Conclusion: The suggested Lokomat training induced improvement in walking capacity of children/adolescents with cerebral palsy whatever the level of severity. Hence, Lokomat training could be viewed as a valuable training modality in this population.

PMID: 33011059

13. Human 3D pose estimation in a lying position by RGB-D images for medical diagnosis and rehabilitation
Qingqiang Wu, Guanghua Xu, Sicong Zhang, Yu Li, Fan Wei

Annu Int Conf IEEE Eng Med Biol Soc. 2020 Jul;2020:5802-5805. doi: 10.1109/EMBC44109.2020.9176407.

Posture recognition in the human lying position is of great significance for the rehabilitation evaluation of lying patients and the diagnosis of infants with early cerebral palsy. In this paper, we proposed a novel method for human 3D pose estimation in a lying position with the RGB image and corresponding depth information. Firstly, we employ current pose estimation method on RGB images to achieve the human full body 2D keypoints. By combining the depth information and coordinate transformation, the 3D movement of human in lying position can be obtained. We validate our method with two public datasets. The results show that the accuracy can reach the state-of-the-art.

PMID: 33019293

14. Customized Access Technology for Children using Head Movement Recognition
Silvia Orlandi, Fanny Hotze, Derrick Lim, Sofia Gonzalez Estrada, Destinee Muir, Hilary A Friesen, Tom Chau

Annu Int Conf IEEE Eng Med Biol Soc. 2020 Jul;2020:1783-1786. doi: 10.1109/EMBC44109.2020.9175747.

Children with cerebral palsy and complex communication needs face limitations in their access technology (AT) usage. Speech recognition software and conventional ATs (e.g., mechanical switches) can be insufficient for those with speech impairment and limited control of voluntary motion. Automatic recognition of head movements represents a promising pathway. Previous studies have shown the robustness of head pose estimation algorithms on adult participants, but further research is needed to use these methods with children. An algorithm for head movement recognition was implemented and evaluated on videos recorded in a naturalistic environment when children were playing a videogame. A face-tracking algorithm was used to detect the main facial landmarks. Head poses were then estimated using the Pose from Orthography and Scaling with Iterations (POSIT) algorithm and three head movements were classified through Hidden Markov Models (HMMs). Preliminary classification results obtained from the analysis of videos of five typically developing children showed an accuracy of up to 95.6% in predicting head movements.

PMID: 33018344

15. Differentiating Motor Coordination and Position Sense in Children with Cerebral Palsy and Typically Developing Populations Through Robotic Assessments
Stephan C D Dobri, Dawa Samdup, Stephen H Scott, T Claire Davies

Annu Int Conf IEEE Eng Med Biol Soc. 2020 Jul;2020:3654-3657. doi: 10.1109/EMBC44109.2020.9175878.

Motor function and coordination improve as children age. Robotic assessments of motor function and coordination have been shown to be repeatable, objective, and accurate. Additionally, robotic assessments have been used to measure and quantify deficits in motor function and coordination in children with cerebral palsy (CP). Normative models of motor function and coordination based on age have not been used widely to differentiate impaired performance from typical performance. This study presents preliminary results of identifying deficits in motor function and coordination assessed with a robotic reaching task and using a normative model of typical performance that accounts for age, sex, and handedness. The models were compared with data from three participants with CP to evaluate whether the models could be used to identify deficits in motor function. The models indicated motor deficits in one participant when performing a visually guided reaching task with respect to initial speed and distance ratios. There was no evidence of motor control deficits in the other two participants. Future work will refine the models to be able to better identify and quantify motor control impairments with the potential to target therapy around quantifiable goals.

PMID: 33018793

16. A Study of the Safety and Functionality of Gamified Electromyographic Biofeedback for Children with Cerebral Palsy
E Narducci, K Mouttet, A Shahbazi, D Pool, T Tan

Cerebral palsy is a neurodevelopmental condition that affects 17 million individuals worldwide. Traditionally, methods of therapy are repetitive and monotonous, generating immense difficulty in maintaining patient motivation and engagement. This project's objective was to provide a novel method of therapeutic intervention that was co-designed by therapists and had the capacity to increase patient motivation and enjoyment. The system developed incorporated the use of muscle activations retrieved from a bespoke surface electromyography subsystem, to control custom computer games to increase therapy uptake. The safety and functionality of this device was verified through a series of trials performed on adults without any muscular impairments. Furthermore, a feasibility evaluation was conducted whereby the system was demonstrated to a group of healthcare professionals to gain their feedback. The trial results confirmed the safety and functionality of the system, with professional therapists confirming its clinical potential and its perceived benefits.

PMID: 33019152

17. Emergency department use in children with cerebral palsy: a data linkage study
Olivier Fortin, Pamela Ng, Marc Dorais, Louise Koclas, Nicole Pigeon, Michael Shevell, Maryam Oskoui

PMID: 33023677

18. Risk Factors of Strabismus Surgery among Pediatric Cerebral Palsy Population with Strabismus in Taiwan: A Population-Based Cohort Study
Wei-Yu Lai, Tsu-Jen Kuo, Ching-Chih Lee, Chun-Hao Yin

Background: To identify the risk factors of strabismus surgery among Taiwanese children with severe cerebral palsy (CP) and strabismus. Methods: This retrospective nationwide population-based cohort study examined a cohort of newly diagnosed pediatric CP patients (age ≤ 10 years) between 1997 and 2013 with strabismus. The primary endpoint was strabismus surgery. A stepwise logistic regression was applied to determine the demographic factors, ophthalmic conditions, and comorbidities associated with strabismus surgery. Results: Out of 808 patients, 115 had received strabismus surgery. The significant factors correlated to strabismus surgeryin pediatric patients with severe CP and strabismus were CP diagnosis age < 4 years, residency in a suburban/rural area, low birth weight, and strabismic amblyopia. Conclusion: In CP children with strabismus who have risk factors of younger CP diagnosis age (age < 4years), residency in a suburban/rural area, a low birthweight, and the presence of strabismic amblyopia, strabismus surgery should be considered.

PMID: 33009210

19. Users of rehabilitation services in 14 countries and territories affected by conflict, 1988-2018
Cornelia A Barth, Andreas Wladis, Catherine Blake, Prashant Bhandarkar, Cliona O'Sullivan

Objective: To analyse the demographic and clinical characteristics of people attending physical rehabilitation centres run or supported by the International Committee of the Red Cross in countries and territories affected by conflict. Methods: Of 150 such rehabilitation centres worldwide, 38 use an electronic patient management system. We invited all 38 centres to participate.

We extracted de-identified data from 1988 to 2018 and categorized them by sex, age, country or territory and reason for using rehabilitation services. Findings: Thirty-one of the 38 rehabilitation centres in 14 countries and territories participated. We included data for 287 274 individuals. Of people using rehabilitation services, 61.6% (176 949/287 274) were in Afghanistan, followed by 15.7% (44 959/287 274) in Cambodia. Seven places had over 9000 service users each (Afghanistan, Cambodia, Gaza Strip, Iraq, Myanmar, Somalia and Sudan). Overall, 72.6% (208 515/287 274) of service users were male. In eight countries, more than half of the users were of working age (18-59 years). Amputation was the most common reason for using rehabilitation services; 33.3% (95 574/287 274) of users were people with amputations, followed by 13.7% (39 446/287 274) with cerebral palsy. The male predominance was greater in the population aged 18-34 years (83.1%; 71 441/85 997) and in people with amputations (88.6%; 84 717/95 574) but was evident across all places, age groups and health conditions. Conclusion: The considerably lower attendance of females at the rehabilitation centres highlights the need to understand the factors that affect the accessibility and acceptability of rehabilitation for women and girls in conflict settings.

PMID: 33012860

20. Puberty and menarche in young females with cerebral palsy and intellectual disability: a qualitative study of caregivers' experiences

Susan H Gray, Molly Wylie, Sinead Christensen, Anqa Khan, David Williams, Laurie Glader

Dev Med Child Neurol. 2020 Oct 3. doi: 10.1111/dmcn.14698. Online ahead of print.

Aim: To explore experiences of parents of young females with cerebral palsy (CP) and intellectual disability at the onset of puberty. Method: This was a phenomenological qualitative study. We conducted phone interviews of parents of young females with CP and intellectual disability who had been seen in the CP center at a freestanding children's hospital within the prior 2 years. Inclusion criteria were English-speaking parents of young females who had combined diagnoses of CP and intellectual disability. Interviews were coded and analyzed by the research team facilitated by Dedoose software. Results: Nine interviews were conducted with parents of daughters aged 14 to 24 years. All daughters used wheelchairs for mobility and augmentative technology for communication. Despite homogeneity in functional ability, there was marked variation in parental perception of the significance of puberty for their daughters. Families often learned about reproductive health from informal social networks. Although families acknowledged the need for sexual abuse screening, there was little consensus about how to do it, and most denied that their own daughter could ever be abused. Interpretation: Parents of young females with CP and intellectual disability have diverse reproductive health beliefs that health care providers must explore in order to provide appropriate recommendations for management of puberty.

PMID: 33010048

21. The Most Cited Original Articles in Brain Imaging of Children With Cerebral Palsy: A Bibliometric Analysis Between 1984 and 2019

Fan Wu, Xiaoyu Wang, Xianjun Li, Haoxiang Jiang, Tingting Huang, Congcong Liu, Miaomiao Wang, Zhonghui Zhai, Xiaoman Zhang, Jingjing Zhang, Heng Liu, Jian Yang

Front Neurol. 2020 Sep 8;11:955. doi: 10.3389/fneur.2020.00955. eCollection 2020.

Objective: Brain imaging is important in diagnosing children with cerebral palsy (CP) and in identifying its etiology. To provide study navigation in this field, a bibliometric analysis was conducted by analyzing the most highly cited articles. Methods: The Web of Science All Databases were used for literature search in this study. All original articles on imaging in children with CP were searched. Two reviewers screened the search results independently and eliminated articles based on exclusion criteria such as participants over 20 years old, topics referring to images outside of the brain, or trauma. According to descending order of yearly citation counts, the top 25% of all included articles were considered as highly cited articles. Information such as yearly citations, research purposes, imaging modalities, CP types, and study designs were recorded and analyzed. Results: A total of 50 highly cited articles ranked by yearly citations (from 23.85 to 3.33, 1991-2018) were included in this study. Considering different research purposes, these studies were classified into three categories: diagnosis studies (n = 25; 1991-2017, median: 2011), mechanism studies (n = 15; 1999-2018; median: 2014), and prognosis and therapeutic effect studies (n = 10; 2008-2017; median: 2014.5). First, for diagnosis studies, 22 studies used single modality and three used multi-modalities; the majority of these studies focused on diagnostic value evaluation (n = 10) and image performance (n = 12) of a single type of CP (n = 15) by using descriptive (n = 14) or cross-sectional approaches (n = 10). Second, for mechanism studies, the ratio between single and multi-modality was 8:7; most of these studies concentrated on a single subtype of spastic CP

(hemiplegia = 10, quadriplegia = 2) with a cross-sectional study design (n = 10). Third, regarding the prognosis and therapeutic effect studies, the single vs. multi-modality ratio was 5:5, and these studies were dedicated to the efficiency of constraint-induced movement therapy in children with hemiplegia; paired design trials (n = 6) and randomized controlled trials (n = 2) were used more frequently. Conclusion: Studies using multi-modality and high-level evidence-based design to provide information regarding mechanism, prognosis, and therapeutic efficacy may be the potential future research direction in the field of CP research.

PMID: 33013636

22. Evaluation of neurofilament light chain in the cerebrospinal fluid and blood as a biomarker for neuronal damage in experimental pneumococcal meningitis

Ngoc Dung Le, Lukas Muri, Denis Grandgirard, Jens Kuhle, David Leppert, Stephen L Leib

Background: Pneumococcal meningitis (PM) remains a global public health concern and affects all age groups. If acquired during infancy or childhood, permanent neurofunctional deficits including cognitive impairment, cerebral palsy, and secondary epilepsy are typical sequelae of neuronal injury. Determination of patients at risk for the development of brain injury and subsequent neurofunctional sequelae could help to identify patients for focused management. Neurofilament light chain (NfL) is an axonal cytoskeletal protein released upon neuronal injury into the cerebrospinal fluid (CSF) and blood. As little is known about the course of neurofilament release in the course of PM, we measured CSF and serum NfL levels longitudinally in experimental PM (ePM). Methods: Eleven-day-old infant Wistar rats were infected intracisternally with Streptococcus pneumoniae and treated with ceftriaxone. At 18 and 42 h post-infection (hpi), the blood and CSF were sampled for NfL measurements by a single molecule array technology. Inflammatory cytokines and MMP-9 in CSF were quantified by magnetic bead multiplex assay (Luminex®) and by gel zymography, respectively. Results: In ePM, CSF and serum NfL levels started to increase at 18 hpi and were 26- and 3.5-fold increased, respectively, compared to mock-infected animals at 42 hpi ($p < 0.0001$). CSF and serum NfL correlated at 18 hpi ($p < 0.05$, $r = 0.4716$) and 42 hpi ($p < 0.0001$, $r = 0.8179$). Both CSF and serum NfL at 42 hpi strongly correlated with CSF levels of IL-1β, TNF-α, and IL-6 and of MMP-9 depending on their individual kinetics. Conclusion: Current results demonstrate that during the peak inflammatory phase of ePM, NfL levels in CSF and serum are the highest among CNS disease models studied so far. Given the strong correlation of CSF versus serum NfL, and its CNS-specific signal character, longitudinal measurements to monitor the course of PM could be performed based on blood sample tests, i.e., without the need of repetitive spinal taps. We conclude that NfL in the serum should be evaluated as a biomarker in PM.

PMID: 33028339