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**Professor Nadia Badawi**

Macquarie Group Foundation Chair of Cerebral Palsy  
PO Box 560, Darlinghurst, New South Wales 2010 Australia

## Interventions and Management

### 1. Dev Neurorehabil. 2013 Apr 25. [Epub ahead of print]

#### **NeuroGame Therapy to improve wrist control in children with cerebral palsy: A case series.**

Rios DC, Gilbertson T, McCoy SW, Price R, Gutman K, Miller KE, Fechko A, Moritz CT.

Department of Rehabilitation Medicine, University of Washington, Seattle, WA, USA.

**Objective:** This case series examines the feasibility, specificity, and preliminary effectiveness of NeuroGame Therapy (NGT) for improving wrist control in four children with cerebral palsy (CP). NGT uses surface electromyographic (sEMG) signals routed through motivating computer games to improve motor control. **Methods:** Primary outcomes of NGT included feasibility (hours of play) and specificity (changes in sEMG activity during game play). Secondary outcomes included changes in co-contraction, range of motion, segmental alignment, and spontaneous upper extremity function following intervention. **Results:** Participants completed a mean of 8.8 hours of NGT over 5-6 weeks. Participants demonstrated dramatic improvement of the sEMG activity during game play. Several participants also showed improvements in range of motion, co-contraction, and spontaneous upper extremity function following NGT. **Conclusion:** This case series provides evidence for the feasibility, specificity, and effectiveness of NGT. Future studies will pair NGT with functional practice to improve transfer of learning to daily activities.

[PMID: 23617243](#) [PubMed - as supplied by publisher]

### 2. Pediatrics. 2013 Apr 22. [Epub ahead of print]

#### **Structural Neuroplastic Change After Constraint-Induced Movement Therapy in Children With Cerebral Palsy.**

Sterling C, Taub E, Davis D, Rickards T, Gauthier LV, Griffin A, Uswatte G.

Departments of Psychology.

Research from the present laboratory with adult stroke patients showed that structural neuroplastic changes are correlated with clinical improvements due to constraint-induced movement (CI) therapy. This pilot study evaluated whether comparable changes occur in children receiving CI therapy. Ten children (6 boys) with congenital hemiparesis (mean age: 3 years, 3 months) underwent MRI scans 3 weeks before, immediately before, and

immediately after receiving 3 weeks of CI therapy. Longitudinal voxel-based morphometry was performed on MRI scans to determine gray matter change. In addition, the Pediatric Motor Activity Log-Revised was administered at these time points to assess arm use in daily life before and after treatment. Children exhibited large improvements after CI therapy in spontaneous use of the more-affected arm ( $P < .001$ ,  $d' = 3.24$ ). A significant increase in gray matter volume occurred in the sensorimotor cortex contralateral to the more-affected arm ( $P = .04$ ); there was a trend for these changes to be correlated with motor improvement ( $r = 0.63$ ,  $P = .063$ ). Trends were also observed for increases in gray matter volume in the ipsilateral motor cortex ( $P = .055$ ) and contralateral hippocampus ( $P = .1$ ). No significant gray matter change was seen during the 3 weeks before treatment. These findings suggest that CI therapy produces gray matter increases in the developing nervous system and provide additional evidence that CI therapy is associated with structural remodeling of the human brain while producing motor improvement in patients with disabling central nervous system diseases.

[PMID: 23610209](#) [PubMed - as supplied by publisher]

### **3. Dev Neurorehabil. 2013 Apr 25. [Epub ahead of print]**

#### **Functional strength training in child with cerebral palsy GMFCS IV: Case report.**

Dos Santos AN, da Costa CS, Golineleo MT, Rocha NA.

Department of Physiotherapy, Neuropediatrics Section, Universidade Federal de São Carlos , São Carlos, SP , Brazil.

**Objective:** To evaluate the effectiveness of a functional strength training. **Case report:** A nine-year-old child with Cerebral Palsy (CP) classified as level IV according to Gross Motor Function Classification System participated in the study. Assessments were at baseline, five weeks and 10 weeks post-intervention. Lower-extremity muscles strength was evaluated with an isokinetic dynamometer. Also, Gross Motor Function Measure (GMFM-88) and Timed up & Go (TUG) tests were assessed. A functional strength training protocol, four sessions a week, for 10 weeks was applied. **Results:** Following functional strength training, it improvements were found in hip, knee and ankle muscles strength, as well as increase in GMFM-88 score and decrease in time for TUG test performance. **Positives outcomes** from functional strength training were obtained beyond improvements in strength, since improvements in functional motor performance were also achieved. **Conclusion:** Therefore, individualized, specific and functional strength training seems to be an alternative to rehabilitation of children with CP with high level of functional disability.

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### **4. Disabil Rehabil. 2013 Apr 24. [Epub ahead of print]**

#### **The bodily experience of cerebral palsy: a journey to self-awareness.**

Brunton LK, Bartlett DJ.

Health and Rehabilitation Sciences Program, Faculty of Health Sciences, The University of Western Ontario , London, ON , Canada and.

**Purpose:** The aim of the study was to describe the lived bodily experience of cerebral palsy (CP). **Method:** This was a descriptive phenomenological inquiry. Ten participants were interviewed about their bodily experiences of living with CP. Interviews were semi-structured around pain and fatigue. Inductive thematic analysis was used to identify themes. **Results:** The bodily experience of CP centered on issues of fatigue and pain as a feeling of muscle soreness. An overwhelming amount of the discussion on fatigue emphasized the fatigue that occurs with walking and prolonged activity. Self-awareness of the individuals' own bodies and adapting activity to continue to participate in various aspects of their lives emerged as the most important theme. Some participants used strategies to manage their pain or fatigue; other participants were not yet fully aware of how to recognize signs of fatigue and/or how to adapt their activities. **Conclusions:** Self-awareness appears to be an important process to be fostered by service providers and parents. Specifically, encouraging youth with CP to be aware of their own bodies and the effects (positive and negative) of activity on pain and fatigue should be incorporated into transition programs as the individual becomes responsible for his or her own health care needs. **Implications for Rehabilitation** Fatigue is a

major concern for some youth and young adults with cerebral palsy. Adolescents and young adults with cerebral palsy use a variety of techniques (including adapting or restricting activity and building in rest breaks) to manage fatigue. The process of self-awareness should be fostered by health care professionals leading up to and during transition from pediatric to adult care. Clinical conversations should explore the role of exercise, adaptive equipment, rest and other strategies for dealing with fatigue with a focus on understanding each client's needs individually.

[PMID: 23614354](#) [PubMed - as supplied by publisher]

##### **5. Int J Rehabil Res. 2013 Apr 17. [Epub ahead of print]**

###### **Effect of radial shock wave therapy on muscle spasticity in children with cerebral palsy.**

Gonkova MI, Ilieva EM, Ferriero G, Chavdarov I.

a. Department of Physical and Rehabilitation Medicine, Medical University, Plovdiv b. Specialized Hospital for Rehabilitation of Children with Cerebral Palsy 'Santa Sofia', Sofia, Bulgaria Unit of Occupational Rehabilitation and Ergonomics, 'Salvatore Maugeri' Foundation, IRCCS, Scientific Institute of Veruno (NO), Veruno, Italy.

Extracorporeal shock wave therapy is a treatment of choice in patients with musculoskeletal disorders. The aim of this study was to investigate the effect of radial shock wave therapy (RSWT) on muscle spasticity of plantar flexor muscles in children with cerebral palsy. This was an open, controlled, observational study with one placebo treatment session, followed 4 weeks later by one active treatment session. Procedures and measurements were performed on inpatients of the Physical and Rehabilitation department of the Medical University Hospital, Plovdiv, Bulgaria. Twenty-five children, mean age  $4.84 \pm 3.11$  years, with spastic diplegia and hemiplegia participated in the study. They received a single session of RSWT to the plantar flexors of the foot. The following clinical methods were used for outcome assessment before, after, and 2 and 4 weeks later: passive range of motion, Modified Ashworth Scale. Baropodometric measurements were performed before and after the placebo and active session. After placebo application, no changes measured by clinical or instrumental methods were found. After RSWT, a significant increase in passive range of motion was observed:  $47.00 \pm 2.29^\circ$  versus  $33.25 \pm 2.20^\circ$  ( $P < 0.001$ ), which persisted at the second ( $46.87 \pm 2.08^\circ$ ,  $P < 0.001$ ) and fourth week ( $44.12 \pm 1.93^\circ$ ,  $P < 0.001$ ) after treatment. The Modified Ashworth Scale score decreased from 2.77 to 2.00 points ( $P < 0.001$ ), which persisted at the second (mean  $2.05 \pm 0.07$  points,  $P < 0.001$ ) and fourth week ( $2.15 \pm 0.76$  points,  $P < 0.001$ ) after treatment. Baropodometric measurement showed a significant increase in the contact plantar surface area of the affected foot (from  $81.32 \pm 6.14$  to  $101.58 \pm 5.41$  cm,  $P < 0.001$ ) and in heel pressure (from  $50.47 \pm 6.61$  to  $75.17 \pm 3.42$  N/cm,  $P < 0.001$ ). There is a significant reduction in the spasticity of plantar flexor muscles in children with cerebral palsy after a single session of RSWT and this improvement remains at the 4-week follow-up.

[PMID: 23603803](#) [PubMed - as supplied by publisher]

##### **6. Arch Dis Child. 2013 Apr 20. [Epub ahead of print]**

###### **Pain in young people aged 13 to 17 years with cerebral palsy: cross-sectional, multicentre European study.**

Parkinson KN, Dickinson HO, Arnaud C, Lyons A, Colver A; on behalf of the SPARCLE group.  
Collaborators (10)

Institute of Health and Society, Newcastle University, , Newcastle upon Tyne, UK.

**OBJECTIVE:** To determine the prevalence and associations of self- and parent-reported pain in young people with cerebral palsy (CP). **DESIGN AND SETTING:** Cross-sectional questionnaire survey conducted at home visits in nine regions in seven European countries. Participants were 13 to 17-year-olds ( $n=667$ ) drawn from population CP registers in eight regions and from multiple sources in one region. 429 could self-report; parent-reports were obtained for 657. Data were collected on: severity, frequency, site and circumstances of pain in previous week; severity of pain associated with therapy in previous year. **RESULTS:** The estimated population prevalence of any pain in previous week was 74% (95% CI 69% to 79%) for self-reported pain and 77% (95% CI 73% to 81%) for parent-reported pain. 40% experienced leg pains, 34% reported headaches and 45% of those who received physiotherapy experienced pain during therapy. Girls reported more pain than boys (OR=2.1, 95% CI 1.5 to 3.0)

and young people reported more pain if they had emotional difficulties (comparing highest and lowest quartiles: OR=3.1, 95% CI 1.7 to 5.6). Parents reported more pain in children with emotional difficulties (OR=4.2, 95% CI 2.7 to 6.6), or with more impaired walking ability. **CONCLUSIONS:** Pain in young people with CP is highly prevalent. Because pain causes immediate distress and is associated with lower subjective well-being and reduced participation, clinicians should routinely assess pain. Clinical interventions to reduce pain should be implemented and evaluated. The efficacy of medical and therapeutic interventions causing pain should be re-examined to establish if their benefit justifies the pain and fear of pain that accompany them.

[PMID: 23606716](#) [PubMed - as supplied by publisher]

## 7. Disabil Rehabil. 2013 Apr 25. [Epub ahead of print]

### Parents' perspectives on the quality of life of adolescents with cerebral palsy: trajectory, choices and hope.

Shikako-Thomas K, Bogossian A, Lach LM, Shevell M, Majnemer A.

School of Physical and Occupational Therapy .

**Introduction:** Quality of life (QoL) is an important outcome of health interventions for children and youth with cerebral palsy (CP). When planning interventions it is fundamental to understand what constitutes a good QoL, a subjective construct, and what factors are important to consider from both parents' and children's perspectives. **Methods:** We used a grounded theory methodology to explore parents' perspectives on the factors that are important for the QoL of their adolescents with CP. Fourteen parents were interviewed using a purposeful sampling strategy, followed by theoretical sampling until saturation was reached. **Results:** Parents reflected on several important aspects of their children's QoL. In particular, they described how their trajectories as parents of a child with a disability have contributed to their adolescents' current well-being. Over time, parents' hopes for a cure were transformed into hopes for their child's happiness. This trajectory was influenced by the adolescents' intrinsic characteristics and the parents' strategies to overcome challenges and was informed by the parents' and their children's ability to make choices in pursuit of their preferences. **Conclusions:** Adolescents' and parents' accounts should be considered when planning interventions for adolescents with disabilities. It is important to consider parents' personal characteristics, experiences and the strategies that have been proven to be efficacious in improving their children's QoL and to understand their need to make choices relating to participation and accessibility in order to promote QoL for this at-risk population. **Implications for Rehabilitation** Parents' trajectory on raising a child with a disability is important for understanding adolescents' QoL. Parents' characteristics and environmental factors influence adolescents' well-being. Hope and choice experiences by parents of children with CP are important for their children's QoL. Transition from pediatric to adult services are required to address disability-related aspects as well as adolescent needs for intimacy, sexuality and planning for their future during adolescence.

[PMID: 23614371](#) [PubMed - as supplied by publisher]

## 8. Zhongguo Dang Dai Er Ke Za Zhi. 2013 Apr;15(4):317-20.

### The assessment of general movements: a reliable tool for predicting the neurodevelopment of preterm infants in an very early phase [Article in Chinese]

Li N, Jia FY, DU L.

Division of Pediatric Neurorehabilitation, Department of Pediatrics, Second Part of First Hospital of Jilin university, Changchun 130031, China. feiyong\_jia@yahoo.cn.

**OBJECTIVE:** Cerebral palsy (CP) is a permanent disorder in the development of movement and posture in the developing infant brain and is one of the major disabilities that result from extremely preterm birth. Early identification of possible neurodevelopmental injury offers the opportunity to deliver intervention at a very early age and thus prevent severe disability. The assessment of general movements (GMs), has emerged as a reliable and valid predictor of severe neurologic deficits in infants. This method is based on a visual Gestalt perception of the quality of GMs in the preterm and term periods, and postterm up to 5 months. The quality of "fidgety movements" is the most valuable marker for predicting neurologic outcomes.

[PMID: 23607961](#) [PubMed - in process]

## Prevention and Cure

**9. Acta Paediatr. 2013 Apr 19. doi: 10.1111/apa.12271. [Epub ahead of print]**

**Development of neuromotor functions in very low birth weight children from six to ten years of age: patterns of change.**

Natalucci G, Schneider M, Werner H, Cafilisch JA, Bucher HU, Jenni OG, Latal B.

Child Development Centre, University Children's Hospital Zurich, Switzerland; Department of Neonatology, University Hospital Zurich, Switzerland.

**AIM:** To assess patterns of change for different neuromotor functions in very low birth weight (VLBW) children during school age and to identify factors associated with improvement. **METHODS:** In a longitudinal study, we examined 65 prospectively enrolled VLBW children (38 female, 59%) without cerebral palsy at age six and ten years. Measures included the evaluation of timed motor performance and motor overflow (MO) for the motor components of the Zurich Neuromotor Assessment (pure motor-, adaptive fine and gross motor tasks, static balance) and a standardized neurological examination. Variables associated with improvement were assessed by multiple regression analyses. **RESULTS:** Between six and ten years, adaptive fine motor tasks (40% versus 17% of children scoring below 10th percentile) and MO (77% versus 55%) improved significantly (both  $p < 0.01$ ), while all other components remained stable (pure motor 23% versus 25%, adaptive gross motor 26% versus 34%, static balance 18% versus 20%, respectively). Mild neurological abnormalities at six years of age were associated with less improvement. **CONCLUSION:** Neuromotor functions improve in some children potentially reflecting catch up of maturational delay. However, the majority of neuromotor functions remain abnormal in a significant proportion of VLBW children. This article is protected by copyright. All rights reserved.

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**10. Arch Dis Child Fetal Neonatal Ed. 2013 Apr 19. [Epub ahead of print]**

**Long-term cognitive and neurological outcome of preterm infants with postnatally acquired CMV infection through breast milk.**

Goelz R, Meisner C, Bevot A, Hamprecht K, Kraegeloh-Mann I, Poets CF.

Department of Neonatology, University Children's Hospital, Tuebingen, Germany.

**INTRODUCTION:** Long-term follow-up data on preterm infants with breast milk-acquired postnatal cytomegalovirus (CMV) infection are sparse. **AIM:** To systematically evaluate the long-term cognitive outcome and prevalence of cerebral palsy (CP) in patients after postnatal CMV infection. **PATIENTS AND METHODS:** All surviving infants <1500 g born in our centre between 1 June 1995 and 1 June 2000, and with postnatal CMV infection acquired at up to 3 months of corrected age, were eligible for our study; this included neurological and neurocognitive assessment, using the Kaufman Assessment Battery for Children (K-ABC) at the age of >4 years. A blinded and controlled matched-pairs design was used with gestational age, gender and date of birth as matching criteria. **RESULTS:** Of 50 eligible children, 42 (84%) could be tested. There was no difference in the prevalence of cerebral palsy. Following CMV infection during their hospital stay, infants had significantly lower results in the simultaneous processing scale of the K-ABC ( $p = 0.029$ ) after correction for additional risk factors like socioeconomic status (SES). Results for the sequential and achievement scales were only slightly reduced ( $p > 0.05$ ). **CONCLUSIONS:** It seems possible that breast milk-acquired CMV infection has a detrimental influence on cognitive development of preterm infants.

[PMID: 23603882](#) [PubMed - as supplied by publisher]

**11. Eur J Paediatr Neurol. 2013 Apr 18. pii: S1090-3798(13)00049-4. doi: 10.1016/j.ejpn.2013.03.006. [Epub ahead of print]**

**Cooling in the real world: Therapeutic hypothermia in hypoxic-ischemic encephalopathy.**

Garfinkle J, Sant'anna GM, Wintermark P, Ali N, Morneault L, Koclas L, Shevell MI.

Department of Neurology/Neurosurgery, McGill University, Montreal Children's Hospital-McGill University Health Center, Montreal, Quebec, Canada; Division of Pediatric Neurology, Montreal Children's Hospital-McGill University Health Center, Montreal, Quebec, Canada.

**BACKGROUND AND AIM:** The benefits of therapeutic hypothermia have not been assessed from the perspective of the neurology clinic. We aimed to report the impact of the implementation of a local regional therapeutic hypothermia program on the neurodevelopmental outcomes of surviving hypoxic-ischemic encephalopathy (HIE) infants who were followed in the neonatal neurology clinic. **METHODS:** Retrospective analysis of term infants referred to the neonatal neurology clinic after having been diagnosed with HIE and meeting eligibility criteria for therapeutic hypothermia between March 1999 and June 2010. Therapeutic hypothermia was implemented in September 2008. Outcome measures were dichotomously defined as: normal or adverse, which included cerebral palsy, global developmental delay, and epilepsy. **RESULTS:** Thirty infants were included in the pre-therapeutic hypothermia group. Thirty-one infants received therapeutic hypothermia and 27 were adequately followed and included in the post-therapeutic hypothermia group. The frequency of an adverse outcome was significantly higher in the pre-therapeutic hypothermia infants (19/30 [63%] versus 4/27 [15%]; OR = 0.10; 95% CI, 0.03-0.37;  $P < 0.001$ ). Neonatal clinical seizures were more frequent in the pre-therapeutic hypothermia group ( $P = 0.012$ ). There were no differences regarding frequency of fetal distress, rate of caesarean sections, Apgar scores, need of resuscitation, cord/initial blood gases, and degrees of encephalopathy between the two groups. **CONCLUSIONS:** The implementation of a regional therapeutic hypothermia program in our institution has vastly reduced the observed neurological morbidity of surviving HIE infants followed in our neonatal neurology clinic. A similar change in outcomes of infants with HIE can be anticipated by other centers and other clinics adopting this therapy.

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**12. J Matern Fetal Neonatal Med. 2013 Apr 24. [Epub ahead of print]**

**Protective Effects of Pentoxifylline on Lipopolysaccharide-induced White Matter Injury in a Rat Model of Periventricular Leukomalacia.**

Dilek M, Kumral A, Okyay E, Ozbal S, Tugyan K, Tuzun F, Haydar Sever A, Yilmaz O, Duman N, Ozkan H.

Department of Pediatrics, Division of Neonatology.

**Objective.** To investigate the potential neuroprotective effect of maternal pentoxifylline (PNTX) treatment in endotoxin-induced periventricular leukomalacia (PVL) in the developing rat brain. **Methods.** Intraperitoneal injection of lipopolysaccharide were administered on two of three Wistar pregnant rats to establish PVL. To obtain PNTX-treated group, one of the two dams were injected PNTX. The control group was treated with saline. Rat pups were grouped as control, maternal LPS-treated group and PNTX+LPS-treated group. At 7th postnatal days, apoptosis and hypomyelination were evaluated. Apoptosis was evaluated by caspase-3 and terminal deoxynucleotidyl transferase [TdT] dUTP nick endlabelling reaction (TUNEL) immunostaining. To assess hypomyelination, myelin basic protein (MBP) staining, as a marker of myelination, was evaluated. **Results.** MBP staining was significantly less and weaker in the brains of the LPS-treated group as compared with the PNTX-treated group. PNTX treatment significantly reduced the number of apoptotic cells in the periventricular WM shown on Tunel and caspase-3. **Conclusions.** Presented study is firstly indicated that PNTX may provide protection against an LPS-induced inflammatory response and WMI in the developing rat brain. Our results also suggest that PNTX treatment in pregnant women with maternal or placental infection may minimize the risk of PVL and cerebral palsy.

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**13. Neonatology. 2013 Apr 23;104(1):15-21. [Epub ahead of print]****Introduction of Hypothermia for Neonates with Perinatal Asphyxia in the Netherlands and Flanders.**

Groenendaal F, Casaer A, Dijkman KP, Gavilanes AW, de Haan TR, Ter Horst HJ, Laroche S, Naulaers G, Rijken M, van Straaten HL, Steiner K, Swarte RM, Zecic A, Zonnenberg IA.

Department of Neonatology, Wilhelmina Children's Hospital/University Medical Center Utrecht, Utrecht, The Netherlands.

Background: Therapeutic hypothermia was introduced in the Netherlands and Flanders, Belgium, in 2008. Since then, an increasing number of patients has been treated - up to 166 in 2010. Complications and outcome were registered in an online database. Objectives: The aim of this study was to analyse complications and outcome after implementation. Methods: Data were retrieved from an online database to which all centres had contributed. Results: In 3 years, 332 patients were treated. Excluding 24 patients with congenital abnormalities or metabolic disorders, mortality was 31.8%. Of the 210 survivors without congenital malformations, 21 had cerebral palsy, another 19 a developmental delay of more than 3 months at the age of at least 24 months, and 2 had severe hearing loss. The total adverse outcome, combining death and adverse neurodevelopment, in 308 patients without congenital malformations is 45.5%, which is similar to that of the large trials. Conclusions: The introduction of therapeutic hypothermia for neonates with perinatal asphyxia in the Netherlands and Flanders has been rapid and successful, with results similar to findings in the randomised controlled trials.

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**14. BMC Res Notes. 2013 Apr 24;6(1):163. [Epub ahead of print]****Intra-partum fever and cerebral palsy in Khartoum, Sudan.**

Abdullahi H, Satti M, Rayis DA, Imam AM, Adam I.

BACKGROUND: Cerebral palsy (CP) is a major cause of childhood disability. There are various maternal and neonatal predictors associated with the development of CP, and they are variable across different populations. This case-control study was designed to investigate maternal and neonatal predictors of CP at Khartoum pediatric neurology clinics. Data (maternal sociodemographic characteristics and neonatal expected predictors) were collected from mothers of children with CP and healthy controls using questionnaires. RESULTS: One hundred and eleven cases of CP and 222 controls were included. Spastic CP was the most common type (69.4%). In logistic regression, maternal age, parity, birth weight, and sex were not associated with CP. However, maternal fever (OR = 8.4, CI = 2.3-30.5; P = 0.001), previous neonatal death (OR = 5.4, CI = 1.8-16.2; P = 0.003), and poor sucking (OR = 30.5, CI = 10.0-93.1; P < 0.001) were predictors of CP. CONCLUSIONS: Fever during labor is a significant risk factor for developing CP in children. Further efforts are required for labor management to prevent CP in this setting.

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