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Interventions and Management

1. Individualized OnabotulinumtoxinA Treatment for Upper Limb Spasticity Resulted in High Clinician- and Patient-Reported Satisfaction: Long-Term Observational Results from the ASPIRE Study.
Francisco GE, Jost WH, Bavikatte G, Bandari DS, Tang SFT, Munin MC, Largent J, Adams AM, Zuzek A, Esquenazi A.

INTRODUCTION: OnabotulinumtoxinA treatment for spasticity is dependent on numerous factors and varies according to selected treatment goals. OBJECTIVE: Examine real-world onabotulinumtoxinA treatment utilization and effectiveness in patients with upper limb spasticity over 2 years from the Adult Spasticity International Registry (ASPIRE) study. DESIGN: Multicenter, prospective, observational registry (NCT01930786). SETTING: 54 international clinical sites in North America, Europe, and Asia. PATIENTS: Adults (naïve or non-naïve to botulinum toxins for spasticity) with upper limb focal spasticity related to upper motor neuron syndrome across multiple etiologies. INTERVENTIONS: OnabotulinumtoxinA administered at clinician's discretion. MAIN OUTCOME MEASURES: OnabotulinumtoxinA utilization, clinician and patient satisfaction. RESULTS: 484 patients received ≥1 treatment of onabotulinumtoxinA for upper limb spasticity. Patients were on average 55.1 years old, 50.8% male, predominantly Caucasian (72.3%), and 38.6% were naïve to botulinum toxins. Stroke was the most frequently reported underlying etiology (74.0%). Most patients (81.2%) had moderate to severe spasticity at baseline. The most commonly treated upper limb clinical presentation was clenched fist (79.1% of patients). Across all presentations, onabotulinumtoxinA doses ranged between 5-600 U. Electromyography (EMG) was most often utilized to localize muscles (≥57.0% of treatment sessions). Clinicians (92.9% of treatment sessions) and patients (85.7%) reported being extremely satisfied/satisfied that treatment helped manage spasticity, and clinicians (98.6%) and patients (92.2%) would definitely/ probably continue onabotulinumtoxinA treatment. 179 patients (37.0%) reported 563 adverse events (AEs); 15 AEs in 14 patients (2.9%) were considered treatment-related. 69 patients (14.3%) reported 137 serious AEs; 3 serious AEs in 2 patients (0.4%) were considered treatment-related. No new safety signals were identified. CONCLUSIONS: ASPIRE captured the real-world individualized nature of onabotulinumtoxinA utilization for upper limb spasticity over 2 years, with consistently high clinician- and patient-reported satisfaction. Data in this primary analysis will guide clinical use of onabotulinumtoxinA, as well as provide insights to improve educational programs on spasticity management. This article is protected by copyright. All rights reserved.

PMID: 31953896

2. Preoperative Variables Associated With Respiratory Complications After Pediatric Neuromuscular Spine Deformity Surgery.
Luhmann SJ, Furdock R.

OBJECTIVE: The objective of this study is to identify preoperative laboratory values and patient factors that are associated

with postoperative respiratory complications in pediatric neuromuscular scoliosis (NMS) populations undergoing posterior spinal fusion (PSF) with instrumentation. PSF in NMS patients are high-risk surgeries. Respiratory complications are the most common post-operative event, with rates up to 28.2% following surgery. METHODS: A single-surgeon, two-hospital pediatric spine surgery database was reviewed to identify all patients who underwent PSF for NMS. Diagnoses included cerebral palsy (n=83), myelomeningocele (n = 13), spinal muscular atrophy (n=4), and other (n = 11). This study defined respiratory complications as postoperative pneumonia, pleural effusion, pneumothorax, need for reintubation, respiratory status requiring a return to the pediatric intensive care unit (PICU), or prolonged (> 4-day) need for mechanical ventilation. Preoperative laboratory values for transferrin, prealbumin, hemoglobin/hematocrit, total protein, albumin, and total lymphocyte count were collected. RESULTS: There were 50 males and 61 females with a mean age of 14 years 2.5 months (8-20 years). Seventeen patients (15.3%) experienced postoperative respiratory complications. On univariate analysis, any history of pneumonia, the presence of gastrostomy tube, and low transferrin levels were associated with postoperative respiratory complications, and a strong trend (p = .06) was observed for tracheostomy. On multivariate analysis, the presence of gastrostomy tube and history of pneumonia remained as clinically significant predictors of postoperative respiratory complications. CONCLUSION: Pediatric NMS patients undergoing PSF that have history of pneumonia or gastrostomy tube present at time of surgery are at increased risk for postoperative respiratory complications. The univariate associations of tracheostomy presence and low transferrin levels with postoperative respiratory complications deserve further examination. LEVEL OF EVIDENCE: Level II.

PMID: 31975254

3. Do All Patients With Cerebral Palsy Require Postoperative Intensive Care Admission After Spinal Fusion?

Brooks JT, Yaszay B, Bartley CE, Bastrom TP, Sponseller PD, Shah SA, Samdani A, Cahill PJ, Miyanji F, Newton PO; Harms Study Group.

STUDY DESIGN: Retrospective review of a prospective cohort. OBJECTIVE: To identify patient and surgical factors that alter the length of postoperative intensive care unit (ICU) stays after spinal fusion/ instrumentation in patients with neuromuscular scoliosis secondary to cerebral palsy (CP). High perioperative complication rates in patients with CP contribute to the practice of utilizing the ICU postoperatively for monitoring. However, this is costly and little is known regarding which patients truly need this increased acuity of care. METHODS: A prospective, multicenter database was queried for patients with CP who underwent spinal fusion and instrumentation. Patients with an ICU length of stay (LOS) ⩽1 day were assumed to not have required postoperative ICU admission. Demographic and surgical characteristics were compared between those with ICU LOS of ⩽1 day versus > 1 day. A classification and regression tree (CART) analysis was utilized to create a decision algorithm for postoperative ICU admission. RESULTS: Three hundred twenty-four patients were identified with a mean ICU LOS of 4.7 days (range 0-47). Sixty-eight patients (21%) had an ICU LOS ⩽1 day and 256 patients (79%) had an ICU LOS >1 day. CART analysis demonstrated that the institution where the surgery was performed was the primary predictor with two groups: sites that almost routinely had ICU stay > 1 day (92%) and those that were split (50.5% > 1 day). In the latter group, an operative time greater than 4 hours was a risk factor for a longer ICU stay. CONCLUSION: Because of their heterogeneous makeup, CP patients should be evaluated individually and their postoperative disposition should not be based on institutional tradition but instead on objective surgical factors. For those patients with surgical times less than 4 hours, discussions should be held regarding the safety of a postoperative disposition to a regular floor. LEVEL OF EVIDENCE: Level III.

PMID: 31975253

4. Use of an Accelerated Discharge Pathway in Patients With Severe Cerebral Palsy Undergoing Posterior Spinal Fusion for Neuromuscular Scoliosis.

Bellaire LL, Bruce RW Jr, Ward LA, Bowman CA, Fletcher ND.

BACKGROUND: Implementation of a coordinated multidisciplinary postoperative pathway has been shown to reduce length of stay after posterior spinal fusion (PSF) for adolescent idiopathic scoliosis. This study sought to compare the outcomes of nonambulatory cerebral palsy (CP) patients treated with PSF and cared for using an accelerated discharge (AD) pathway with those using a more traditional discharge (TD) pathway. METHODS: A total of 74 patients with Gross Motor Function Classification System (GMFCS) class 4/5 CP undergoing PSF were reviewed. Thirty consecutive patients were cared for using a TD pathway, and 44 patients were subsequently treated using an AD pathway. The cohorts were then evaluated for postoperative complications and length of stay. RESULTS: Length of stay (LOS) was 19% shorter in patients managed with the AD pathway (AD 4.0 days [95% CI 2.5-5.5] vs. TD 4.9 days [95% CI 3.5-6.3], p = .01). There was no difference between

groups with respect to age at surgery, GMFCS class, preoperative curve magnitude, pelvic obliquity, kyphosis, postoperative curve correction, fusion to the pelvis, or length of fusion between groups. Length of stay remained significantly shorter in the AD group by 0.9 days when controlling for estimated blood loss (EBL) and length of surgery. Complication rates trended lower in the AD group (33% AD vs. 52% TD, p = .12), including pulmonary complications (21% AD vs. 38% TD, p = .13). There was no significant difference in wound complications, return to the operating room, or medical readmissions between groups. CONCLUSIONS: Adoption of a standardized postoperative pathway reduced LOS by 19% in nonambulatory CP patients. Overall, complications, including pulmonary, trended lower in the AD group. Early discharge appears to be possible in this challenging patient population. Although the AD pathway may not be appropriate for all patients, the utility of the AD pathway in optimizing care for more routine PSF for this patient subset appears to be worthwhile. LEVEL OF EVIDENCE: Level III, therapeutic.

PMID: 31975195

5. Is Performing a Definitive Fusion for Scoliosis in Juvenile Cerebral Palsy Patients a Good Long-term Surgical Option?
Howard R, Sponseller P, Shah SA, Miyanji F, Samdani A, Newton P, Yaszay B.

Spine Deform. 2019 Nov;7(6):1029-1030. doi: 10.1016/j.jspd.2019.09.026.

PMID: 31974950

6. Treatment with MCGR Results in Improved Scoliosis Correction but No Difference in UPROR as Compared to Traditional Growth Friendly Surgery for Children with Cerebral Palsy.
Sun M, Buckler N, Al Nouri M, Vaughan M, Hilaire T, Sponseller P, Smith J, Thompson G, Howard J, El-Hawary R; Pediatric Spine Study Group.

Spine Deform. 2019 Nov;7(6):1024-1025. doi: 10.1016/j.jspd.2019.09.014.

PMID: 31974956

7. The Pros and Cons of Operating Early Versus Late in the Progression of Cerebral Palsy Scoliosis.
Hollenbeck SM1, Yaszay B, Sponseller PD, Bartley CE, Shah SA, Asghar J, Abel MF, Miyanji F, Newton PO.

Spine Deform. 2019 May;7(3):489-493. doi: 10.1016/j.jspd.2018.09.002. Epub 2019 Dec 30.

STUDY DESIGN: Retrospective review of prospective data. OBJECTIVE: To delineate a curve threshold where further delay of surgery significantly increased the risks for patients with cerebral palsy (CP) scoliosis. Two approaches exist in the management of CP scoliosis: a proactive one where surgery is recommended once there is a risk of progression (Cobb > 50°) and a reactive one where surgery is recommended after the patient/caregiver may have significant challenges caused by a large deformity. METHODS: A prospectively collected CP scoliosis surgical registry was queried for patients with minimum two years of follow-up. Three groups were delineated based on the distribution of curve magnitudes: <70° (proactive), 70°-90°, and >90° (reactive). Radiographic, surgical, and quality of life outcome data were compared between the groups using analysis of variance and chi-square analyses. RESULTS: There were 38 patients in the <70° group, 44 in the 70°-90° group, and 42 in the >90° group. They were similar in age. The >90° group had significantly longer operative time (p < .001), a higher percentage of anterior/posterior procedures (31% vs 5%), and a higher infection rate requiring I&D (16.7%) than the other groups (<70°: 5.3%; 70°-90°: 6.8%; p < .05). The percentage blood volume loss was significantly higher in the >90° group compared to <70°. There were no differences in length of hospitalization or intensive care unit stay. Preoperatively, the Caregiver Priorities and Child Health Index of Life with Disabilities (CPchild) QOL score was significantly higher for the <70° group. At two years, the <70° and 70°-90° groups reached similar QOL scores, whereas the >90° trended toward a lower postoperative QOL. CONCLUSIONS: Being proactive (Cobb <70°) has no advantage in terms of decreasing risks or improving outcomes compared to curves 70°-90°. However, delaying surgery to a curve greater than 90° increases the risk of infection, blood loss, and the need for anterior/ posterior procedures. Ideally, surgery should be recommended for curves less than 90°.

PMID: 31974835

8. More Than 10-Year Follow-Up After Laminoplasty and Pedicle Screw Fixation for Cervical Myelopathy Associated with Athetoid Cerebral Palsy.
Demura S, Kato S, Shinmura K, Yokogawa N, Yonezawa N, Shimizu T, Oku N, Kitagawa R, Handa M, Annen R, Murakami H, Kawahara N, Tsuchiya H.

Spine (Phila Pa 1976). 2020 Jan 20. doi: 10.1097/BRS.0000000000003383. [Epub ahead of print]

MINI: We performed laminoplasty and posterior pedicle screw instrumentation in patients with athetoid cerebral palsy. The procedure maintained stable fixation and maintained clinical outcome more than 10 years. STUDY DESIGN: Retrospective case series. OBJECTIVE: To investigate the clinical outcomes more than 10 years following laminoplasty and pedicle screw fixation for cervical myelopathy associated with athetoid cerebral palsy (CP). SUMMARY OF BACKGROUND DATA: Surgery for cervical myelopathy associated with CP remains a challenge because of perioperative instrumentation failure and adjacent segment problems due to patients' repetitive involuntary neck movements with deformity of the cervical spine. METHODS: A single-center series of 14 patients were reviewed. The patients comprised 7 women and 7 men with a mean age of 52 years at the time of surgery. The mean follow-up period was 12.5 years. The Barthel index (BI), which shows independence in activities of daily life, and Japanese Orthopaedic Association (JOA) score were assessed. Radiographic evaluation included changes of the C2-C7 angle in the sagittal plane, fusion rate, adjacent segment degeneration, and instrument failure. RESULTS: The 10-year BI and JOA score significantly improved at 36% and 31%, respectively. The preoperative Cobb angle of the sagittal plane from C2-C7 measured 11.9 degrees of kyphosis, which improved to 0.8 degrees of lordosis. In the radiographic analysis, 35% (proximal) and 21% (distal) of the adjacent segment showed progression in degeneration of more than one grade after 10 years. More than 90% of the patients who underwent magnetic resonance imaging showed progressive disc degeneration on either side after 10 years. Auto-fusion inside the disc or anterior vertebral bony bridging was observed in 86% of intervertebral levels without anterior procedures. CONCLUSIONS: The procedure showed favorable initial stability and maintained favorable clinical outcomes in patients with CP. More than 90% of the patients showed disc degeneration on either side. The rate of proximal adjacent segment degeneration was higher than that of distal segments with or without symptoms at the more than 10-year follow-up. LEVEL OF EVIDENCE: 4.

PMID: 31977680

9. Outcome of Femoral Varus Derotational Osteotomy for the Spastic Hip Displacement: Implication for the Indication of Concomitant Pelvic Osteotomy.
Park H, Abdel-Baki SW, Park KB, Park BK, Rhee I, Hong SP, Kim HW.

J Clin Med. 2020 Jan 17;9(1). pii: E256. doi: 10.3390/jcm9010256.

No previous studies have suggested a reliable criterion for determining the addition of a concomitant pelvic osteotomy by using a large patient cohort with quadriplegic cerebral palsy and a homogenous treatment entity of femoral varus derotational osteotomies (VDRO). In this retrospective study, we examined our results of hip reconstructions conducted without a concomitant pericapsular acetabuloplasty in patients with varying degrees of hip displacement. We wished to investigate potential predictors for re-subluxation or re-dislocation after the index operation, and to suggest the indications for a simultaneous pelvic osteotomy. We reviewed the results of 144 VDROs, with or without open reduction, in 72 patients, at a mean follow-up of 7.0 (2.0 to 16.0) years. Various radiographic parameters were measured, and surgical outcomes were assessed based on the final migration percentage (MP) and the Melbourne Cerebral Palsy Hip Classification Scale (MCPHCS) grades. The effects of potential predictive factors on the surgical outcome was assessed by multivariate regression analysis. A receiver operating characteristic (ROC) curve analysis was also performed to determine whether a threshold of each risk factor existed above which the rate of unsatisfactory outcomes was significantly increased. In total, 113 hips (78.5%) showed satisfactory results, classified as MCPHCS grades I, II, and III. Thirty-one hips (21.5%) showed unsatisfactory results, including six hip dislocations. Age at surgery and preoperative acetabular index had no effects on the results. Lower pre- and postoperative MP were found to be the influential predictors of successful outcomes. The inflection point of the ROC curve for unsatisfactory outcomes corresponded to the preoperative MP of 61.8% and the postoperative MP of 5.1%, respectively; these thresholds of the pre- and postoperative MP may serve as a guideline in the indication for a concomitant pelvic osteotomy. Our results also indicate that the severely subluxated or dislocated hip, as well as the hip in which the femoral head is successfully reduced by VDRO but is still contained within the dysplastic acetabulum, may benefit from concomitant pelvic osteotomy.

PMID: 31963548

10. Evaluation of the bilateral function in para-athletes with spastic hemiplegia: A model-based clustering approach.
Reina R, Barbado D, Soto-Valero C, Sarabia JM, Roldán A.

J Sci Med Sport. 2020 Jan 9. pii: S1440-2440(19)30662-0. doi: 10.1016/j.jsams.2020.01.003. [Epub ahead of print]

OBJECTIVES: Spastic hemiplegia is one of the most common forms of cerebral palsy, in which one side of the body is affected to a greater extent than the other one. Hemiplegia severity (i.e. moderate vs mild forms) is currently used in some Para sports for classification purposes. This study evaluates the sensitivity of several tests of stability (e.g. one-legged stance test), dynamic balance (side-step test), coordination (rapid heel-toe placements), range of movement (backward stepping lunge), and lower limb power (the triple hop distance and the isometric peak force of the knee extensors) to discriminate between the impaired and unimpaired lower extremities' function in para-athletes with spastic hemiplegia. METHODS: A sample of 87 international para-athletes with cerebral palsy took part in the study, and their bilateral performance was measured for the abovementioned tests. The tests' sensitivity to discriminate between impaired vs unimpaired legs was assessed using Boruta's method. RESULTS: The triple hop distance, the magnitude of the mean velocity in the one-legged stance test and the time to perform the rapid heel-toe placement test are the most sensitive variables when performing random forest classifiers. In addition, the study confirms two optimal clusters by Gaussian finite mixture models to represent the athletes' performance. CONCLUSIONS: Reference scores for the clusters are provided, demonstrating that coordination, balance, and power of the lower limbs are relevant variables for classifying para-athletes with spastic hemiplegia.

PMID: 31956044

11. Leucine Supplementation Increases Muscle Strength and Volume, Reduces Inflammation, and Affects Wellbeing in Adults and Adolescents with Cerebral Palsy.
Theis N, Brown MA, Wood P, Waldron M.

J Nutr. 2020 Jan 21. pii: nxaa006. doi: 10.1093/jn/nxaa006. [Epub ahead of print]

BACKGROUND: Spastic cerebral palsy (CP) is characterized by muscle weakness owing, in part, to a blunted muscle protein synthetic response. This might be normalized by long-term leucine supplementation. OBJECTIVES: The study assessed the effects of 10 wk leucine supplementation in adolescents and adults with CP. METHODS: The study was a single-center randomized controlled trial. Twenty-four participants were randomly assigned to a control group (n = 12) or a leucine group (n = 12). l-Leucine (192 mg/kg body mass) was dissolved in water and administered daily for 10 wk. The primary outcome measures of elbow flexor muscle strength and muscle volume (measured by 3D ultrasound technique) and inflammation [C-reactive protein (CRP) concentration] were assessed before and after the 10 wk, alongside the secondary outcomes of body composition (measured by CP-specific skinfold assessment), metabolic rate (measured by indirect calorimetry), and wellbeing (measured by a self-reported daily questionnaire). Data were compared via a series of 2-factor mixed ANOVAs. RESULTS: Twenty-one participants completed the intervention (control group: n = 11, mean ± SD age: 18.3 ± 2.8 y, body mass: 48.8 ± 11.9 kg, 45% male; leucine group: n = 10, age: 18.6 ± 1.7 y, body mass: 58.3 ± 20.2 kg, 70% male). After 10 wk, there was a 25.4% increase in strength (P = 0.019) and a 3.6% increase in muscle volume (P = 0.001) in the leucine group, with no changes in the control group. This was accompanied by a 59.1% reduction in CRP (P = 0.045) and improved perceptions of wellbeing (P = 0.006) in the leucine group. No changes in metabolism or body composition were observed in either group (P > 0.05). CONCLUSIONS: Improvements in muscle strength and volume with leucine supplementation might provide important functional changes for adults and adolescents with CP and could be partly explained by reduced inflammation. The improved wellbeing highlights its capacity to improve the quality of daily living. This trial was registered at clinicaltrials.gov as NCT03668548.

PMID: 31965179

12. Brain magnetic resonance imaging is a predictor of bimanual performance and executive function in children with unilateral cerebral palsy.
Crichton A, Ditchfield M, Gwini S, Wallen M, Thorley M, Bracken J, Harvey A, Elliott C, Novak I, Hoare B.

AIM: To examine the association between brain magnetic resonance imaging (MRI) characteristics and executive function and bimanual performance in children with unilateral cerebral palsy (CP). METHOD: Clinical MRI brain scans were classified as: (1) predominant pathological pattern (normal, white matter injury [WMI]; grey matter injury; focal vascular insults [FVI]; malformations; or miscellaneous); and (2) focal lesions (frontal, basal ganglia, and/or thalamus). Assessments included: (1) bimanual performance; (2) unimanual dexterity; and (3) executive function tasks (information processing, attention control, cognitive flexibility, and goal setting) and behavioural ratings (parent). RESULTS: From 131 recruited children, 60 were ineligible for analysis, leaving 71 children (47 males, 24 females) in the final sample (mean age 9y [SD 2y], 6y-12y 8mo). Brain MRIs were WMI (69%) and FVI (31%); and frontal (59%), thalamic (45%), basal ganglia (37%), and basal ganglia plus thalamic (21%). Bimanual performance was lower in FVI versus WMI (p<0.003), and with frontal (p=0.36), basal ganglia (p=0.032), and thalamic/basal ganglia lesions (p=0.013). Other than information processing, executive function tasks were not associated with predominant pattern. Frontal lesions predicted attention control (p=0.049) and cognitive flexibility (p=0.009) but not goal setting, information processing, or behavioural ratings. INTERPRETATION: Clinical brain MRI predicts cognitive and motor outcomes when focal lesions and predominate lesion patterns are considered.

PMID: 31965572

13. Preliminary Investigation of the Perspectives of Parents of Children With Cerebral Palsy on the Supports, Challenges, and Realities of Integrating Augmentative and Alternative Communication Into Everyday Life.

O'Neill T, Wilkinson KM.

Purpose To ensure long-term adoption and use of augmentative and alternative communication (AAC) technologies, they must be designed to support children to participate within everyday activities and routines that are prioritized by families. The aim of this study was to gain parent perspectives on how AAC technologies were integrated into everyday life. Method Nine parents of children with cerebral palsy who used AAC technologies participated in semistructured interviews to provide their perspectives on how AAC technologies were integrated into the functional contexts of everyday life. Results Five major themes emerged from the discussions: (a) integrating AAC into life, (b) AAC technologies, (c) child needs and skills, (d) parent responsibilities and priorities, and (e) AAC process and decision making. Children were able to use AAC technologies within a variety of everyday contexts with various partners; however, challenges included access to technologies within care routines and outdoor activities as well as partners who lacked knowledge regarding operational competencies and effective interaction strategies. To integrate AAC technologies into life, parents prioritized technology features including ease of programming, improved physical design, features to enhance efficiency and ease of access, and availability of multiple functions and features (e.g., games and leisure activities, environmental controls). Conclusion AAC manufacturers and mainstream technology developers should work to ensure that technologies are responsive to the supports, limitations, and ideal features identified by parents. Future research should seek input from a larger group of stakeholders and use longitudinal methods to examine perceptions of AAC technologies over time. Supplemental Material https://doi.org/10.23641/asha.11625543.

PMID: 31961702

14. Study on the effect of sympathetic nerve on children's brain diseases based on the analysis of Mr kurtosis.

Chen J, Li H, Zhang S, Deng W, Jiang S, Hao Y, Huo Z.

This paper collects data from 22 children with unilateral spastic cerebral palsy who underwent common carotid sympathetic neural network ablation in our hospital from January 1, 2014 to December 1, 2018, using magnetic resonance kurtosis imaging technology parameters. To evaluate the improvement of common carotid artery sympathetic neural network exfoliation on the grey and white matter functional area in children with cerebral palsy, and to analyse the relationship between DKI parameters and clinical signs in children with cerebral palsy. The study found that the FA values of the frontal lobe, parietal lobe, temporal lobe, internal sac forelimb, and corpus callosum were statistically significant before and after surgery. The internal sac forelimb, corpus callosum, and FA values were not statistically significant. The MK values of the frontal lobe, parietal lobe, temporal lobe, hindlimb of the internal capsule, corpus callosum, and caudate nucleus were statistically significant before and

after operation, but the MK values of the forelimb, corpus callosum, and thalamus were not statistically significant significance. The GMFM-66 score is negatively correlated with the FA value and positively correlated with the MK value. Therefore, it can be concluded that DKI technology can more accurately reflect the grey and white matter damage in children with cerebral palsy, and its parameter value can be used as a monitoring and evaluation index for children with cerebral palsy.

PMID: 31953102

15. Clinical features and aetiology of cerebral palsy in children from Cross River State, Nigeria.
Duke R, Torty C, Nwachukwu K, Ameh S, Kim M, Eneli N, Onyedikachi A, Aghaji A, Burton K, Dyet L, Bowman R.

Arch Dis Child. 2020 Jan 20. pii: archdischild-2019-317932. doi: 10.1136/archdischild-2019-317932. [Epub ahead of print]

OBJECTIVE: There are few studies on cerebral palsy (CP) in African children and our study aimed to describe the aetiology, characteristics and severity of CP in children from Nigeria. DESIGN: A population-based study using key informant methodology (KIM) was conducted as part of a clinical research trial. Children aged 4-15 years were clinically assessed for CP. RESULTS: The estimated prevalence of CP using KIM was 2.3/1000 children (95% CI 2.0 to 2.5/1000). 388 children were diagnosed with CP, with Gross Motor Function Classification System level 1 in 70 (18.1%), II in 156 (40.2%), III in 54 (13.9%), IV in 54 (13.9%), V in 54 (13.9%). 300/388 (77.3%) had Manual Ability Classification Scale of level 1-3 and 88 (22.7%) of level 4-5. CP types were spastic in 271 (70%), with 60% of these bilateral and 40% unilateral, ataxic 38 (9.8%), dystonic 18 (4.6%), choreoathetoid 29 (7.5%) and unclassifiable 32 (8.3%). Postneonatal risk factors for CP were seen in 140 (36.1%) children including malaria with seizures 101/140 (72.1%), malaria with coma 21/140 (15.0%), meningitis 12/140 (8.6%), tuberculosis 2/140 (1.4%), sickle cell disease 3/140 (2.2%), HIV 1/221 (0.7%). Prenatal/perinatal risk factors were seen in 248 (63.9%%), birth asphyxia 118 (47.6%) and clinical congenital rubella syndrome 8 (3.3%) and hyperbilirubinaemia 59 (23.8%) were identified as preventable risk factors for CP. CONCLUSION: The profile of CP in this population is similar to that found in other low-income and middle-income countries (LMIC). Some risk factors identified were preventable. Prevention and management strategies for CP designed for LMIC are needed.

PMID: 31959596

16. Early intervention and follow-up programs among children with cerebral palsy in Moldova: potential impact on impairments?
Bufteac EG, Andersen GL, Spinei L, Jahnsen RB.

BMC Pediatr. 2020 Jan 22;20(1):29. doi: 10.1186/s12887-020-1931-7.

AIM: To study whether early intervention services (EI) and a follow-up program (FU) influence outcomes of children with cerebral palsy (CP) in Moldova. METHODS: Records from 351 children with CP in Moldova born during 2009 and 2010 were retrieved from hospital and orphanage archives between 1 July 2016 and 30 September 2017. We investigated the proportion enrolled in EI and FU at the Early Intervention Centre Voinicel and at the Institute of Mother and Child in 2009-2012. Logistic regression analyses were applied to calculate crude and adjusted odds ratios (OR) with 95% confidence intervals (CI) for outcomes in children enrolled and not enrolled. RESULTS: Among all children with CP, 166 (47%) were enrolled in EI and FU. Of the 51 children born extremely preterm (gestational age ≤ 31 weeks), 46 (90%) were enrolled, compared to 97 (39%) of the 250 children born at term. Among 110 non-walking children with CP, 82 (74%) were enrolled into EI and FU, compared to 84 (35%) of 241 able to walk. There was no difference in outcomes of cognition, communication, vision and hearing impairments between those enrolled or not enrolled in EI and FU. However, the subgroup analyses showed that the risk of contractures was 11 times higher among non-walking children who were not enrolled in EI and FU programs (OR = 10.931, 95% CI 2.328-51.328, p = 0.002). CONCLUSION: In Moldova, EI and FU seem to be offered mostly to extremely preterm and non-walking children with CP. The results indicate a decreased risk for contractures in these children.

PMID: 31969109

17. Analysis of Health-Related Quality of Life in Cerebral Palsy Patients Treated with Growth-Friendly Surgery for Early-Onset Scoliosis.

Buckler N, Sun M, Al Nouri M, Vaughan M, Hilaire T, Matsumoto H, Sponseller P, Smith J, Thompson G, Howard J, El-Hawary R; Pediatric Spine Study Group.

Spine Deform. 2019 Nov;7(6):1025-1026. doi: 10.1016/j.jspd.2019.09.015.

PMID: 31974955

18. Assessing participation of children with acquired brain injury and cerebral palsy: a systematic review of measurement properties.
Resch C, Van Kruijsbergen M, Ketelaar M, Hurks P, Adair B, Imms C, De Kloet A, Piskur B, Van Heugten C.

Dev Med Child Neurol. 2020 Jan 23. doi: 10.1111/dmcn.14465. [Epub ahead of print]

AIM: To examine which instruments used to assess participation of children with acquired brain injury (ABI) or cerebral palsy (CP) align with attendance and/or involvement constructs of participation; and to systematically review measurement properties of these instruments in children with ABI or CP, to guide instrument selection. METHOD: Five databases were searched. Instruments that quantified 'attendance' and/or 'involvement' aspects of participation according to the family of participation-related constructs were selected. Data on measurement properties were extracted and methodological quality of the studies assessed. RESULTS: Thirty-seven instruments were used to assess participation in children with ABI or CP. Of those, 12 measured attendance and/or involvement. The reliability, validity, and responsiveness of eight of these instruments were examined in 14 studies with children with ABI or CP. Sufficient measurement properties were reported for most of the measures, but no instrument had been assessed on all relevant properties. Moreover, most psychometric studies have marked methodological limitations. INTERPRETATION: Instruments to assess participation of children with ABI or CP should be selected carefully, as many available measures do not align with attendance and/or involvement. Evidence for measurement properties is limited, mainly caused by low methodological study quality. Future studies should follow recommended methodological guidelines. WHAT THIS PAPER ADDS: Twelve instruments used to assess participation of children with acquired brain injury (ABI) or cerebral palsy (CP) aligned with attendance/involvement. Seven instruments have some psychometric evidence supporting their use with children with CP. For children with ABI, only the Child and Adolescent Scale of Participation has shown preliminary evidence of measurement properties.

PMID: 31975385

19. [Using the FOCUS Family Intervention for Family-Centered Care in a Premature Infant With Grade IV Intraventricular Hemorrhage]. [Article in Chinese; Abstract available in Chinese from the publisher]
Qiu XY, Fann GL, Yang HL.

Hu Li Za Zhi. 2020 Feb;67(1):106-112. doi: 10.6224/JN.202002_67(1).13.

Preterm infants face increased rates of mortality and developmental complications, which are a burden on children's parents (and caregivers), who suffer from exhaustion and situational uncertainty. This case focused on an extremely-low-birth-weight (908 gm) premature infant with initial unstable vital signs complicated by a grade 4 intraventricular hemorrhage (IVH) that led to partial brain atrophy and enlarged brain ventricles. A poor neurological outcome was expected due to the high risk of cerebral palsy and impaired cognitive abilities. Long-term healthcare for this critical infant was causing tremendous physical, emotional, and financial strains on the family. The parents suffered from worries over the poor prognosis, resulting in stress, sleep disorders, and relationship difficulties with the healthcare professionals. Considering the poor prognosis of the infant, the parents faced a medical dilemma between choosing aggressive treatment and withdrawal of treatment, which led to stress and sleep disorders. Differences between the parents and health professionals regarding disease severity perception and treatment opinions further strained their mutual relationship. To ameliorate this issue, the author implemented family-centered care (the FOCUS family intervention) to help the patient and his family. This intervention is designed to increase family involvement, foster an optimistic attitude and effective stress coping techniques, and reduce uncertainty and negative emotions. For the patient, we provided symptom-relief management to improve abnormal muscle tone and development delay. Our intervention ameliorated the negative emotions, insomnia symptoms, and imbalanced family relationships and improved the life quality of the caregivers. Furthermore, the intervention enhanced the patient's autoregulatory ability, and both physical and neurological development. This case study is expected to provide experience in critical care for premature infants with a poor prognosis and their family using a FOCUS family intervention as well as to improve the quality of healthcare delivery in intensive clinical settings.

PMID: 31960402

20. Movement disorders - Childhood Rating Scale 4-18 revised in children with dyskinetic cerebral palsy.
Battini R, Sgandurra G, Menici V, Scalise R, Olivieri I, Di Pietro R, Lucibello S, Giannini MT, Cioni G; and MD-CRS Group.

Eur J Phys Rehabil Med. 2020 Jan 23. doi: 10.23736/S1973-9087.20.06079-7. [Epub ahead of print]

BACKGROUND: Movement Disorders - Childhood Rating Scale 4-18 (MD-CRS 4-18) is a tool aimed to evaluate movement disorders in developmental age, validated since 2008 and applied in literature. Psychometric properties, including inter- and intra-reliability and construct validity have been evaluated over time on children and adolescents with different types of movement disorders. AIM: Aim of the study is to revise the Movement Disorders - Childhood Rating Scale 4-18 (MD-CRS 4-18 R) and evaluate its psychometric properties, compared to previous version of the scale, in Dyskinetic Cerebral palsy. DESIGN: This is a measurement-focused study of video recorder sessions. SETTING: Video session carried out inpatient and outpatient. POPULATION: This measurement-focused study was carried out on a cohort of 57 participants with DCP (37 males; mean age 9y 6mo, SD 3y 8mo) evaluated through video-recorded sessions by experienced scorers using MD-CRS 4-18 and MR-CRS 4-18 R. METHODS: Inter-rater reliability, intra-rater reliability of MD-CRS 4-18 and MD-CRS 4-18 R were performed. RESULTS: This study supports the relevant contribution of MD-CRS 4-18 R to identify the severity of movement disorders in dyskinetic cerebral palsy, as indicated by the higher ICC values on Index II compared to previous MD-CRS 4-18 results. Standard Error Measurement (SEM) and Minimally Detectable Difference (MDD) of MD-CRS 4-18 R in DCP were all very low, with SEMs ranging from 0.01 to 0.02 and MDD from 0.03 to 0.06. CONCLUSIONS: Data obtained with MD-CRS 4-18 R are in accordance with previous scale on individuals with movement disorders due to different aetiologies, tested with MD-CRS 4-18. CLINICAL REHABILITATION IMPACT: MD-CRS 4-18 R is able to verify natural history of the disease and represents a standardized clinical outcome measure in the evaluation and follow-up of children with DCP. Also MD-CRS 4-18 Revised form is a feasible tool, now easier to understand than the previous one, more available for incoming clinical trials.

PMID: 31976641

21. Decreased mitochondrial DNA copy number in children with cerebral palsy quantified by droplet digital PCR.
Lu B, Zeng F, Xing W, Liang L, Huo J, Tan C, Zhu L, Liu Z.

Clin Chim Acta. 2020 Jan 21. pii: S0009-8981(20)30027-9. doi: 10.1016/j.cca.2020.01.018. [Epub ahead of print]

BACKGROUND: Mitochondrial DNA copy number is a potential biomarker for mitochondrial dysfunction and is involved in a variety of disease states including autism, neurodegenerative diseases and traumatic brain injury, but few studies on mitochondrial DNA copy number in cerebral palsy have been reported. Therefore, this study aims to investigate the role of mitochondrial DNA copy number in children with cerebral palsy. METHODS: A total of 104 children with cerebral palsy and 78 typically developing children were enrolled in this study. All children with cerebral palsy were diagnosed according to clinical criteria and furtherly divided into clinical subtypes. Mitochondrial DNA copy number was quantified by droplet digital PCR. RESULTS: We observed a significant reduction in mitochondrial DNA copy number from children with cerebral palsy comparing to healthy controls (216.76 ± 71.39 vs 359.66 ± 72.78, $p < 0.001$). An upward trend in mitochondrial DNA copy number alteration with the increase of age was found in healthy controls rather than in children with cerebral palsy. In addition, the mitochondrial DNA copy number in children with spastic hemiplegia was higher than that in children with spastic quadriplegia (152.27 ± 49.78 vs 90.64 ± 21.55, $p = 0.001$). CONCLUSIONS: Our results suggest that on the basis of accurate quantification by droplet digital PCR, the declined mitochondrial DNA copy number probably has certain implications for mitochondrial dysfunction in children with cerebral palsy, which provides a new clue for the investigation on the molecular mechanism and clinical characteristics of cerebral palsy.

PMID: 31978410

22. Outcomes of preterm infants born with marginal viability in a University Hospital in Thailand.
Piriyapokin N, Chuthapisith J, Emrat K, Nuntnarumit P.

AIM: Reports of the outcomes of infants born with marginal viability in developing countries are limited. This study aimed to determine the mortality rate and major disabilities of extremely preterm infants. METHODS: A retrospective cohort with a prospective part of neurodevelopmental assessment was performed in infants born at 23-25+6 weeks' gestational age (GA) who received active resuscitation and were admitted to neonatal intensive care unit during 2005-2015. Surviving infants were recruited for neurodevelopmental assessment including cognition, gross motor and neurosensory disorders. Major disability was defined as one of the following: severe cognitive impairment, severe cerebral palsy, blindness or deafness. RESULTS: A total of 67 infants were enrolled (8, 22 and 37 in the 23, 24 and 25 weeks' GA groups, respectively). The overall mortality rate before discharge was 26%. Infants in the 23 and 24 weeks' GA groups had a significantly higher mortality rate than did those in the 25 weeks' GA group (42 vs. 10%). Of 50 survivors (aged 2-12 years), 3 and 2 had blindness and deafness, respectively. Cognitive function assessment in 37 survivors showed that 4 (11%) and 15 (40%) had severe and borderline cognitive impairment, respectively. Death or major disability was found in 100, 63 and 38% in the 23, 24 and 25 weeks' GA groups, respectively. CONCLUSION: In our centre, infants born at 23-24 weeks had a much higher chance of death or major disability than those born at 25 weeks' GA. Given such information, active management should be offered together with the family's involvement.

PMID: 31971316

23. PredictMed: A logistic regression-based model to predict health conditions in cerebral palsy.

Bertoncelli CM, Altamura P, Vieira ER, Iyengar SS, Solla F, Bertoncelli D.

Logistic regression-based predictive models are widely used in the healthcare field but just recently are used to predict comorbidities in children with cerebral palsy. This article presents a logistic regression approach to predict health conditions in children with cerebral palsy and a few examples from recent research. The model named PredictMed was trained, tested, and validated for predicting the development of scoliosis, intellectual disabilities, autistic features, and in the present study, feeding disorders needing gastrostomy. This was a multinational, cross-sectional descriptive study. Data of 130 children (aged 12-18 years) with cerebral palsy were collected between June 2005 and June 2015. The logistic regression-based model uses an algorithm implemented in R programming language. After splitting the patients in training and testing sets, logistic regressions are performed on every possible subset (tuple) of independent variables. The tuple that shows the best predictive performance in terms of accuracy, sensitivity, and specificity is chosen as a set of independent variables in another logistic regression to calculate the probability to develop the specific health condition (e.g. the need for gastrostomy). The average of accuracy, sensitivity, and specificity score was 90%. Our model represents a novelty in the field of some cerebral palsy-related health outcomes treatment, and it should significantly help doctors' decision-making process regarding patient prognosis.

PMID: 31957544

Prevention and Cure

24. N-acetylcysteine inhibits bacterial lipopeptide-mediated neutrophil transmigration through the choroid plexus in the developing brain.

Mottahedin A, Blondel S, Ek J, Leverin AL, Svedin P, Hagberg H, Mallard C, Ghersi-Egea JF, Strazielle N.

The etiology of neurological impairments associated with prematurity and other perinatal complications often involves an infectious or pro-inflammatory component. The use of antioxidant molecules have proved useful to protect the neonatal brain from injury. The choroid plexuses-CSF system shapes the central nervous system response to inflammation at the adult stage, but little is known on the neuroimmune interactions that take place at the choroidal blood-CSF barrier during development. We

previously described that peripheral administration to neonatal mice of the TLR2 ligand PAM3CSK4 (P3C), a prototypic Gram-positive bacterial lipopeptide, induces the migration of innate immune cells to the CSF. Here we showed in neonatal rats exposed to P3C that the migration of neutrophils into the CSF, which occurred through the choroid plexuses, is abolished following administration of the antioxidant drug N-acetylcysteine. Combining light sheet microscopy imaging of choroid plexus, a differentiated model of the blood-CSF barrier, and multiplex cytokine assays, we showed that the choroidal epithelium responds to the bacterial insult by a specific pattern of cytokine secretion, leading to a selective accumulation of neutrophils in the choroid plexus and to their trafficking into CSF. N-acetylcysteine acted by blocking neutrophil migration across both the endothelium of choroidal stromal vessels and the epithelium forming the blood-CSF barrier, without interfering with neutrophil blood count, neutrophil tropism for choroid plexus, and choroidal chemokine-driven chemotaxis. N-acetylcysteine reduced the injury induced by hypoxia-ischemia in P3C-sensitized neonatal rats. Overall, the data show that a double endothelial and epithelial check point controls the transchoroidal migration of neutrophils into the developing brain. They also point to the efficacy of N-acetylcysteine in reducing the deleterious effects of inflammation-associated perinatal injuries by a previously undescribed mechanism, i.e. the inhibition of innate immune cell migration across the choroid plexuses, without interfering with the systemic inflammatory response to infection.

PMID: 31973769