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Interventions and Management

1. Effect of Trunk Targeted Interventions on Functional Outcomes in Children with Cerebral Palsy- A Systematic Review

Aishwarya J Talgeri, Akshatha Nayak, Shreekanth D Karnad, Preyal Jain, Jaya Shanker Tedla, Ravi Shankar Reddy, Devika Rani Sangadala

Objective of this review was to collate information on the effectiveness of trunk targeted intervention on children with cerebral palsy (CP) on three functional outcomes that are gross motor function, trunk control and balance. A comprehensive search was conducted on online databases from inception to August 2021, using relevant keywords. A total of 15 randomized controlled trials which enrolled children with cerebral palsy under 18 years met the inclusion criteria. A significant improvement was seen in the trunk targeted training groups on applying trunk targeted interventions. Trunk targeted interventions improve gross motor function, trunk control as well as balance, hence should be incorporated in the conventional physical therapy program delivered to children with CP and would help in greater functional recovery.

PMID: 37021364

2. Translation, reliability, and validity of the Brazilian-Portuguese version of the Early Activity Scale for Endurance (EASE)

Angélica Cristina Sousa Fonseca Romeros, Ricardo Sousa Junior, Deisiane Souto, Alyssa Fiss, Mariana Aguiar de Matos, Kennea Martins Almeida Ayupe, Robert J Palisano, Paula Silva de Carvalho Chagas, Ana Cristina Resende Camargos, Hércules Ribeiro Leite

Purpose: Translate, investigate reliability, and construct validity of the Brazilian Early Activity Scale for Endurance (EASE). Materials and methods: Translation followed the international guidelines. Test-retest reliability was tested by 100 parents of children with cerebral palsy (CP): 18 months-5 years and 6-11 years. To determine construct validity, 94 parents of typically children completed the EASE. Statistical analysis included Bland-Altman, Intraclass Correlation Coefficient (ICC), Internal Consistency, and Floor and Ceiling Effect. Results: The majority of the sample consisted of children with CP in GMFCS (IV-V). EASE showed good test-retest reliability for younger (ICC = 0.8) and excellent test-retest reliability for older children with CP (ICC = 0.9), and good internal consistency of 0.7 and 0.8 for the young and older group, respectively. Bland-Altman showed the bias close to zero, with no ceiling or floor effect. Regarding construct validity, younger children showed lower scores when compared to the older children. Endurance differed significantly between children with CP who were walking and those who were not walking and also for age groups. Children with CP showed lower endurance compared to typically participants in the same age group. Conclusions: Brazilian EASE is reliable and valid to estimate endurance in children with CP. Results provide evidence of construct validity.

PMID: 37026412

3. The effects of weight gain over time on gait in children with cerebral palsy: Comparison to a matched healthy weight cerebral palsy control group

Karen Brady, Damien Kiernan

Background: Children with cerebral palsy (CP) have demonstrated higher rates of overweight and obesity than their typically developed peers. Limited studies have assessed how being overweight or obese affect lower limb kinematics during gait in these children. Research question: How are lower limb kinematics during gait affected in children with CP who progress from a healthy weight to being overweight or obese compared to a well-matched healthy weight CP control group? Methods: A retrospective analysis of the movement analysis laboratory database was conducted. Children with CP were included if they were aged between 4 and 17 years at baseline ,had a follow-up assessment with a minimum of 12 months between assessments, and had no orthopaedic interventions between assessments. A matched control group of children with CP with the same inclusion criteria, except for a requirement of healthy BMI at follow-up, was included. Temporal-spatial and full 3-dimensional lower limb kinematic data were examined. Results: Normalized speed and step length reduced from baseline to follow-up for both groups, with no difference in the amount of change between groups. Children with increased BMI demonstrated increased external hip rotation during stance at follow-up not evident in the control group. Significance: Results demonstrated similar changes over time between groups. Increased external hip rotation in children with increased BMI was considered small and within the threshold of error associated with transverse plane kinematics. Our results suggest that being overweight or obese does not result in a meaningful change in lower limb kinematics in children with CP.

4. Feasibility of Functional Repetitive Neuromuscular Magnetic Stimulation (frNMS) Targeting the Gluteal Muscle in a Child with Cerebral Palsy: A Case Report

Michaela V Bonfert, Anne Meuche, Giada Urban, Corinna Börner, Ute Breuer, Birgit Warken, Christine Wimmer, Henriette Strattner, Tessa Müller, Matthias Hösl, Florian Heinen, Steffen Berweck, Sebastian A Schröder

Background: Motor impairment due to spasticity, weakness, and insufficient selective motor control is a key feature of cerebral palsy (CP). For standing and walking, the gluteal muscles play an important role. Physical therapy represents an evidence-based treatment to promote strength and endurance but may be limited to address selective motor control. Treatment incorporating neurostimulating techniques may increase the therapeutic benefits in these situations. Purpose: The aim of this case report was to evaluate the feasibility, safety and clinical effects of a customized protocol of functional repetitive neuromuscular magnetic stimulation (frNMS). Methods: This case report describes a frNMS protocol applied to the gluteal muscles in an 8-year old boy with bilateral spastic CP. The protocol combines 12 sessions of customized physiotherapeutic exercises with simultaneous electromagnetic stimulation. Results: frNMS protocol was adhered to as planned, no relevant adverse events were observed. At day four after the intervention the patient reported clinical benefits and improvements of standing and walking assessed by Gross Motor Function Measure dimensions D (+5.1%) and E (+4.2%) were documented. Body sway as measured by center of pressure displacement during posturography decreased. Conclusion: Clinical studies are warranted to assess effects of frNMS and its mechanisms of action in a controlled setting.

5. Validity and reliability of the 3-meter backward walk test in children with cerebral palsy

Omer Faruk Celik, Hatice Adiguzel, Zekiye Ipek Katirci Kirmaci, Suat Erel, Arzu Demirguc

Objective: To examine the validity and reliability of 3-Meter Backwalk Test (3MBWT) in children with Cerebral Palsy (CP). Methods: Study included 55 children with CP with the mean age of 12.34 ± 3.78 years, at Expanded and Revised Gross Motor Functional Classification System (GMFCS-E&R) I and II levels. Intraclass Correlation Coefficient (ICC) was used for the intra-rater and inter-rater reliability of 3MBWT according to the GMFCS-E&R levels. MDC estimates were calculated using baseline data. Convergent validity of 3MBWT was evaluated with its correlation between the Timed Up and Down Stairs Test (TUDS), Pediatric Balance Scale (PBS), Timed Up and Go Test (TUG), Pediatric Reach Test (PRT), Four Square Step Test (FSST). Results: Intra-rater and inter-rater reliability of 3MBWT was determined excellent at GMFCS-E&R I (Intra-rater ICC = 0.981-0.987, inter-rater ICC = 0.982-0.993), and GMFCS-E&R II (ICC = 0.927-0.933, ICC = 0.954-0.968). Intra-rater MDC values for GMFCS-E&R I were 1.17-1.22 s (s); 1.40-1.42 s for GMFCS-E&R II. Inter-rater MDC values for GMFCS-E&R I were 1.00-1.28 s, and MDC values for GMFCS-E&R II were 1.08-1.22 s. There was strong correlation between 3MBWT and PBS, TUG, and FSST in GMFCS-E&R I, moderate correlation between 3MBWT and TUDS, strong correlation between BBS, moderate correlation between TUG, and strong correlation between FSST in GMFCS-E&R II (p < 0.05). Conclusion: The

3MBWT was found to be valid and reliable in children with CP. According to the MDC results, small differences in CP children can be adequately detected with 3MBWT. The 3MBWT also may add some more information on to GMFCS (E&R) data for following the disease progression as well as rehabilitation responses.

PMID: 37014515

6. Identifying and prioritising strategies to optimise community gym participation for young adults with cerebral palsy: an e-Delphi study

Georgia McKenzie, Claire Willis, Alexa Yao, Freya Munzel, Rachel Kennedy, Nora Shields

Disabil Rehabil. 2023 Apr 5;1-9. doi: 10.1080/09638288.2023.2193431. Online ahead of print.

Purpose: Identify and prioritise strategies to optimise physical activity participation in the community gym setting for young adults with cerebral palsy. Methods: An e-Delphi method was implemented over three rounds with four stakeholder groups (young adults with cerebral palsy, their families, gym staff or exercise professionals, and health professionals). Strategies for change were identified by the stakeholders in round 1. In rounds 2 and 3, strategies for change were rated on the importance for implementation using a 7-point Likert scale (1 being lowest importance, 7 being highest). The consensus was achieved if ≥70% of participants identified a strategy as high importance. Results: Seventy participants (20 young adults 10 family members, 21 health professionals, and 19 exercise professionals) identified 83 strategies for improving gym participation. Of these, 44 strategies met the consensus criteria. The highest priority strategies related to changing the physical environment, addressing cost barriers, gym staff training, and developing partnerships between sectors. Conclusions: Addressing physical accessibility, cost of attendance and the skills of gym staff were agreed upon by the stakeholder groups as priority areas for future resource allocation and research translation. Clinicians and community leisure facilities must work with consumers to implement strategies in their local contexts. IMPLICATIONS for rehabilitation. The physical environment, gym staff training, and the cost of attendance are the priority areas for future interventions agreed on by key stakeholder groups. Health professionals can facilitate community participation by partnering with the recreation and research sectors to create pathways to gym exercise. Health professionals can play a role in developing the knowledge, skills and confidence of gym staff to support young people with cerebral palsy in the gym. When implementing 1:1 social support in community gym settings, consider the preferences of young adults and the resources available.

PMID: 37021370

7. Identifying reduced hearing in children who have developmental disabilities: Insights for inclusive research practices with electronic health records

Angela Yarnell Bonino, Deborah Mood

Front Psychol. 2023 Mar 15;14:1134034. doi: 10.3389/fpsyg.2023.1134034. eCollection 2023.

Introduction: Recent advancements in big data analytics and the formation of large-scale clinical data repositories provide a unique opportunity to determine the current state of pediatric hearing health care for children who have developmental disabilities. Before answering unresolved questions about diagnostic practice, it is paramount to determine a standard and reliable method for identifying children who have reduced hearing because clinical management is affected by hearing status. The purpose of this study was to compare 5 different methods for identifying cases of reduced hearing from pure-tone thresholds based on developmental disability status. Methods: Using retrospective clinical data from 100,960 children (0-18 years), hearing status was determined for a total of 226,580 encounters from three clinical sites. 9% of the children had a diagnosis of intellectual disability, autism spectrum disorder, Down syndrome, or cerebral palsy. Results: Results revealed that encounters from children who have developmental disabilities were more likely to have insufficient data to allow hearing status to be determined. Moreover, methods with higher data demands (i.e., number of thresholds and ear-specific thresholds) resulted in fewer classifiable encounters. The average child age when hearing status was classified for the first time was older for children who have developmental disabilities than for children in the comparison group. Allowing thresholds to build up over multiple test sessions did result in more children who have developmental disabilities being classified than for single-encounter methods, but a meaningful decrease in child age at the time of classification was not seen for this strategy. Compared to the comparison group, children who have developmental disabilities were more likely to have reduced hearing that was stable over time, yet their hearing status was determined at older ages. Discussion: Results provide key guidance to researchers for how to determine hearing status in children for big data applications using electronic health records. Furthermore, several assessment disparities are spotlighted for children who have developmental disabilities that warrant further investigation.

PMID: 37008840

8. Effectiveness of wheeled mobility skill interventions in children and young people with cerebral palsy: A systematic review

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Dev Med Child Neurol. 2023 Apr 6. doi: 10.1111/dmcn.15597. Online ahead of print.

Aim: To systematically review the effectiveness of wheeled mobility interventions in children and young people with cerebral palsy (CP). Method: A systematic literature search was performed in MEDLINE, Embase, Cochrane Central Register of Controlled Trials, EBSCO, PEDro, and Web of Science using database-specific concepts such as 'child' and 'wheelchair'. Studies focusing on wheeled mobility skill interventions with participants aged 6 to 21 years with CP were included. Results: Twenty studies with 203 participants were included. The impact of wheeled mobility skill interventions was assessed on mobility skills (n = 18), activity and participation (n = 10), and quality of life (n = 3). No studies reported effects on stress, fatigue, and motivational aspects. Interventions included power wheelchair skill training (n = 12), computer-based training (n = 5), smart wheelchair training (n = 2), and manual wheelchair training (n = 1), showing positive wheeled mobility intervention effects. Study quality based on the Methodological Index for Non-Randomized Studies scale was 9 out of 16 and 14 out of 24 for non-comparative and comparative studies respectively. Risk of bias was serious-to-critical on the Risk of Bias in Non-Randomized Studies of Interventions. Interpretation: Wheeled mobility interventions showed promising beneficial effects on wheeled mobility, activity and participation, and quality of life for children and young people with CP. Future studies with structured and standardized training programmes and assessment tools are warranted to further accelerate the wheeled mobility skill acquisition process in this population.

PMID: 37021407

9. Safety and adherence of pressure garment therapy in children with upper limb unilateral cerebral palsy. Results from a randomized clinical trial ancillary analysis

Laurent Béghin, Yasser Mohammad, Séverine Fritot, Guy Letellier, Sixtine Masson, Yann Zagamé, Catherine Donskoff, Mathide Toussaint-Thorin, Laurence Gottrand

Front Pediatr. 2023 Mar 21;11:1043350. doi: 10.3389/fped.2023.1043350. eCollection 2023.

Background: This study was conducted to assess the safety and adherence of the use of a PGT (Pressure Garment Therapy) Lycra® sleeve to treat upper limb unilateral cerebral palsy (UCP) in children. Methods: This study was conducted as a prospective, placebo-controlled, double-blinded, randomized monocenter study. Included in the study were 58 UCP children, 49 of whom were analyzed. 25 children (mean age 6.6 ± 1.6 years; 12 girls) were allocated to the active group vs. 24 (mean age 6.7 ± 1.6 years; 10 girls) in the placebo group. The intervention consisted of an active PGT Lycra® arm sleeve manufactured to generate a homogeneous pressure ranging from 15 to 25 mmHg. The placebo PGT Lycra® sleeve was manufactured to generate a homogeneous pressure under 7 mmHg. The time of wearing period was set at 3 h/day at minimum and 6 h/day at maximum, over the course of 6 months. The main outcome measures were safety outcomes including the number and intensity of Adverse Events of Special Interest (AESIs). AESIs were defined as adverse events imputable to compressive therapy and Lycra® wearing. Level of adherence was expressed in percentage of number of days when the sleeve was worn for at least 3 h per day compared to length of duration in days (start and end date of wearing period). Results: Frequency of AESIs were very low and no different between groups ($4.12 \pm 11.32\%$ vs. $1.83 \pm 3.38\%$; p = 0.504). There were no differences in adherence ($91.86 \pm 13.86\%$ vs. $94.30 \pm 9.95\%$; p = 0.425). Conclusion: The use of PGT Lycra® arm sleeve in children with UCP is safe and well-tolerated with a very good adherence. The low rate of AESIs is promising for further randomized clinical trials on efficacy.

PMID: 37025290

10. Understanding the use and benefits of assistive devices among young children with cerebral palsy and their families in Norway: a cross-sectional population-based registry study

Rikke Damkjær Moen, Sigrid Østensjø

Disabil Rehabil Assist Technol. 2023 Apr 7;1-9. doi: 10.1080/17483107.2023.2198563. Online ahead of print.

Purpose: Assistive technology intervention has become an important strategy in enhancing function in young children with cerebral palsy. This study aimed to provide an in-depth knowledge of the use of assistive devices by describing their purposes, the environments in which they are used, frequency of use and perceived benefits from the caregiver's perspective. Material and methods: This is a cross-sectional population-based study using data from national cerebral palsy registers in Norway. Of a total of 202 children, 130 participated (mean age 49.9 months, SD 14.0 months). Results: The 130 children and their families used a median of 2.5 assistive devices (range 0-12) to support positioning, mobility, self-care and training, stimulation and play. Devices most commonly had one or two main purposes and were used both at home and in kindergarten/school. The

usage rate varied from less than twice a week to several times a day. The majority of parents reported significant benefits for caregiving and/or the child's functioning. Total use increased in accordance with the level of the child's gross motor limitations and was associated with restrictions imposed by housing concerns. Conclusions: The frequent use of a wide range of devices, and the intended and perceived benefits, demonstrates that early provision of assistive devices can be an effective function-enhancing strategy in young children with cerebral palsy. However, the findings also indicate that factors others than the child's motor abilities must be considered when integrating the use of devices into the child's daily routines and activities. Implications for Rehabilitation. Early provision of assistive devices can be a powerful strategy to support everyday functioning and facilitate care in young children with cerebral palsy. Assistive devices seems to be most effective when they are well integrated into the child's daily routines and activities across environments. The clinical classifications of motor abilities (Gross Motor Function Classification System and Manual Ability Classification System) can be used to estimate the need for assistive devices, however, factors others than the child's motor function seem to be critical for optimum effectiveness, such as type of equipment, its physical and social environment and the intended benefits of use.

PMID: 37026592

11. Epidemiology of cerebral palsy in the Republic of Kazakhstan: Incidence and risk factors

Maiya Zhakupova, Ardak Nurbakyt, Dinara Ospanova, Ardak Chuyenbekova, Zhanat Kozhekenova, Gauhar Dauletova, Akmaral Aitmanbetova, Maksat Abdikadir, Zhilvinas Padaiga, Marina Izmailovich, Natalya Glushkova, Yuliya Semenova

Background: There is a paucity of robust data on the incidence and causes of cerebral palsy (CP) in Central Asian countries, while this information is important for planning local healthcare services. This epidemiological study was designed to clear the gap in knowledge on both the incidence of CP and the underlying risk factors in the Republic of Kazakhstan. Methods: This was a retrospective study that comprised two stages. At the first stage, a cross-sectional analysis of CP frequencies was performed on the basis of official statistics obtained from the Republican Center for Health Development. A study with age- and sex-matched controls was carried out at the second stage to elucidate the maternal and neonatal risk factors associated with CP. Results: Mild variability in national CP incidence was observed, ranging from 68.7 to 83.3 per 100,000 population. A number of maternal risk factors were significantly associated with CP, including arterial hypertension, thrombocytopenia, diabetes mellitus, pathology of fetal membranes, premature rupture of membranes, and acute respiratory illness during pregnancy. Low Apgar score, gestational age, birth weight, and presence of intraventricular hemorrhage or periventricular leukomalacia were among the important neonatal risk factors. Conclusion: There is a need for a more comprehensive prospective study to document the extent of the CP problem in Kazakhstan. In addition, a national CP registry must be envisaged to overcome the lack of essential data.

PMID: 37025867

12. Odds of Cardiometabolic Diseases and Medications in Children With Cerebral Palsy

Rachel Dum, Vonn Walter, Neal J Thomas, Conrad Krawiec

Introduction/objectives: Individuals with cerebral palsy may be at risk of obesity, but outcomes and risk factors are understudied. The study objectives are to evaluate the frequency of body mass index (BMI) weight categories of individuals with cerebral palsy and the odds of cardiometabolic-specific diseases and medications. We hypothesize subjects with cerebral palsy and an increased body mass index will have higher odds of cardiometabolic specific diseases and medications. Methods: This is a retrospective observational cohort study utilizing TriNetX, an electronic health record database, in subjects with cerebral palsy aged 2-18 years with an available body mass index. The study population was divided into 4 body mass index percentile categories, underweight (<5th body mass index percentile), healthy weight (≥5th to <85th percentile), overweight (≥85th to <95th percentile), and obese (≥95th percentile), and the odds of the following variables were evaluated: diagnostic codes and medication codes. We computed the odds ratio to test for associations between the body mass index categories and the variables of interest. Results: A total of 5993 subjects were included: underweight (251, 4.2%), healthy weight (2390, 39.9%), overweight (943, 15.7%), and obese (2409, 40.2%). Obese subjects had a higher odds of asthma, diabetes mellitus, hypertension, and sleep apnea when compared to the health weight group. Conclusions: This study found patients with cerebral palsy classified as obese had higher odds of cardiometabolic comorbidity and medication codes that influence weight. Body mass index measurements are limited in this population but may be used cautiously to evaluate the body type of children with cerebral palsy and monitor cardiometabolic-associated comorbidity occurrence.

PMID: 37016991

13. Cerebral palsy as a public health indicator

Nigel Paneth

No abstract available

PMID: 37016539

14. Neurodevelopment outcome of late prematurity: a retrospective cohort study from a developing country

Anindya Kumar Saha, Suchandra Mukherjee

The late preterm infants (34 0/7 to 36 6/7 weeks of gestation) account for at least 70% of all preterm birth. Our aim was to detect growth and neurodevelopment outcome, incidence of neurodevelopmental disability, and its association with maternal and neonatal risk factors among sick late preterm population. Two hundred and ninety-nine late preterm infants were followed up till corrected 2 years of age in this retrospective cohort study. Assessment was done by anthropometry and Developmental Assessment Scale for Indian Infants (DASII) scale at corrected 2 years of age. Presence of visual and hearing impairment, cerebral palsy, and overall neurodevelopmental impairment were also recorded. At 2 years of corrected age, average motor development quotient (DMoQ) was 93.55 (95% CI 90.9 to 96.20) and average mental development quotient (DMeQ) was 89.59 (95% CI 87.13 to 92.04). The incidence of bilateral severe to profound hearing loss and visual loss were found in 6 (2%) and 4 (1.33%) infants, respectively. Severe neurodevelopmental impairment was found in 19 (6.35%) infants. Central nervous system disease and sepsis were found as independent predictors of moderate to severe neurodevelopmental disability. Conclusion: Late preterm infants admitted in neonatal units were at risk of growth and neurodevelopmental impairment requiring close neurodevelopmental follow-up. In a resource limited setting, this may best be achieved by using DASII in follow-up clinic. What is Known: • Late preterm infants are at a high risk of prematurity-related morbidities. • There is increased risk of cognitive defect, learning difficulties, and behavior problems found at school age for sick late preterm infants. What is New: • Central nervous system disease and sepsis were found as independent predictors of early moderate to severe neurodevelopmental impairment for sick late preterm infants in developing countries like India.

PMID: 37004586

15. A Training-Free Infant Spontaneous Movement Assessment Method for Cerebral Palsy Prediction Based on Videos

Qingqiang Wu, Penglin Qin, Jiachen Kuang, Fan Wei, Zejiang Li, Ruping Bian, Chengcheng Han, Guanghua Xu

Objective: Early diagnosis of infant cerebral palsy (CP) is very important for infant health. In this paper, we present a novel training-free method to quantify infant spontaneous movements for predicting CP. Methods: Unlike other classification methods, our method turns the assessment into a clustering task. First, the joints of the infant are extracted by the current pose estimation algorithm, and the skeleton sequence is segmented into multiple clips through a sliding window. Then we cluster the clips and quantify infant CP by the number of cluster classes. Results: The proposed method was tested on two datasets, and achieved state-of-the-arts (SOTAs) on both datasets using the same parameters. What's more, our method is interpretable with visualized results. Conclusion: The proposed method can quantify abnormal brain development in infants effectively and be used in different datasets without training. Significance: Limited by small samples, we propose a training-free method for quantifying infant spontaneous movements. Unlike other binary classification methods, our work not only enables continuous quantification of infant brain development, but also provides interpretable conclusions by visualizing the results. The proposed spontaneous movement assessment method significantly advances SOTAs in automatically measuring infant health.

PMID: 37028311

16. Codesigning a social prescribing pathway to address the social determinant of health concerns of children with cerebral palsy and their families in Australia: a protocol for a mixed-methods formative research study

Katarina Ostojic, Simon Paget, Tanya Martin, Betty-Jean Dee-Price, Sarah McIntyre, Hayley Smithers Sheedy, Laurel Mimmo, Heather Burnett, Timothy Scott, Alison Berg, Anne Masi, Michele Scarcella, Jack Calderan, Sheikh Azmatullah, Masyitah Mohamed, Mackenzie Woodbury, Alunya Wilkinson, Karen Zwi, Russell Dale, Valsamma Eapen, Raghu Lingam, Iva Strnadová, Susan Woolfenden; EPIC-CP Group

Introduction: Social determinants of health (SDH) are contributors to health inequities experienced by some children with cerebral palsy and pose barriers to families engaging with complex and fragmented healthcare systems. There is emerging evidence to support 'social prescribing' interventions that systematically identify SDH concerns and refer patients to non-medical social care support and services to address their needs. To date, social prescribing has not been trialled specifically for children with neurodevelopmental disabilities, including cerebral palsy, in Australia. This study aims to codesign a social prescribing programme to address SDH concerns of children with cerebral palsy and their families who attend one of the three tertiary paediatric rehabilitation services in New South Wales, Australia. Methods and analysis: This is a qualitative multi-site study conducted at the three NSW paediatric hospitals' rehabilitation departments using a codesign approach. Children aged 12-18 years with cerebral palsy, parents/caregivers of children (aged 0-18 years) with cerebral palsy, and clinicians will be involved in all stages to codesign the social prescribing programme. The study will consist of three components: (1) 'what we need', (2) 'creating the pathways' and (3) 'finalising and sign off'. This project is overseen by two advisory groups: one group of young adults with cerebral palsy and one group of parents of young people with cerebral palsy. The study will be guided by the biopsychosocial ecological framework, and analysis will follow Braun and Clark's thematic approach. Ethics and dissemination: The study protocol was approved by the human research ethics committee of the Sydney Children's Hospitals Network. This codesign study will inform a future pilot study of feasibility and acceptability, then if indicated, a pilot clinical trial of efficacy. We will collaborate with all project stakeholders to disseminate findings and undertake further research to build sustainable and scalable models of care.

PMID: 37024248

17. Effectiveness of early diagnosis of cerebral palsy guideline implementation: a systematic review

Lynda M McNAMARA, Karen M Scott, Roslyn N Boyd, Annabel E Webb, Chloe J Taifalos, Iona E Novak

Introduction: Tailored implementation interventions are required to overcome the diagnostic research-practice gap for cerebral palsy (CP). Evaluating the impact of interventions on patient outcomes is a priority. This review aimed to summarize the established evidence for the effectiveness of guideline implementations in lowering the age of CP diagnosis. Evidence acquisition: A systematic review was conducted according to PRISMA. CINAHL, Embase, PubMed and MEDLINE were searched (2017-October 2022). Inclusion criteria were studies that evaluated effect of CP guideline interventions on health professional behaviour or patient outcomes. GRADE was used to determine quality. Studies were coded for use of theory (Theory Coding Scheme). Meta-analysis was performed and a standardized metric used to summarize statistics of intervention effect estimates. Evidence synthesis: Of (N.=249) records screened, (N.=7) studies met inclusion, comprising interventions following infants less than 2 years of age with CP risk factors (N.=6280). Guideline feasibility in clinical practice was established through health professional adherence and patient satisfaction. Efficacy of patient outcome of CP diagnosis by 12 months of age was established in all studies. Weighted averages were: (1) high-risk of CP (N.=2) 4.2 months and (2) CP diagnosis (N.=5) at 11.6 months. Meta-analysis of (N.=2) studies found a large, pooled effect size $Z = 3.00$ (P=0.003) favoring implementation interventions lowering age of diagnosis by 7.50 months, however study heterogeneity was high. A paucity of theoretical frameworks were identified in this review. Conclusions: Multifaceted interventions to implement the early diagnosis of CP guideline are effective in improving patient outcomes by lowering the age of CP diagnosis in high-risk infant follow-up clinics. Further targeted health professional interventions including low-risk infant populations are warranted.

PMID: 37021615

18. Transarticular Fixation Using Bioabsorptive Screws for Cervical Lesions

Daijiro Morimoto, Kyongsong Kim, Rinko Kokubo, Takao Kitamura, Toyohiko Isu, Akio Morita

Transarticular screw fixation is a method for posterior cervical fixation. It is ergonomic because neither connectors nor rods are needed. Biomechanical studies have shown that its fixation force is not inferior to that of lateral mass screws. More information is needed on the surgical outcome of procedures using bioabsorptive screws. We investigated the long-term surgical and radiological outcomes of posterior cervical decompression and fusion using bioabsorptive screws for transarticular fixation. Of 10 patients who underwent cervical spine transarticular fixation using bioabsorptive screws, nine presented with cervical degenerative spondylosis and one with a traumatic cervical spine injury. The mean postoperative follow-up period was 57.1 months. Transarticular screw fixation was successful in all 10 patients; no intraoperative complications were encountered. Bilateral screw breakage was discovered in a patient with cervical spine instability and associated dystonia due to cerebral palsy; there was no symptom deterioration, facet joint breakage, or instability exacerbation. Facet fusion was obtained in the nine other patients. At the patients' last visit, their clinical symptoms were significantly improved. Whole cervical spine alignment (-4.21 ± 7.2 to -5.2 ± 8.7) and the fused segment angle (mean, -0.1 ± 9.9 to -1.2 ± 13.7) did not significantly worsen postoperatively (mean: -0.1 ± 9.9 to -1.2 ± 13.7). Transarticular fixation using bioabsorptive screws is safe and associated with good long-term outcomes. In patients with exacerbation of local instability after posterior decompression, additional transarticular fixation using bioabsorbable screws is a treatment option.

PMID: 37019654

19. Additional value of 3-month cranial MRI in infants with neonatal encephalopathy following perinatal asphyxia

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Objective: To assess the evolution of neonatal brain injury noted on magnetic resonance imaging (MRI), develop a score to assess brain injury on 3-month MRI, and determine the association of 3-month MRI with neurodevelopmental outcome in neonatal encephalopathy (NE) following perinatal asphyxia. Methods: Retrospective single-center study including 63 infants with perinatal asphyxia and NE (n=28 cooled) with cranial MRI <2 weeks and 2-4 months after birth. Both scans were assessed using biometrics, a validated injury score for neonatal MRI, and a new score for 3-month MRI, with a white matter (WM), deep gray matter (DGM), and cerebellum sub-score. The evolution of brain lesions was assessed, and both scans were related to 18-24 month composite outcome. Adverse outcomes included cerebral palsy, neurodevelopmental delay, hearing/visual impairment, and epilepsy. Results: Neonatal DGM injury generally evolved into DGM atrophy and focal signal abnormalities, and WM/watershed injury evolved into WM and/or cortical atrophy. While the neonatal total and DGM scores were associated with composite adverse outcomes, the 3-month DGM score (OR 1.5, 95% CI 1.2 - 2.0) and WM score (OR 1.1, 95% CI 1.0 - 1.3) were also associated with composite adverse outcomes (occurring in n=23). The 3-month multivariable model (including the DGM and WM sub-scores) had higher positive (0.88 versus 0.83) but lower negative predictive value (0.83 versus 0.84) than neonatal MRI. Inter-rater agreement for the total, WM, and DGM 3-month score was 0.93, 0.86, and 0.59. Conclusions: Especially DGM abnormalities on 3-month MRI, preceded by DGM abnormalities on the neonatal MRI, were associated with 18-24 month outcome, indicating utility of 3-month MRI for treatment evaluation in neuroprotective trials. However, the clinical usefulness of 3-month MRI seems limited compared with neonatal MRI.

PMID: 37019329

20. Long-term neurological morbidity among children delivered by vacuum extraction - a national cohort study

Hanna Ulfsdottir, Cecilia Ekéus, Kristina Tedroff, Katarina Åberg, Hans Järnbert-Pettersson

Introduction: This is the first nationwide cohort study of vacuum extraction (VE) and long-term neurological morbidity. We hypothesized that VE per se, and not only complicated labor, can cause intracranial bleedings, which could further cause neurological long-term morbidity. The aim of this study was to investigate the risk of neonatal mortality, cerebral palsy (CP), and epilepsy among children delivered by VE in a long-term perspective. Material and methods: The study population included 1 509 589 term singleton children planned for vaginal birth in Sweden (January 1, 1999 to December 31, 2017). We investigated the risk of neonatal death (ND), CP, and epilepsy among children delivered by VE (successful or failed) and compared their risks with those born by spontaneous vaginal birth and emergency cesarean section (ECS). We used logistic regression to study the adjusted associations with each outcome. The follow-up time was from birth until December 31, 2019. Results: The percentage and total number of children with the outcomes were ND (0.04%, n = 616), CP (0.12%, n = 1822), and epilepsy (0.74%, n = 11 190). Compared with children delivered by ECS, those born by VE had no increased risk of ND, but there was an increased risk for those born after failed VE (adj OR 2.23 [1.33-3.72]). The risk of CP was similar among children born by VE and those born spontaneously vaginally. Further, the risk of CP was similar among children born after failed VE compared with ECS. The risk of epilepsy was not increased among children born by VE (successful/failed), compared with those who had spontaneous vaginal birth or ECS. Conclusions: The outcomes ND, CP, and epilepsy are rare. In this nationwide cohort study, children born after successful VE had no increased risk of ND, CP or epilepsy compared with those delivered by ECS, but there was an increased risk of ND among those born by failed VE. Concerning the studied outcomes, VE appears to be a safe obstetric intervention; however, it requires a thorough risk assessment and awareness of when to convert to ECS.

PMID: 37017927

21. Early detection of developmental delay in infants born very preterm or with very low birthweight

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Aim: This study aimed to identify early clinical biomarkers from birth to 16 weeks corrected age to predict typical outcome and developmental delay in infants born very preterm or with very low birthweight. Method: A prospective cohort of infants on the

Sunshine Coast, Australia, was assessed using the Premie-Neuro Examination, the General Movement Assessment (GMA), the Alberta Infant Motor Scale, and the Infant Sensory Profile 2. At 24 months corrected age, delay was identified using the Bayley Scales of Infant and Toddler Development, Third Edition (Bayley-III) and Neurosensory Motor Developmental Assessment (NSMDA). Results: One hundred and four infants were recruited; 79 completed outcome assessments (43 females, 36 males; mean gestational age 30 weeks [SD 1 week 6 days], mean birthweight 1346 g [SD 323]). The incidence of developmental delay (motor or cognitive) was 6.3%. Suboptimal quality of fidgety general movements (temporal organization) at 16 weeks corrected age demonstrated the best predictive accuracy (Bayley-III motor: sensitivity 100% [95% confidence interval {CI} 3-100], specificity 75% [95% CI 63-84], area under the curve [AUC] 0.87); Bayley-III cognitive: sensitivity 100% [95% CI 3-100], specificity 75% [95% CI 64-84], AUC 0.88); NSMDA motor: sensitivity 100% [95% CI 40-100], specificity 81% [95% CI 70-90], AUC 0.91 [95% CI 0.86-0.95]). GMA trajectories that combined abnormal writhing general movements at 4 to 5 weeks corrected age with suboptimal quality of fidgety movement at 16 weeks corrected age were strongly predictive of developmental delay, superior to all other clinical tools, and perinatal and demographic variables investigated (p = 0.01, Akaike information criterion method 18.79 [score corrected for small sample size], accounting for 93% of the cumulative weight). Interpretation: Only the GMA had sufficient predictive validity to act as a biomarker for both conditions: typical outcome and developmental delay (motor or cognitive). GMA trajectories that assessed both writhing general movements at 4 to 5 weeks corrected age and quality of fidgety movement at 16 weeks corrected age predicted adverse neurodevelopmental outcome, accurately differentiating between infants with typical outcomes and those at increased risk for motor or cognitive delay.

PMID: 37017185

22. Error analysis of Raven's Coloured Progressive Matrices in children and adolescents with cerebral palsy

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Background: Analysis of the errors in the Raven's Coloured Progressive Matrices (RCPM) has been previously performed for children with intellectual disabilities but has not been investigated for those with cerebral palsy (CP). This study aimed to investigate whether the types and positions of errors made by individuals with CP differed from those made by typically developing (TD) controls. Methods: Forty-five participants with CP aged 4-18 years and 30 TD children aged 3-9 years underwent RCPM testing. We first compared the RCPM performance and error characteristics between the groups and then examined the association between RCPM and the severity of CP and receptive vocabulary in the CP group. Results: The results showed that while mean total scores in the two groups were comparable, the types and positions of errors made by individuals with CP differed from those of TD controls. The development of non-verbal intelligence in children with CP increased with age; when controlling for age, non-verbal intelligence was significantly correlated with all three functional levels of CP severity and receptive vocabulary. Conclusions: This study provides valuable insights into the problem-solving strategies employed by children with CP.

PMID: 37016552

23. Tracheostomy, Feeding-Tube, and In-Hospital Postoperative Mortality in Children: A Retrospective Cohort Study

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Background: Neuromuscular/neurologic disease confers increased risk of perioperative mortality in children. Some patients require tracheostomy and/or feeding tubes to ameliorate upper airway obstruction or respiratory failure and reduce aspiration risk. Empiric differences between patients with and without these devices and their association with postoperative mortality have not been previously assessed. Methods: This retrospective cohort study using the Pediatric Health Information System measured 3- and 30-day in-hospital postsurgical mortality among children 1 month to 18 years of age with neuromuscular/neurologic disease at 44 US children's hospitals, from April 2016 to October 2018. We summarized differences between patients presenting for surgery with and without these devices using standardized differences. Then, we calculated 3- and 30-day mortality among patients with tracheostomy, feeding tube, both, and neither device, overall and stratified by important exposures, using Fisher exact test to test whether differences were significant. Results: There were 43,193 eligible patients. Unadjusted 3-day mortality was 1.3% (549/43,193); 30-day mortality was 2.7% (1168/43,193). Most (79.1%) used neither a feeding tube or tracheostomy, 1.2% had tracheostomy only, 15.5% had feeding tube only, and 4.2% used both devices. Compared to children with neither device, children using either or both devices were more likely to have multiple CCCs, dysphagia, chronic pulmonary disease, cerebral palsy, obstructive sleep apnea, or malnutrition, and a prolonged intensive care unit (ICU) stay within the previous year. They were less likely to present for high-risk surgeries (33% vs 57%). Having a feeding tube was associated with decreased 3-day mortality overall compared to having neither device (0.9% vs 1.3%, P = .003), and among children having low-risk surgery, and surgery during urgent or emergent hospitalizations. Having both devices was associated with decreased 3-day mortality among children having low-risk surgery (0.8% vs 1.9%; P = .013), and during urgent or emergent hospitalizations (1.6% vs 2.9%; P = .023). For 30-day mortality, having a feeding tube or both devices was associated with lower mortality when the data were stratified by the number of CCCs. Conclusions: Patients

requiring tracheostomy, feeding tube, or both are generally sicker than patients without these devices. Despite this, having a feeding tube was associated with lower 3-day mortality overall and lower 30-day mortality when the data were stratified by the number of CCCs. Having both devices was associated with lower 3-day mortality in patients presenting for low-risk surgery, and surgery during urgent or emergent hospitalizations.

PMID: 37014983

24. Meconium-stained amniotic fluid.

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Green-stained amniotic fluid, often referred to as meconium-stained amniotic fluid, is present in 5% to 20% of patients in labor and has been traditionally considered an obstetrical hazard. Discolored amniotic fluid has been attributed to the presence of heme catabolic products from the passage of fetal colonic content (meconium), intraamniotic bleeding, or both. The frequency of green-stained amniotic fluid increases as a function of gestational age, reflecting maturation of the gastrointestinal system, and reaches approximately 27% in postterm gestation. Before the introduction of routine continuous fetal heart rate monitoring, green-stained amniotic fluid during labor was associated with fetal acidemia (umbilical artery pH <7.00), neonatal respiratory distress, and seizures, and was considered a risk factor for cerebral palsy. Hypoxia has been considered the main mechanism responsible for fetal defecation and meconium-stained amniotic fluid; however, most fetuses with meconium-stained amniotic fluid do not have fetal acidemia. Nonetheless, in the absence of fetal heart rate abnormalities, meconium-stained amniotic fluid is not associated with fetal acidemia. Intraamniotic infection/inflammation has emerged as an important factor in meconium-stained amniotic fluid in term and preterm gestations, and green-stained amniotic fluid is a risk factor for maternal and neonatal infections. Whether intraamniotic infection/inflammation results in discoloration of amniotic fluid via oxidative stress or the passage of meconium has not been determined. Two randomized clinical trials suggest that, in patients with meconium-stained amniotic fluid, intrapartum administration of antibiotics decreases the rate of clinical chorioamnionitis. Meconium aspiration syndrome is a severe complication typical of term newborns, which develops in 5% of cases presenting with meconium-stained amniotic fluid. Meconium aspiration syndrome is attributed to the mechanical and chemical effects of aspirated meconium coupled with local and systemic fetal inflammation. A systematic review of randomized controlled trials suggested that amnioinfusion may decrease the rate of meconium aspiration syndrome. Routine naso/oropharyngeal suctioning and tracheal intubation in cases of meconium-stained amniotic fluid have not been shown to be beneficial and are no longer recommended in obstetrical practice. Histologic staining of the membranes with meconium has been used in the context of medical legal litigation to attempt to time the occurrence of fetal injury. This has been largely based on the results of in vitro experiments. However, extrapolation of these findings to the clinical setting is unwarranted. Experimental studies in animals and observational studies in human fetuses suggest that fetal defecation is a physiological phenomenon throughout pregnancy.

PMID: 37012128

25. Factors associated with caregiver burden among family caregivers of children with cerebral palsy: a systematic review

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Objectives: To identify caregiver and children factors associated with caregiver burden on primary caregivers of children with cerebral palsy (CP). Design: Systematic review DATA SOURCES: Seven electronic databases, including PubMed, Cochrane Library, Scopus, PsycINFO, Web of Science, CINAHL and Embase, were systematically searched up to 1 February 2023. Eligibility criteria: Original observational studies reporting caregiver burden and related factors among caregivers of children with CP. Data abstraction and synthesis: Two reviewers independently screened results and assessed the quality of studies. Title, abstract, full-text screening and data abstraction were done independently by two reviewers. Risk of bias was assessed using the JBI Critical Appraisal Checklist for Analytical Cross-Sectional Studies. The quality of evidence for factors was rated using the Grading of Recommendations Assessment, Development and Evaluation (GRADE) approach. Results: 16 articles were included in the review. All studies were cross-sectional and examined caregiver-reported burden measures. The Zarit Burden Interview was the most commonly used questionnaire. Depression of caregiver and severity of illness in children with CP were moderate quality of evidence for factors contributing to caregiver burden. Conclusions: Higher caregiver burden is associated with more depressive feelings and worse life quality of the caregiver, and with more severe physical disability of the children. Future studies should focus on high-quality longitudinal research and appropriate assistance to reduce caregiver burden and improve the quality of caregiving for children with CP.

PMID: 37012010

26. Neuro-imaging characteristics of sensory impairment in cerebral palsy; a systematic review

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Background: Objective: To identify and examine neural reorganization of the sensory network in terms of lesion type, somatotopic organization of the primary somatosensory area, and functional connectivity in relation to sensory function in children and young adults with cerebral palsy (CP). Methods: Design: systematic review, Prospero registration ID 342570. Data sources: PubMed; Cochrane; Web of Science; Embase; CINAHL and PEDro from inception to March 13, 2021. Eligibility criteria: All types of original studies, concerning sensory connectivity in relation to sensory outcome in patients with spastic CP, <30 years of age. No publication status or date restrictions were applied. Data extraction and synthesis: Two authors independently determined the eligibility of studies. Quality assessment was performed by a third author. Neuro-imaging/neurophysiological techniques, sensory outcomes and patient characteristics were extracted. Results: Children and young adults with periventricular leucomalacia (PVL) lesions have significantly better hand function and sensation scores than patients with cortical-subcortical/middle cerebral artery (MCA) lesions. Ipsilesional reorganization of the S1 (primary somatosensory cortex) area appears to be the primary compensation mechanism after a unilateral early brain lesion, regardless of the timing of the lesion. Interhemispheric reorganization of the sensory system after early brain lesions is rare and, when it occurs, poorly effective. Diffusion tractography shows a positive correlation between the ascending sensory tract (AST) diffusivity metrics of the more affected hemisphere and sensory test outcomes. Discussion and conclusions: Because of the large variability in study design, patient characteristics, neuroimaging/neurophysiological techniques and parameters as well as sensory assessment methods used, it is difficult to draw definite inferences on the relationship between the reorganization of the sensory network following early brain damage and sensory function in children and young adults with CP. In general, sensory function seems to be worse in cortical as opposed to white matter tract (PVL) lesions. International consensus on a clinically relevant sensory test battery is needed to enhance understanding of the intriguing compensatory mechanisms of sensory network following early brain damage and potential consequences for rehabilitation strategies.

PMID: 37009398

27. A Case of General Anaesthesia Using an I-gel Airway for MRI of an Adult Patient With Athetoid Cerebral Palsy

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Patients with athetoid cerebral palsy may develop cervical myelopathy owing to repetitive involuntary motion. In these patients, MRI evaluation is required; involuntary motion is problematic, and general anaesthesia and immobilisation may be necessary. However, MRI studies requiring muscle relaxation and general anesthesia in adults are rare. A 65-year-old man with a history of athetoid cerebral palsy required an MRI of the cervical spine under general anaesthesia. General anaesthesia was administered with 5 mg of midazolam and 50 mg of rocuronium in a room adjacent to the MRI room. The airway was secured using an i-gel airway, and the patient was ventilated using a Jackson-Rees circuit. As the only MRI-compatible monitoring method available at our institution was SpO2 monitoring, blood pressure was monitored by palpation of the dorsal pedal artery, and ventilation was monitored visually by an anaesthesiologist in the MRI room. The MRI was uneventful. After scanning, the patient awoke promptly and was returned to the ward. An MRI scan under general anaesthesia requires monitoring of the patient, securing of the airway and ventilation, and careful selection of suitable anaesthetic agents. Although MRI scans requiring general anaesthesia are rare, anaesthesiologists should be prepared for this eventuality.

PMID: 37009376

28. Retinopathy of prematurity and neurodevelopmental outcomes in preterm infants: A systematic review and meta-analysis

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Background: Retinopathy of prematurity (ROP) and abnormal brain development share similar risk factors and mechanisms. There has been contrasting evidence on the association of ROP with adverse neurodevelopmental outcomes. Objective: We analysed the association between ROP at levels of severity and treatment with all neurodevelopmental outcomes until adolescence. Data source: We followed PRISMA guidelines and searched Medline and Embase between 1 August 1990 and 31 March 2022. Study selection and participants: Randomised or quasi-randomised clinical trials and observational studies on preterm infants (<37 weeks) with ROP [type 1 or severe ROP, type 2 or milder ROP, laser or anti-vascular endothelial growth factor (VEGF) treated] were included. Data extraction and synthesis: We included studies on ROP and any neurocognitive or neuropsychiatric outcomes. Outcomes: The primary outcomes were as follows: cognitive composite scores evaluated between

the ages of 18 and 48 months by the Bayley Scales of Infant and Toddler Development (BSID) or equivalent; neurodevelopmental impairment (NDI; moderate to severe NDI or severe NDI), cerebral palsy, cognitive impairment; and neuropsychiatric or behavioural problems. The secondary outcomes were as follows: motor and language composite scores evaluated between the ages of 18 and 48 months by BSID or equivalent; motor/language impairment; and moderate/severe NDI as defined by the authors. Results: In preterm infants, "any ROP" was associated with an increased risk of cognitive impairment or intellectual disability [n = 83,506; odds ratio (OR): 2.56; 95% CI: 1.40-4.69; p = 0.002], cerebral palsy (n = 3,706; OR: 2.26; 95% CI: 1.72-2.96; p < 0.001), behavioural problems (n = 81,439; OR: 2.45; 95% CI: 1.03-5.83; p = 0.04), or NDI as defined by authors (n = 1,930; OR: 3.83; 95% CI: 1.61-9.12; p = 0.002). Type 1 or severe ROP increased the risk of cerebral palsy (OR: 2.19; 95% CI: 1.23-3.88; p = 0.07), cognitive impairment or intellectual disability (n = 5,167; OR: 3.56; 95% CI: 2.6-4.86; p < 0.001), and behavioural problems (n = 5,500; OR: 2.76; 95% CI: 2.11-3.60; p < 0.001) more than type 2 ROP at 18-24 months. Infants treated with anti-VEGF had higher odds of moderate cognitive impairment than the laser surgery group if adjusted data (gestational age, sex severe intraventricular haemorrhage, bronchopulmonary dysplasia, sepsis, surgical necrotising enterocolitis, and maternal education) were analysed [adjusted OR (aOR): 1.93; 95% CI: 1.23-3.03; p = 0.04], but not for cerebral palsy (aOR: 1.29; 95% CI: 0.65-2.56; p = 0.45). All outcomes were adjudged with a "very low" certainty of evidence. Conclusion and relevance: Infants with "any ROP" had higher risks of cognitive impairment or intellectual disability, cerebral palsy, and behavioural problems. Anti-VEGF treatment increased the risk of moderate cognitive impairment. These results support the association of ROP and anti-VEGF treatment with adverse neurodevelopmental outcomes.

PMID: 37009271

29. BCI-activated electrical stimulation in children with perinatal stroke and hemiparesis: A pilot study

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Background: Perinatal stroke (PS) causes most hemiparetic cerebral palsy (CP) and results in lifelong disability. Children with severe hemiparesis have limited rehabilitation options. Brain computer interface- activated functional electrical stimulation (BCI-FES) of target muscles may enhance upper extremity function in hemiparetic adults. We conducted a pilot clinical trial to assess the safety and feasibility of BCI-FES in children with hemiparetic CP. Methods: Thirteen participants (mean age = 12.2 years, 31% female) were recruited from a population-based cohort. Inclusion criteria were: (1) MRI-confirmed PS, (2) disabling hemiparetic CP, (3) age 6-18 years, (4) informed consent/assent. Those with neurological comorbidities or unstable epilepsy were excluded. Participants attended two BCI sessions: training and rehabilitation. They wore an EEG-BCI headset and two forearm extensor stimulation electrodes. Participants' imagination of wrist extension was classified on EEG, after which muscle stimulation and visual feedback were provided when the correct visualization was detected. Results: No serious adverse events or dropouts occurred. The most common complaints were mild headache, headset discomfort and muscle fatigue. Children ranked the experience as comparable to a long car ride and none reported as unpleasant. Sessions lasted a mean of 87 min with 33 min of stimulation delivered. Mean classification accuracies were (M = 78.78%, SD = 9.97) for training and (M = 73.48, SD = 12.41) for rehabilitation. Mean Cohen's Kappa across rehabilitation trials was M = 0.43, SD = 0.29, range = 0.019-1.00, suggesting BCI competency. Conclusion: Brain computer interface-FES was well -tolerated and feasible in children with hemiparesis. This paves the way for clinical trials to optimize approaches and test efficacy.

PMID: 37007682

30. Pathogenesis from the microbial-gut-brain axis in white matter injury in preterm infants: A review

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White matter injury (WMI) in premature infants is a unique form of brain injury and a common cause of chronic nervous system conditions such as cerebral palsy and neurobehavioral disorders. Very preterm infants who survive are at high risk of WMI. With developing research regarding the pathogenesis of premature WMI, the role of gut microbiota has attracted increasing attention in this field. As premature infants are a special group, early microbial colonization of the microbiome can affect brain development, and microbiome optimization can improve outcomes regarding nervous system development. As an important communication medium between the gut and the nervous system, intestinal microbes form a microbial-gut-brain axis. This axis affects the occurrence of WMI in premature infants via the metabolites produced by intestinal microorganisms, while also regulating cytokines and mediating oxidative stress. At the same time, deficiencies in the microbiota and their metabolites may exacerbate WMI in premature infants. This confers promise for probiotics and prebiotics as treatments for improving neurodevelopmental outcomes. Therefore, this review attempted to elucidate the potential mechanisms behind the communication of gut bacteria and the immature brain through the gut-brain axis, so as to provide a reference for further prevention and treatment of premature WMI.

PMID: 37006416

31. Stability of the gross motor function classification system in children with cerebral palsy in the two to four year age band

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Purpose: This study aimed to investigate the stability of the Gross Motor Function Classification System (GMFCS) in children with cerebral palsy (CP) in the two to four year age band, the frequency at which children were reclassified, and trends of reclassification to higher or lower ability. Methods: This retrospective study included 164 children with CP between 24 to 48 months old with two or more GMFCS ratings at least 12 months apart between their second and fourth birthdays. GMFCS ratings were captured closest to 24, 36, and 48 months. Stability and reclassification trends were analyzed using inferential statistics. Frequency of reclassification, age at ratings, duration between ratings, and corresponding change rate were analyzed using descriptive statics. Results: When comparing ratings closest to second and fourth birthdays, a linear weighted kappa of 0.726 was found. Of the total population, 46.95% changed GMFCS levels at any time between two to four years of age, the majority of which were reclassified to a higher level of ability. Conclusion: Findings suggest the GMFCS is less stable in the two to four year age band compared to older age bands. Due to the importance of providing accurate guidance for caregivers and high rate of reclassification, it is recommended GMFCS levels be reassessed every six months during this period of time.

PMID: 37005905

32. Gurka vs Slaughter equations to estimate the fat percentage in children with cerebral palsy from all subtypes and levels of the Gross Motor Function Classification System

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Background: Body composition assessment in children with cerebral palsy (CP) is a challenge, specially the fat percentage. There are different methods that can be used to estimate the fat percentage in this population, such as anthropometric equations, but there is still a need to determine which is the best and most accurate. The purpose of the study was to determine the method that best estimates the fat percentage in children from all CP subtypes and levels of the Gross Motor Function Classification System (GMFCS). Methods: Analytical cross-sectional study in which 108 children with CP diagnosed by a pediatric neurologist were included with any type of dysfunction and from all levels of the GFMCS. Slaughter equation, Gurka equation and Bioelectrical impedance analysis (BIA) as reference method, were used. Groups were stratified by sex, CP subtypes, GMFCS level and Tanner stage. Median differences, Kruskal-Wallis, Mann-Whitney U test, Spearman's correlation coefficients and simple regressions were used, also multivariate models were performed. Results: The Slaughter equation differed from the other methods in the total population and when it was compared by sex, CP subtypes, gross motor function and Tanner stage. The Gurka equation showed significant differences by sex and gross motor function. Gurka equation correlated positively and significantly with BIA to estimate the fat percentage in all the CP subtypes and levels of the GMFCS. Tricipital skinfold (TSF), arm fat area (AFA) and weight for age index (W/A) showed the highest variability with respect to fat percentage. Conclusion: Gurka equation is more appropriate and accurate than Slaughter equation to estimate the fat percentage in children with CP from all subtypes and levels of the GMFCS.

PMID: 37005565

33. Nutritional Support System (Nss) as a New Therapeutic Strategy for Cerebral Palsy

Fernando Leal-Martine, Guadalupe Jimenez-Ramirez, Antonio Ibarra

Cerebral palsy (CP) is part of a group of nonprogressive motor disorders. The disease affects movement and posture and constitutes the most frequent cause of motor disability in childhood. CP is characterized by spasticity, reflecting lesions in the pyramidal pathway. Treatment is currently focused on physical rehabilitation, and the annual progression of the disease is 2-3%. About 60% of these patients present severe degrees of malnutrition associated with dysphagia, gastrointestinal abnormalities, malabsorption, increased metabolism, and depression. These alterations promote sarcopenia functional dependence and affect the quality of life and delay the evolution of motor skills. Currently, there is evidence that the supplementation of several nutrients, dietary correction, and probiotics can improve neurological response by stimulating neuroplasticity, neuroregeneration, neurogenesis, and myelination. This therapeutic strategy could shorten the response period to treatment and increase both gross and fine motor skills. The interaction of nutrients and functional foods integrating a Nutritional Support System (NSS) has shown greater efficiency in neurological stimulation than when nutrients are supplied separately. The most studied elements in the neurological response are glutamine, arginine, zinc, selenium, cholecalciferol, nicotinic acid, thiamine, pyridoxine, folate, cobalamin, Spirulina, omega-3 fatty acids, ascorbic acid, glycine, tryptophan, and probiotics. The NSS represents a therapeutic alternative that will restore neurological function in patients with spasticity and

pyramidal pathway lesions, both characteristics of patients with CP.

PMID: 37005522

34. Gross Motor Function Classification System in other neurological disorders

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No abstract available

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