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Professor Nadia Badawi AM

Macquarie Group Foundation Chair of Cerebral Palsy

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Interventions and Management

1. Dev Med Child Neurol. 2015 Nov 14. doi: 10.1111/dmcn.12963. [Epub ahead of print]

Reflections on the contribution of the Assisting Hand Assessment.

Wallen M.

This commentary is on the original article by Holmefur and Krumlind-Sundholm. 'Psychometric properties of a revised version of the Assisting Hand Assessment (Kids-AHA 5.0)'

[PMID: 26566733](#)

2. J Pediatr Orthop B. 2015 Nov 19. [Epub ahead of print]

Satisfaction and pain levels after proximal femoral valgus osteotomy according to Schanz in patients with cerebral palsy and hip dislocation.

Harmsen AM, Witbreuk MM, Pruijs HJ, Buizer AI, van der Sluijs JA.

Outcome after Schanz osteotomy in the treatment of chronic hip dislocation in children with cerebral palsy was evaluated. Medical charts and questionnaires were used to assess pain, functional outcome and satisfaction. A total of 24 children, with a mean age of 13.8 years (± 8.9), were included in the study, out of which 11 were classified with Gross Motor Function Classification System (GMFCS) level IV and 13 with GMFCS level V. Current pain was comparable to patients without chronic hip dislocation, and satisfaction was intermediate. Functional outcome improved in several domains. Longer postoperative time was associated with improved pain and satisfaction. The Schanz osteotomy allowed improvement in pain levels; however, it did not completely meet caregiver's expectation and has high reoperation rates.

[PMID: 26588835](#)

3. *Neurosci J.* 2015;2015:872015. Epub 2015 Oct 20.

Do Three Different Passive Assessments of Quadriceps Spasticity Relate to the Functional Activity of Walking for Children Diagnosed with Cerebral Palsy?

White H, Uhl TL, Augsburg S.

A stiff-knee gait pattern is frequently associated with several impairments including quadriceps spasticity in children diagnosed with cerebral palsy (CP). The relationship of clinical measures of quadriceps spasticity and the stiff-knee gait pattern in children diagnosed with CP has not been well established. Therefore, the purpose of this study was to determine the ability of clinical measures of quadriceps spasticity (modified Ashworth scale [MAS], Ely tests, and pendulum test) to categorize a stiff-knee gait pattern in children with CP. Children were categorized as having a stiff-knee gait pattern based on kinematic and EMG gait data. Results of a logistic regression model revealed that the only significant measure was A1 of the pendulum test. Discriminant analysis functions were used to predict group membership (stiff-knee, not stiff-knee gait pattern) for each measure. The A1 of the pendulum test demonstrated the highest classification accuracy and the highest sensitivity compared to the other measures. Therefore, a negative pendulum test (indicated by an A1 value of 45 degrees or more) is more useful for ruling out a stiff-knee gait pattern compared to the other clinical measures.

[PMID: 26576411](#)

4. *BMC Musculoskelet Disord.* 2015 Nov 14;16(1):351.

Psychometric evaluation of spinal assessment methods to screen for scoliosis in children and adolescents with cerebral palsy.

Persson-Bunke M, Czuba T, Hägglund G, Rodby-Bousquet E.

BACKGROUND: In cerebral palsy (CP) there is an increased risk of scoliosis. It is important to identify a progressive scoliosis early-on because the results of surgery depend on the magnitude of the curve. The Swedish follow-up program for cerebral palsy (CPUP) includes clinical examinations of the spine. The reliability and validity of the assessment method have not been studied. In this study we evaluate the interrater reliability of the clinical spinal examination used in CPUP and scoliometer measurement in children with CP and we evaluate their validity compared to radiographic examination. **METHODS:** Twenty-eight children (6-16 years) with CP in Gross Motor Function Classification System levels II-V were included. Clinical spinal examinations and scoliometer measurements in sitting position were performed by three independent examiners. The results were compared to the Cobb angle as determined by radiographic measurement. Interrater reliability was calculated using weighted kappa. Concurrent validity was analyzed using the Cobb angle as gold standard. Sensitivity, specificity, area under receiver operating characteristic curves (AUC) and likelihood ratios (LR) were calculated. Cut-off values for scoliosis were set to $\geq 20^\circ$ Cobb angle and $\geq 7^\circ$ scoliometer angle. **RESULTS:** There was an excellent interrater reliability for both clinical examination (weighted kappa = 0.96) and scoliometer measurement (weighted kappa = 0.86). The clinical examination showed a sensitivity of 75 % (95 % CI: 19.4-99.4 %), specificity of 95.8 % (95 % CI: 78.9-99.9 %) and an AUC of 0.85 (95 % CI: 0.61-1.00). The positive LR was 18 and the negative LR was 0.3. The scoliometer measurement showed a sensitivity of 50 % (95 % CI: 6.8-93.2 %), specificity of 91.7 % (95 % CI: 73.0-99.0 %) and AUC of 0.71 (95 % CI: 0.42-0.99). The positive LR was 6 and the negative LR was 0.5. **CONCLUSION:** The psychometric evaluation of the clinical examination showed an excellent interrater reliability and a high concurrent validity compared to the Cobb angle. The findings should be interpreted cautiously until research with larger samples may further quantify the psychometric properties. Clinical spinal examinations seem appropriate as a screening tool to identify scoliosis in children with CP.

[PMID: 26578150](#)

5. Osteoporos Int. 2015 Nov 17. [Epub ahead of print]

Osteoporosis in adults with cerebral palsy: feasibility of DXA screening and risk factors for low bone density.

Marciniak C, Gabet J, Lee J, Ma M, Brander K, Wysocki N.

This study aims to describe osteoporosis screening in adults with cerebral palsy (CP) and identify any associated factors. Bone mineral density (BMD) was often lower than expected-for-age in these adults, and present even in young adulthood, particularly at the spine. Low BMD is frequent in adults with CP. **INTRODUCTION:** This study aims to describe the feasibility of dual-energy X-Ray absorptiometry (DXA) screening in adults with cerebral palsy (CP) and identify factors associated with low bone mineral density (BMD), including longitudinal changes. **METHODS:** A retrospective chart review study of these adults seen at an urban academic rehabilitation clinic and who underwent DXA scan(s). BMD and Z-scores for the lumbar spine, hips, and femoral (neck and total) were recorded. The change in BMD and Z-scores from baseline to follow-up DEXA, Gross Motor Functional Classification System (GMFCS), CP pattern (hemiplegic, diplegic, or quadriplegic), body mass index (BMI), and transfer and ambulation status were assessed. **RESULTS:** Forty-two patients (83 % less than age 50 years) had at least one DXA. Seventeen had at least two studies, 15 without pharmacologic interventions between studies. Thirteen fractures in eight subjects were noted, most often lower limb. Fifty percent of spine studies in individuals under 50 had a Z-score of less than -2, while 25 and 30.8 % of these individuals had such scores at the right and left total hip sites, respectively. Need for transfer assistance was associated with lower BMD and Z-scores at all hip sites, but not the lumbar spine. Progressive abnormalities were seen at follow-up DXAs at some sites, however these were not statistically significant. **CONCLUSIONS:** Lower than expected-for-age BMD was very frequent in adults with CP with mobility limitations, present at both spine and hip sites. Low BMI and need for transfer assistance had a negative impact on BMD. Although not statistically significant, progression of abnormalities was seen at follow-up for DXAs Z-scores at some sites, which suggests longitudinal studies in this population are needed.

[PMID: 26576540](#)

6. Arch Dis Child. 2015 Dec;100(12):1181-3. doi: 10.1136/archdischild-2015-309460.

Question 2: Do standing frames and other related physical therapies reduce the risk of fractures in children with cerebral palsy?

Whittaker S, Tomlinson R.

SCENARIO A 9-year-old girl with non-ambulant cerebral palsy (Gross Motor Function Classification Scale (GMFCS) level 4) attends clinic. Despite adequate calcium and vitamin D supplementation, a recent dual-energy x-ray absorptiometry (DEXA) bone scan shows a bone mineral density in the osteopenic range (Z score -2.6). Her mother is anxious about the risk of fractures and asks what can be done to reduce the risk. **STRUCTURED CLINICAL QUESTION** In children with osteopenia secondary to cerebral palsy, do weight-bearing activities (including standing frames, vibration platforms and physiotherapy) reduce the risk of fractures? **SEARCH STRATEGY** A PubMed search using MeSH terms bone density AND cerebral palsy AND physi* gave 26 results. A wider search of MEDLINE, Cochrane and Trip databases was searched for the terms ('cerebral palsy') AND ('physical therapy' OR 'vibration' OR 'physiotherapy' OR 'passive standing' OR 'dynamic standing') AND ('fracture' OR 'bone density'). Fifty-six results were found. No appropriate papers were found on Cochrane review. Nine papers were assessed and included. **COMMENTARY** Children and adolescents with cerebral palsy are prone to fragility fractures that can occur during normal activities such as dressing and transferring. Peripheral and vertebral fractures are associated with low BMD. Children who are non-ambulant (GMFCS level 4 or 5) are at the greatest risk; most will have osteopenia (BMD Z-score <2) and more than a quarter suffer a fracture, most commonly of the lower limb, by age 10 years. 10 Fractures impact on quality of life, causing pain and further limiting the mobility of children, leading to muscle wasting through disuse, hospitalisation and missed schooling. 11 We chose to focus on physical therapy as there is an uncertainty regarding best practice. The recommendations frequently quoted are 60 min of mechanical loading, 4–5 times per week, which were non-evidence-based proposals made by Sturberg in 1992. 12 There are other interventions to improve BMD, which are not considered in this report. Vitamin D and calcium supplementation are recommended given the possible effectiveness and their good safety record. Bisphosphonates increase bone mass by inhibiting osteoclastic activity and are currently considered for children who have experienced a fragility fracture. 13 Weight-bearing stimulates osteoblastic activity, leading to new bone growth¹⁴ with the assumption that this will decrease the risk of fractures. There is not yet evidence for this population of actual fracture risk reduction. We reviewed the evidence for static and dynamic therapy as well as for other related augmentative physical therapies. Interventions evaluated were dynamic standers, passive standing frames, whole-body vibration,

physiotherapy, resistance training and treadmill training. Dynamic standers have footplates that are incorporated into the existing standing frames to provide reciprocal loading that mimics the forces applied to the lower limbs during the natural walking gait. 15 hole-body vibration therapy uses a vibrating platform that the user stands on in a static position or moving in dynamic

movements. Overall, there is some evidence that physical activity, including standing, whether passive or dynamic, improves BMD. There is limited evidence that the improvement in bone density is in the areas most susceptible to fracture, and no evidence yet available that actual fracture rates are decreased. Findings from studies conflicted as to whether dynamic standing provided any additional benefit to BMD, and the small number of participants means no conclusion can be drawn. Vibration therapy may provide some benefit to BMD in ambulant children, but there is no evidence of benefit in those unable to stand. It is unknown whether this is valid finding or a reflection of the challenge of conducting these studies. A combination of all therapies was suggested to significantly improve BMD, but it is not possible to make generalisations of benefit outside of this case series. Therapies appear generally well tolerated, and no significant adverse events were reported in these studies.

Dynamic and combination therapies attempt to recreate the weight-bearing and muscle tension forces of ambulation that stimulate bone growth. It might be reasonable to presume that this style of therapy provides the best stimulus for bone growth, but studies to test the hypothesis are challenging because of the heterogeneity of children with cerebral palsy and the confounding

factors of other therapies and conditions. Study sample sizes, particularly those that found benefit of additional therapies, are generally very small and non-blinded. Consequently, the combination and optimal dose of therapy (duration and frequency) remain unknown. Evidence from larger-scale studies of pragmatic real-life interventions, with matched control group, would be necessary before additional time-consuming therapies can be recommended.

CLINICAL BOTTOM LINE There is some evidence that standing therapies increase bone mineral density in non-ambulant children, which it is hoped might therefore reduce fracture risk (grade c). Vibration and dynamic physical therapy programmes may have additional potential for improvement in bone mineral density, but evidence of clinical value has not been established (grade c). Combining different activities and therapies may seem a reasonable approach, but there is a lack of evidence for the optimum combination and duration of therapy (grade d)

[PMID: 26586521](#)

7. Dev Med Child Neurol. 2015 Nov 14. doi: 10.1111/dmcn.12975. [Epub ahead of print]

Speech, language, communication, and cerebral palsy.

Pennington L.

This commentary is on the original article by Hustad et al. ‘Alignment of classification paradigms for communication abilities in children with cerebral palsy’

[PMID: 26566894](#)

8. Dev Med Child Neurol. 2015 Nov 14. doi: 10.1111/dmcn.12957. [Epub ahead of print]

Language outcomes of children with cerebral palsy aged 5 years and 6 years: a population-based study.

Mei C, Reilly S, Reddihough D, Mensah F, Pennington L, Morgan A.

AIM: To examine the frequency, range, and features of language impairment in a community sample of children with cerebral palsy (CP) aged 5 to 6 years. **METHOD:** Children with CP born between 2005 and 2007 were identified through the Victorian Cerebral Palsy Register. Eighty-four participants were recruited, representing 48% of the contacted families. The recruited sample was representative of non-participants. Participants completed standardized measures of receptive and expressive language, and non-verbal cognition. **RESULTS:** Language impairment was identified in 61% (51/84) of participants. Twenty-four per cent (20/84) were non-verbal. Co-occurring receptive and expressive language impairment was common (37/84, 44%). Isolated receptive (6/84, 7%) and expressive (4/84, 5%) impairments occurred relatively infrequently. At a group level, verbal and non-verbal participants demonstrated deficits across language subdomains (i.e. semantics, syntax, morphology), rather than in single domains. Cognitive impairment and Gross Motor Function Classification System levels IV and V were associated with higher rates of language impairment (odds ratio [OR] 15.2, 95% confidence interval [CI] 3.2-71.8 and OR 8.5, 95% CI 1.8-40.3 respectively). Only cognition was independently associated with language impairment when both of these factors were

considered within a multivariable model. INTERPRETATION: Language impairment was common in 5-year-old and 6-year-old children with CP, affecting three out of five children. Participants were impaired across linguistic subdomains indicating a generalized language deficit. Findings suggest most children would benefit from a clinical language assessment. To target services effectively, subgroups of individuals with CP at greatest risk for language impairment need to be identified.

[PMID: 26566585](#)

Prevention and Cure

9. Crit Care Med. 2015 Dec;43(12 Suppl 1):128.

506: CEREBELLAR INFLAMMATION AND DYSFUNCTION IN A RABBIT MODEL OF CEREBRAL PALSY.

Narayan S, Zhang Z, Nance E, Kannan S.

Learning Objectives: Increasing evidence has shown that in addition to its motor functions, the cerebellum is involved in higher cognitive functions, with functional connectivity to the frontal cortex. We have previously shown that intrauterine lipopolysaccharide (LPS) exposure induced white matter injury and increased microglial activation in the cerebrum, resulting in deficits consistent with clinical findings seen in cerebral palsy (CP). However, the presence and role of cerebellar neuroinflammation is not well elucidated. Our hypothesis is that exposure to intrauterine LPS results in inflammation of the immature cerebellum and impaired cerebellar function. **Methods:** Time-pregnant New Zealand white rabbits underwent a laparotomy and endotoxin or saline administration at gestation day 28 as previously described by us. Cerebellum from CS and endotoxin groups at postnatal day (PND) 1 and 5 were evaluated for presence and morphology of microglia by immunohistochemistry and Neurolucida, and inflammatory response in the cerebellum was quantified by PCR and ELISA. Cerebellar learning was determined using an eye-blink conditioning response, comparing CP and age matched control groups. Targeting activated microglia in the cerebellum for therapeutic intervention was evaluated by determining the localization and distribution of dendrimer nanodevices in the cerebellum, as seen by fluorescent microscopy. **Results:** Increased and persistent microglial activation, as evidenced by increased numbers and morphologic changes, was found in the cerebellar white and deep grey matter in newborn kits with CP. A significant improvement in the non-conditioned response was noted in healthy control rabbits at the end of the eyeblink training period indicating appropriate cerebellar learning. **Conclusions:** Cerebellar inflammation and injury may play an important role in impaired learning and cognition in neurodevelopmental disorders such as autism and CP. Future directions include targeting activated microglia in the cerebellum using dendrimer based nanodevices for improving cerebellar learning and cognitive function.

[PMID: 26570167](#)