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**Professor Nadia Badawi AM**  
CP Alliance Chair of Cerebral Palsy Research

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## Interventions and Management

### 1. Promoting 24-hour movement guideline adherence in ambulatory children with cerebral palsy

Cindy H P Sit

Dev Med Child Neurol. 2022 Aug 4. doi: 10.1111/dmcn.15373. Online ahead of print.

No abstract available

PMID: [35929098](#)

### 2. Neurogenic Bladder: Assessment and Operative Management

Molly E DeWitt-Foy, Sean P Elliott

Review Urol Clin North Am. 2022 Aug;49(3):519-532. doi: 10.1016/j.ucl.2022.04.010. Epub 2022 Jun 30.

We present a phenotype-based approach to neurogenic bladder (NGB) by describing prototypical patients with spinal cord injury (SCI), spina bifida (SB), cerebral palsy (CP), and multiple sclerosis (MS). Surgical management is categorized by failure to store and failure to empty, with a focus on catheterizable channels, bladder augmentation, and bladder outlet procedures. Mitigation and management of common complications are reviewed. Specific attention is paid to social support, body habitus, and extremity function, as we believe a holistic approach is necessary for appropriate surgical selection.

PMID: [35931441](#)

### 3. Extracting synchronized neuronal activity from local field potentials based on a marked point process framework

Yifan Huang, Xiang Zhang, Xiang Shen, Shuhang Chen, Jose Principe, Yiwen Wang

J Neural Eng. 2022 Aug 3. doi: 10.1088/1741-2552/ac86a3. Online ahead of print.

Objective: Brain-machine interfaces (BMIs) translate neural activity into motor commands to restore motor functions for people with paralysis. Local field potentials (LFPs) are promising for long-term BMIs, since the quality of the recording lasts longer than single neuronal spikes. Inferring neuronal spike activity from population activities such as LFPs is challenging, because LFPs stem from synaptic currents flowing in the neural tissue produced by various neuronal ensembles and reflect

neural synchronization. Existing studies that combine LFPs with spikes leverage the spectrogram of LFPs, which can neither detect the transient characteristics of LFP features (here, neuromodulation in a specific frequency band) with high accuracy, nor correlate them with relevant neuronal activity with a sufficient time resolution. Approach: We propose a feature extraction and validation framework to directly extract LFP neuromodulations related to synchronized spike activity using recordings from the primary motor cortex of six Sprague Dawley (SD) rats during a lever-press task. We first select important LFP frequency bands relevant to behavior, and then implement a marked point process (MPP) methodology to extract transient LFP neuromodulations. We validate the LFP feature extraction by examining the correlation with the pairwise synchronized firing probability of important neurons, which are selected according to their contribution to behavioral decoding. The highly correlated synchronized firings identified by the LFP neuromodulations are fed into a decoder to check whether they can serve as a reliable neural data source for movement decoding. Main results: We find that the gamma band (30-80Hz) LFP neuromodulations demonstrate significant correlation with synchronized firings. Compared with traditional spectrogram-based method, the higher-temporal resolution MPP method captures the synchronized firing patterns with fewer false alarms, and demonstrates significantly higher correlation than single neuron spikes. The decoding performance using the synchronized neuronal firings identified by the LFP neuromodulations can reach 90% compared to the full recorded neuronal ensembles. Significance: Our proposed framework successfully extracts the sparse LFP neuromodulations that can identify temporal synchronized neuronal spikes with high correlation. The identified neuronal spike pattern demonstrates high decoding performance, which reveals the possibility of using LFP as an effective modality for long-term BMI decoding.

PMID: [35921802](#)

#### **4. Feasibility of total hip arthroplasty in cerebral palsy patients: a systematic review on clinical outcomes and complications**

Catalina Larrague, Cecilia Fieiras, Diego Campelo, Fernando M Comba, Gerardo Zanotti, Pablo A Slullitel, Martin A Buttarò

Review Int Orthop. 2022 Aug 2. doi: 10.1007/s00264-022-05528-5. Online ahead of print.

Purpose: Total hip arthroplasty (THA) is a successful treatment for hip osteoarthritis secondary to hip dysplasia. However, the reported rate of complications following THA in the settings of neuromuscular diseases is high. This systematic review aimed to analyze the indications, functional outcomes and surgical failures of primary THA in cerebral palsy (CP) patients. Methods: MEDLINE, EMBASE and the Cochrane Database of Systematic Reviews were searched, and all clinical studies focusing on THA in patients with CP from inception through March 2020 were included. The methodological quality was assessed with Guo et al.'s quality appraisal checklist for case series and case-control studies, while cohort and prospective studies were evaluated with a modified version of the Downs and Black's quality assessment checklist. Results: The initial search returned 69 studies out of which 15, including 2732 THAs, met the inclusion criteria. The most frequent indication for THA was dislocated painful hip for which previous non-operative treatment had failed. Complications presented in 10 to 45% of cases. The most frequently reported complication was dislocation (1-20%), followed by component loosening (0.74-20%). Aseptic component loosening was the most frequent cause of revision surgery, followed by dislocation and periprosthetic fracture. Mean implant survival at ten years was 84% (range 81-86%). Conclusion: The available literature suggests that although THA is a beneficial procedure in CP patients, it has a higher rate of complications and worse implant survival than the general population.

PMID: [35916954](#)

#### **5. Race Is Associated with Risk of Salvage Procedures and Postoperative Complications After Hip Procedures in Children with Cerebral Palsy**

Lauryn Brown, Kevin M Cho, Omar H Tarawneh, Theodore Quan, Alisa Malyavko, Sean A Tabaie

J Pediatr Orthop. 2022 Aug 2. doi: 10.1097/BPO.0000000000002216. Online ahead of print.

Background: Despite the many surgical interventions available for spastic hip dysplasia in children with cerebral palsy, a radical salvage hip procedure may still ultimately be required. The purpose of this study was to assess whether race is an independent risk factor for patients with cerebral palsy to undergo a salvage hip procedure or experience postoperative complications for hip dysplasia treatment. Methods: This is a retrospective cohort analysis utilizing the American College of Surgeons National Surgical Quality Improvement Program (NSQIP) Pediatric database from 2012 to 2019. International Classification of Diseases, 9th and 10th Revisions, Clinical Modifications (ICD-9-CM, ICD-10-CM), and current procedural terminology (CPT) codes were used to identify patients with cerebral palsy undergoing hip procedures for hip dysplasia and to

stratify patients into salvage or reconstructive surgeries. Results: There was a total of 3906 patients with cerebral palsy between the ages of 2 and 18 years undergoing a procedure for hip dysplasia, including 1995 (51.1%) White patients, 768 (19.7%) Black patients, and 1143 (29.3%) patients from other races. Both Black (P=0.044) and White (P=0.046) races were significantly associated with undergoing a salvage versus a reconstructive hip procedure, with Black patients having an increased risk compared to White patients [adjusted odds ratio (OR) 1.77, confidence interval (CI) 1.02-3.07]. Only Black patients were found to have an increased risk of any postoperative complication compared to White patients, with an adjusted OR of 1.26 (CI 1.02-1.56; P=0.033). Both White (P=0.017) and black (P=0.004) races were found to be significantly associated with medical complications, with Black patients having an increased risk (adjusted OR 1.43, CI 1.12-1.84) compared to White patients. There were no significant findings between the race and risk of surgical site complications, unplanned readmissions, or reoperations. Conclusion: This study demonstrates that patient race is an independent association for the risk of pediatric patients with cerebral palsy to both undergo a salvage hip procedure and to experience postoperative medical complications, with Black patients having an increased risk compared to White. Level of evidence: Level III Retrospective Cohort Study.

PMID: [35930795](#)

## 6. 5-year risk of "adult-onset" chronic diseases during childhood and adolescent transitioning for individuals with cerebral palsy

Daniel G Whitney

Prev Med Rep. 2022 Jul 28;29:101933. doi: 10.1016/j.pmedr.2022.101933. eCollection 2022 Oct.

Epidemiologic evidence documenting risk of chronic diseases as children with cerebral palsy age throughout growth is lacking to inform prevention strategies. The objective was to characterize the 5-year risk of chronic diseases that are typically associated with advanced aging among < 1-13 year olds with cerebral palsy and effects by patient-level factors. This retrospective cohort study used nationwide commercial administrative claims from 01/01/2001-12/31/2018 from children < 1-13 years old with  $\geq 5$  years of mostly continuous insurance enrollment. The 5-year risk of chronic diseases was examined for the entire cohort with and without cerebral palsy and then by baseline age group (<1-2, 3-5, 6-8, 9-11, 12-13 years old), including cardiorespiratory, metabolic, kidney, and liver diseases, cancer, depression, and osteoarthritis. For cerebral palsy, the association between 5-year chronic disease rate and patient-level factors was assessed using Cox regression. Children with (n = 5,559) vs without (n = 2.3 million) cerebral palsy had a higher 5-year risk of all chronic diseases when comparing the entire cohorts (relative risk, 1.19 to 64.26, all P < 0.05) and most chronic diseases when comparing cohorts for each age group. Among children with cerebral palsy, there were effects by gender, co-occurring intellectual disabilities and/or epilepsy, and wheelchair use for some chronic diseases, which can help to identify at-risk children. This study provides novel epidemiologic evidence of 5-year risk of "adult-onset" chronic diseases for children with cerebral palsy during important developmental stages, and associated patient-level factors (to enhance clinical detection). Findings may inform when to implement prevention strategies and who may be more at risk.

PMID: [35928595](#)

## 7. Brain volumes and functional outcomes in children without cerebral palsy after therapeutic hypothermia for neonatal hypoxic-ischaemic encephalopathy

Arthur P C Spencer, Richard Lee-Kelland, Jonathan C W Brooks, Sally Jary, James Tonks, Frances M Cowan, Marianne Thoresen, Ela Chakkarapani

Dev Med Child Neurol. 2022 Jul 30. doi: 10.1111/dmcn.15369. Online ahead of print.

Aim: To investigate whether brain volumes were reduced in children aged 6 to 8 years without cerebral palsy, who underwent therapeutic hypothermia for neonatal hypoxic-ischaemic encephalopathy (patients), and matched controls, and to examine the relation between subcortical volumes and functional outcome. Method: We measured regional brain volumes in 31 patients and 32 controls (median age 7 years and 7 years 2 months respectively) from T1-weighted magnetic resonance imaging (MRI). We assessed cognition using the Wechsler Intelligence Scales for Children, Fourth Edition and motor ability using the Movement Assessment Battery for Children, Second Edition (MABC-2). Results: Patients had lower volume of whole-brain grey matter, white matter, pallidi, hippocampi, and thalami than controls (false discovery rate-corrected p < 0.05). Differences in subcortical grey-matter volumes were not independent of total brain volume (TBV). In patients, hippocampal and thalamic volumes correlated with full-scale IQ (hippocampi, r = 0.477, p = 0.010; thalami, r = 0.452, p = 0.016) and MABC-2 total score (hippocampi, r = 0.526, p = 0.004; thalami, r = 0.505, p = 0.006) independent of age, sex, and TBV. No significant correlations

were found in controls. In patients, cortical injury on neonatal MRI was associated with reduced volumes of hippocampi ( $p = 0.001$ ), thalami ( $p = 0.002$ ), grey matter ( $p = 0.015$ ), and white matter ( $p = 0.013$ ). Interpretation: Children who underwent therapeutic hypothermia have reduced whole-brain grey and white-matter volumes, with associations between hippocampal and thalamic volumes and functional outcomes.

PMID: [35907252](#)

### **8. Factors associated with MRI success in children cooled for neonatal encephalopathy and controls**

Kathryn Woodward, Arthur P C Spencer, Sally Jary, Ela Chakkarapani

Pediatr Res. 2022 Jul 29. doi: 10.1038/s41390-022-02180-y. Online ahead of print.

**Objective:** To investigate if an association exists between motion artefacts on brain MRI and comprehension, co-ordination, or hyperactivity scores in children aged 6-8 years, cooled for neonatal encephalopathy (cases) and controls. **Methods:** Case children ( $n = 50$ ) without cerebral palsy were matched with 43 controls for age, sex, and socioeconomic status. Children underwent T1-weighted (T1w), diffusion-weighted image (DWI) brain MRI and cognitive, behavioural, and motor skills assessment. Stepwise multivariable logistic regression assessed associations between unsuccessful MRI and comprehension (including Weschler Intelligence Scale for Children (WISC-IV) verbal comprehension, working memory, processing speed and full-scale IQ), co-ordination (including Movement Assessment Battery for Children (MABC-2) balance, manual dexterity, aiming and catching, and total scores) and hyperactivity (including Strengths and Difficulties Questionnaire (SDQ) hyperactivity and total difficulties scores). **Results:** Cases had lower odds of completing both T1w and DWIs (OR: 0.31, 95% CI 0.11-0.89). After adjusting for case-status and sex, lower MABC-2 balance score predicted unsuccessful T1w MRI (OR: 0.81, 95% CI 0.67-0.97,  $p = 0.022$ ). Processing speed was negatively correlated with relative motion on DWI ( $r = -0.25$ ,  $p = 0.026$ ) and SDQ total difficulties score was lower for children with successful MRIs ( $p = 0.049$ ). **Conclusions:** Motion artefacts on brain MRI in early school-age children are related to the developmental profile. **Impact:** Children who had moderate/severe neonatal encephalopathy are less likely to have successful MRI scans than matched controls. Motion artefact on MRI is associated with lower MABC-2 balance scores in both children who received therapeutic hypothermia for neonatal encephalopathy and matched controls, after controlling for case-status and sex. Exclusion of children with motion artefacts on brain MRI can introduce sampling bias, which impacts the utility of neuroimaging to understand the brain-behaviour relationship in children with functional impairments.

PMID: [35906304](#)