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Interventions and Management

1. Foot Ankle Int. 2015 Jun 3. pii: 1071100715588994. [Epub ahead of print]

Mid-term Results of Intramuscular Lengthening of Gastrocnemius and/or Soleus to Correct Equinus Deformity in Flatfoot.

Rong K, Ge WT, Li XC, Xu XY.

BACKGROUND: Intramuscular lengthening of the gastrocnemius and/or soleus (Baumann procedure) is widely used in patients who have cerebral palsy, with several advantages over other lengthening techniques. Tightness of the gastrocnemius or gastrocnemius-soleus complex has been confirmed to be related to flatfoot deformity. The purpose of this study was to evaluate the mid-term results of the Baumann procedure as a part of the treatment of flatfoot with equinus deformity. **METHODS:**

We reviewed 35 pediatric and adult patients (43 feet) with flatfoot who underwent the Baumann procedure for the concomitant equinus deformity. The mean duration of follow-up was 39.4 months. Preoperative and follow-up evaluations included the maximal angle of dorsiflexion of the ankle with the knee fully extended and with the knee flexed to 90 degrees, the American Orthopaedic Foot & Ankle Society ankle-hindfoot (AOFAS-AH) scores, and postoperative complications. **RESULTS:** Preoperatively, the mean angle of passive ankle dorsiflexion with the knee extended was -4.7 ± 2.7 degrees and that with the knee flexed was 2.3 ± 2.5 degrees. At the final follow-up, both values improved significantly by a mean of 13.6 degrees ($P < .001$) and 9.7 degrees ($P < .001$), respectively. The average AOFAS-AH scores improved from 56.8 points preoperatively to 72.1 at the final follow-up. Recurrence of equinus was observed in 3 patients (4 feet). There were no cases of overcorrection, neurovascular injury, or healing problems. **CONCLUSIONS:** Our results indicate that the Baumann procedure can effectively and sequentially correct the tightness of the gastrocnemius or the gastrocnemius-soleus complex in patients with flatfoot deformity, without obvious postoperative complications. **LEVEL OF EVIDENCE:** Level IV, retrospective case series. © The Author(s) 2015.

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2. Gait Posture. 2015 May 11. pii: S0966-6362(15)00460-9. doi: 10.1016/j.gaitpost.2015.04.019. [Epub ahead of print]

Gait Deviation Index, Gait Profile Score and Gait Variable Score in children with spastic cerebral palsy: Intra-rater reliability and agreement across two repeated sessions.

Rasmussen HM, Nielsen DB, Pedersen NW, Overgaard S, Holsgaard-Larsen A.

The Gait Deviation Index (GDI) and Gait Profile Score (GPS) are the most used summary measures of gait in children with cerebral palsy (CP). However, the reliability and agreement of these indices have not been investigated, limiting their clinimetric quality for research and clinical practice. The aim of this study was to investigate the intra-rater reliability and agreement of summary measures of gait (GDI; GPS; and the Gait Variable Score (GVS) derived from the GPS). The intra-rater reliability and agreement were investigated across two repeated sessions in 18 children aged 5-12 years diagnosed with spastic CP. No systematic bias was observed between the sessions and no heteroscedasticity was observed in Bland-Altman plots. For the GDI and GPS, excellent reliability with intraclass correlation coefficient (ICC) values of 0.8-0.9 was found, while the GVS was found to have fair to good reliability with ICCs of 0.4-0.7. The agreement for the GDI and the logarithmically transformed GPS, in terms of the standard error of measurement as a percentage of the grand mean (SEM%) varied from 4.1 to 6.7%, whilst the smallest detectable change in percent (SDC%) ranged from 11.3 to 18.5%. For the logarithmically transformed GVS, we found a fair to large variation in SEM% from 7 to 29% and in SDC% from 18 to 81%. The GDI and GPS demonstrated excellent reliability and acceptable agreement proving that they can both be used in research and clinical practice. However, the observed large variability for some of the GVS requires cautious consideration when selecting outcome measures.

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3. *Pediatr Phys Ther.* 2015 May 28. [Epub ahead of print]

Comparison of 2 Orthotic Approaches in Children With Cerebral Palsy.

Wren TA, Dryden JW, Mueske NM, Dennis SW, Healy BS, Rethlefsen SA.

PURPOSE: To compare dynamic ankle-foot orthoses (DAFOs) and adjustable dynamic response (ADR) ankle-foot orthoses (AFOs) in children with cerebral palsy. **METHODS:** A total of 10 children with cerebral palsy (4-12 years; 6 at Gross Motor Function Classification System level I, 4 at Gross Motor Function Classification System level III) and crouch and/or equinus gait wore DAFOs and ADR-AFOs, each for 4 weeks, in randomized order. Laboratory-based gait analysis, walking activity monitor, and parent-reported questionnaire outcomes were compared among braces and barefoot conditions.

RESULTS: Children demonstrated better stride length (11-12 cm), hip extension (2°-4°), and swing-phase dorsiflexion (9°-17°) in both braces versus barefoot. Push-off power (0.3 W/kg) and knee extension (5°) were better in ADR-AFOs than in DAFOs. Parent satisfaction and walking activity (742 steps per day, 43 minutes per day) were higher for DAFOs. **CONCLUSIONS:** ADR-AFOs produce better knee extension and push-off power; DAFOs produce more normal ankle motion, greater parent satisfaction, and walking activity. Both braces provide improvements over barefoot.

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4. *Pediatr Phys Ther.* 2015 May 28. [Epub ahead of print]

Commentary on: "Comparison of 2 Orthotic Approaches in Children With Cerebral Palsy".

Glanzman AM1, Cort J.

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5. *PM R.* 2015 May 29. pii: S1934-1482(15)00265-8. doi: 10.1016/j.pmrj.2015.05.020. [Epub ahead of print]

A Retrospective Review of Unintended Effects Following Single-Event Multi-Level Chemoneurolysis with Botulinum Toxin-A and Phenol in Children with Cerebral Palsy.

Ploypetch T, Kwon JY, Armstrong HF, Kim H.

BACKGROUND: Single Event Multi-Level Chemoneurolysis (SEMLC) is a single-session procedure that treats various limbs at multiple levels with chemoneurolytic agents in patients with spasticity. Phenol is used in combination with Botulinum toxin A (BTX-A) to enable spastic muscles to be treated without overdosing BTX-A. **OBJECTIVE:** To review unintended effects of SEMLC for children with spastic cerebral palsy (CP). **DESIGN:** Retrospective chart review **SETTING:** Pediatric rehabilitation outpatient clinic, academic medical center **PARTICIPANTS:** 98 children with CP who underwent SEMLC at least one occasion. **INTERVENTIONS:** SEMLC **MAIN OUTCOME MEASURES:** Unintended effects (UEs), the goal achievement for each SEMLC session, Gross Motor Function Classification System (GMFCS-ER) **RESULTS:** A total of 98 subjects and 146 SEMLC procedures were reviewed. Demographics: mean age 7.56 [SD 4.28] years; 57% male; 14 hemiplegia, 22 diplegia, 8 triplegia, & 54 quadriplegia. Most of SEMLCs (72%) were done with combination of BTX-A and 5% phenol in a session. UEs were reported for 31/146 (21%) of SEMLC sessions, 16 out of 31 were temporary weakness. The overall incidence of UEs of the group that received combined agent treatment was not different from the group that received BTX-A only ($p = .267$). Transient pain occurred in 7 cases out of 105 who had combined agents with BTX-A and phenol. No patient developed dysesthesia. Type of CP, GMFCS level, number of muscles injected and doses of medications were not correlated with the incidence of UEs. **CONCLUSIONS:** SEMLC using combined BTX-A and phenol is a safe procedure for children with spastic CP. It could be a treatment option for patients with diffuse spasticity, since combining agents allowed more muscles to be treated without enduring nor serious UEs. Patients and family education is essential to proper response to common UEs, such as temporary weakness and pain.

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6. J Musculoskelet Neuronal Interact. 2015 Jun;15(2):137-44.

The effects of whole body vibration on mobility and balance in children with cerebral palsy: a systematic review with meta-analysis.

Saquetto M, Carvalho V, Silva C, Conceição C, Gomes-Neto M.

OBJECTIVE: We performed a meta-analysis to evaluate the effects of whole-body vibration on physiologic and functional measurements in children with cerebral palsy. **DESIGN AND METHODS:**

We searched MEDLINE, Cochrane Controlled Trials Register, EMBASE, Scielo, CINAHL (from the earliest date available to November 2014) for randomized controlled trials, that aimed to investigate the effects of whole-body vibration versus exercise and/or versus control on physiologic and functional measurements in children with cerebral palsy. Two reviewers independently selected the studies. Weighted mean differences (WMDs) and 95% confidence intervals (CIs) were calculated.

RESULTS: Six studies with 176 patients comparing whole-body vibration to exercise and/or control were included. Whole-body vibration resulted in improvement in: gait speed WMDs (0.13 95% CI: 0.05 to 0.20); gross motor function dimension E WMDs (2.97 95% CI: 0.07 to 5.86) and femur bone density (1.32 95% CI: 0.28 to 2.36). The meta-analysis also showed a nonsignificant difference in muscle strength and gross motor function dimension D for participants in the whole-body vibration compared with control group. No serious adverse events were reported. **CONCLUSIONS:** Whole-body vibration may improve gait speed and standing function in children with cerebral palsy and could be considered for inclusion in rehabilitation programs.

[PMID: 26032205](#) [PubMed - in process] Free full text

7. Child Care Health Dev. 2015 May 30. doi: 10.1111/cch.12263. [Epub ahead of print]

Tertiary paediatric hospital admissions in children and young people with cerebral palsy.

Meehan E, Freed GL, Reid SM, Williams K, Sewell JR, Rawicki B, Reddihough DS.

BACKGROUND: Many previous studies that have investigated hospital admissions in children and young people with cerebral palsy lack information on cerebral palsy severity and complexity. Consequently, little is known about

factors associated with the frequency and type of hospital admissions in this population. This study used hospital admission data available for all children and young people known to a population-based cerebral palsy register to describe the patterns of use of tertiary paediatric hospital services over a 5-year period. **METHODS:** This was a retrospective cohort analysis of routinely collected admission data from the two tertiary paediatric hospitals in the Australian state of Victoria. Data on admissions of individuals born between 1993 and 2008 registered on the Victorian Cerebral Palsy Register were analysed ($n = 2183$). **RESULTS:** Between 2008 and 2012, 53% of the cohort ($n = 1160$) had at least one same-day admission, and 46% ($n = 996$) had one or more multi-day admissions. Those with a moderate to severe motor impairment and those with a co-diagnosis of epilepsy had more admissions, and for multi-day admissions, longer lengths of stay, $P < 0.05$. Across all severity levels, respiratory and musculoskeletal diseases were the most frequently reported reasons for medical and surgical admissions, respectively. All-cause readmission rates for urgent multi-day stays within 7, 30 and 365 days of an index admission were 10%, 23% and 63%, respectively. **CONCLUSIONS:** The reasons for hospital admissions reported here reflect the range of comorbidities experienced by children and young people with cerebral palsy. This study highlights priority areas for prevention, early diagnosis and medical management in this group. Improved primary and secondary prevention measures may decrease non-elective hospital admissions and readmissions in this group and reduce paediatric inpatient resource use and healthcare expenditure attributable to cerebral palsy.

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8. Clin Neurol Neurosurg. 2015 May 23;135:62-68. doi: 10.1016/j.clineuro.2015.05.017. [Epub ahead of print]

Deep anterior cerebellar stimulation reduces symptoms of secondary dystonia in patients with cerebral palsy treated due to spasticity.

Sokal P, Rudaś M, Harat M, Szyłberg Ł, Zieliński P.

INTRODUCTION: Deep anterior cerebellar stimulation (DACS) is a neuromodulation therapy of spasticity. Bilateral DACS is applied in young patients with cerebral palsy (CP). In these patients symptoms of spasticity coexist with symptoms of focal or segmental dystonia, which can cause chronic pain. We performed the study to investigate the therapeutic effects of DACS in spasticity, secondary dystonia and pain. **METHODS:** We examined 10 from 13 patients with CP treated with DACS due to spasticity in years 2006-2012. We compared Ashworth scores of spasticity, VAS scale of pain and UDRS (Unified Dystonia Rating Scale) score before DACS and after it in follow-up lasting from 2 to 11 years in these patients basing on clinical examination and evaluating forms given by the patients or parents. **RESULTS:** We received statistically significant reduction of spasticity in upper extremities (median: from 3 to 1,5 in Ashworth scale) in 8 patients ($p=0,01$), in lower extremities in 7 patients (median: from 3 to 1,75) ($p=0,02$). Symptoms of focal dystonia were reduced. Total score for the UDRS (median=18,0 before surgery) after DACS decreased significantly (median=10,3) ($p=0,043$). Change in consecutive parts of UDRS before (median=1,6) and after (median=1,0) surgery in 7 patients had statistical significance ($p=0,0179$). There were not significant changes in intensity of pain before and after surgery ($p=0,108$). **DISCUSSION:** Chronic bilateral DACS aimed for spasticity treatment not only decreases muscular tone in quadriplegic or paraplegic patients with CP but also is associated with reduction of symptoms of focal or segmental, secondary dystonia.

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9. J Neurosurg Pediatr. 2015 Jun 5:1-5. [Epub ahead of print]

Baclofen pump catheter leakage after migration of the abdominal catheter in a pediatric patient with spasticity.

Dastgir A, Ranalli NJ, MacGregor TL, Aldana PR.

The authors report an unusual case of intrathecal baclofen withdrawal due to the perforation and subsequent leakage of a baclofen pump catheter in a patient with spastic cerebral palsy. A 15-year-old boy underwent an uncomplicated placement of an intrathecal baclofen pump for the treatment of spasticity due to cerebral palsy. After excellent control of symptoms for 3 years, the patient presented to the emergency department with increasing

tremors following a refill of his baclofen pump. Initial evaluation consisted of radiographs of the pump and catheter, which appeared normal, and a successful aspiration of CSF from the pump's side port. A CT dye study revealed a portion of the catheter directly overlying the refill port and extravasation of radiopaque dye into the subfascial pocket anterior to the pump. During subsequent revision surgery, a small puncture hole in the catheter was seen to be leaking the drug. The likely cause of the puncture was an inadvertent perforation of the catheter by a needle during the refilling of the pump. This case report highlights a unique complication in a patient with an intrathecal baclofen pump. Physicians caring for these patients should be aware of this rare yet potential complication in patients presenting with baclofen withdrawal symptoms.

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10. Dent Traumatol. 2015 Jun 1. doi: 10.1111/edt.12184. [Epub ahead of print]

Dental trauma in Brazilian children and adolescents with cerebral palsy.

Cardoso AM, Silva CR, Gomes LN, Gomes MD, Padilha WW, Cavalcanti AL.

BACKGROUND: Assessing the frequency and factors associated with dental trauma in pediatric populations with cerebral palsy is important for the planning and implementation of prevention and health promotion programs. The aim of this study was to determine the prevalence and factors associated with dental trauma in children and adolescents with cerebral palsy. **MATERIAL AND METHODS:** Cross-sectional study with a non-probabilistic sample of 80 patients aged 2-18 years was treated in a rehabilitation institution in northeastern Brazil. Caregivers completed a socioeconomic questionnaire, while oral exams were performed by a calibrated investigator ($K = 0.75-1.00$), with record of the Dental Trauma Index, DMFT and dmft, and Dental Aesthetics and malocclusion indices. Bivariate and multivariate Poisson regression analyses ($\alpha = 0.05$) were performed with the Statistical Package for Social Sciences, version 17. **RESULTS:** The prevalence of dental trauma was 36.3%, enamel fracture was the most common trauma (89.1%), and the upper central incisors were the most affected dental elements (63.0%). Patients with dental trauma were male, aged 7-18 years, with family income more than one minimum wage, caregiver's education over 4 years, increased overjet, lip hypotonia, quadriplegia, epilepsy, oral breathing, and severe communication skills. The presence of dental trauma was not associated with socioeconomic characteristics (gender, age, family income, and caregiver's educational level), oral health perception, and systemic and oral conditions (dental caries, malocclusion, and lip hypotonia) were evaluated ($P > 0.05$). **CONCLUSION:** The prevalence of dental trauma was high, but not associated with clinical variables and evaluated socioeconomic indicators.

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11. Dev Med Child Neurol. 2015 Jun 4. doi: 10.1111/dmcn.12821. [Epub ahead of print]

Socio-economic disparities and functional limitations of children with cerebral palsy.

This commentary is on the original article by Oskoui et al. To view this paper visit <http://dx.doi.org/10.1111/dmcn.12808>.

Durkin MS1.

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12. J Paediatr Child Health. 2015 Jun 4. doi: 10.1111/jpc.12933. [Epub ahead of print]

Sleep concerns in children and young people with cerebral palsy in their home setting.

McCabe SM, Blackmore AM, Abbiss CR, Langdon K, Elliott C.

AIMS: The aims were to identify in-home concerns about sleep in children and young people with cerebral palsy (CP) across age and Gross Motor Function Classification Scale (GMFCS) levels.

METHODS: This was a retrospective review of clinical notes of 154 children and young people with CP, aged 1-18 years (M = 7.8; standard deviation = 5.4) who received a home-based sleep service. Reported concerns were synthesised, for analysis according to age groups (1-5, 6-13, 14-18) and GMFCS levels. **RESULTS:** Sixteen factors of concern were derived from the home-based assessment reports. Most children and young people had multiple factors of concern. These varied across age groups and GMFCS levels. Body position was of concern across all age groups, for over 90% at GMFCS levels IV and V, and for 10% at GMFCS level I. Settling routines were of concern for more than 90% at GMFCS levels I and II, but for less than 50% at GMFCS levels IV and V. Settling routines were of concern to over 65% of those under 6 years but less than 25% of those over 14 years. Conversely, pain and pressure care concerned less than 10% of children under 6, and more than 35% of those over 14 years. **CONCLUSIONS:** Concerns about sleep vary across ages and GMFCS levels of children and young people with CP. Concerns relate to impairment of body structure and function, activity, environment, and personal supports. Multi-disciplinary, home-based assessment and interventions are recommended to address these concerns.

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Prevention and Cure

13. Am J Obstet Gynecol. 2015 May 27. pii: S0002-9378(15)00529-3. doi: 10.1016/j.ajog.2015.05.052. [Epub ahead of print]

Does Magnesium Exposure Affect Neonatal Resuscitation?

Drassinower D, Friedman AM, Levin H, Običan SG, Gyamfi-Bannerman C.

OBJECTIVE: Research on immediate neonatal resuscitation suggests that maternal magnesium exposure may be associated with increased risk of low Apgar scores, hypotonia, and neonatal intensive care unit (NICU) admission. However, not all studies support these associations. Our objective was to determine whether exposure to magnesium at the time of delivery affects initial neonatal resuscitation. **STUDY DESIGN:** This is a secondary analysis of the Randomized Controlled Trial of Magnesium Sulfate for the Prevention of Cerebral Palsy that evaluated whether the study drug (magnesium or placebo) administered at the time of delivery was associated with increased risk for a composite adverse neonatal resuscitation outcome (5 minute Apgar score <7, oxygen administration in the delivery room, intubation, chest compressions, hypotension, and hypotonicity). A sub-group analysis was performed among patients that delivered ≥30 weeks. Log-linear regression was used to control for possible confounders. **RESULTS:** 1047 patients were analyzed, of whom 461 (44%) were exposed to magnesium. There was no increased risk for the primary composite outcome associated with magnesium exposure. Individual adverse neonatal outcomes and other secondary short-term neonatal outcomes evaluated also did not demonstrate an association with magnesium exposure. **CONCLUSION:** Exposure to magnesium sulfate did not affect neonatal resuscitation or other short-term outcomes. These findings may be useful in planning neonatal care and patient counseling.

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14. BJOG. 2015 Jun 3. doi: 10.1111/1471-0528.13460. [Epub ahead of print]

Magnesium sulfate, chorioamnionitis, and neurodevelopment after preterm birth.

Kamyar M, Manuck TA, Stoddard GJ, Varner MW, Clark E.

OBJECTIVE: To assess the neuroprotective effect of magnesium sulfate (MgSO₄) in preterm children exposed to chorioamnionitis. **DESIGN:** A secondary analysis of a multicentre randomised controlled trial of antenatal MgSO₄ administered to women at risk of preterm birth for the prevention of cerebral palsy (CP). Singleton, non-anomalous

pregnancies with clinical chorioamnionitis, delivering at ≥ 24.0 weeks of gestation, were selected. Cases were exposed to antepartum MgSO₄ ; controls received placebo. SETTING: Multicentre randomised controlled trial. POPULATION: Singleton, non-anomalous pregnancies with clinical chorioamnionitis, delivering at ≥ 24.0 weeks of gestation. METHODS: All data were analysed by intention to treat. Univariate and multivariate analyses were performed. MAIN OUTCOME MEASURES: Primary outcome was a composite of stillbirth, death by the age of 1 year, or moderate or severe CP by the age of 2 years. Secondary outcomes included a composite neonatal outcome as well as neurodevelopmental delay, defined as Bayley II mental and psychomotor developmental indices < 70 at the age of 2 years. Subgroup analysis assessed these outcomes in children born at < 28 weeks of gestation. RESULTS: A total of 396 children were included, with 192 (48.5%) randomised to MgSO₄ . Maternal and delivery characteristics were similar between the groups. The primary outcome occurred in 13.2% of children exposed to MgSO₄ and 14.7% of children exposed to placebo (relative risk, RR 1.21; 95% confidence interval, 95% CI 0.76-1.96; P = 0.42). Rates of stillbirth, death, moderate-severe CP, and neurodevelopmental delay did not differ between groups. In the subgroup analysis of children born at < 28 weeks of gestation, there was no difference in the rates of the primary outcome, nor in the secondary outcomes assessed. CONCLUSIONS: Among children at risk for early preterm delivery exposed to chorioamnionitis, antenatal administration of MgSO₄ was not associated with improved neurodevelopmental outcome. We do not recommend any change in the guidelines on the administration of MgSO₄ for neuroprotection based on this study.

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15. J Neurosurg Pediatr. 2015 Jun;15(6):580-8. doi: 10.3171/2014.11.PEDS14364. Epub 2015 Mar 13.

Outcomes of intraventricular hemorrhage and posthemorrhagic hydrocephalus in a population-based cohort of very preterm infants born to residents of Nova Scotia from 1993 to 2010.

Radic JA, Vincer M, McNeely PD.

OBJECT Intraventricular hemorrhage (IVH) is a common complication of preterm birth, and the prognosis of IVH is incompletely characterized. The objective of this study was to describe the outcomes of IVH in a population-based cohort with minimal selection bias. METHODS All very preterm (≥ 30 completed weeks) patients born in the province of Nova Scotia were included in a comprehensive database. This database was screened for infants born to residents of Nova Scotia from January 1, 1993, to December 31, 2010. Among very preterm infants successfully resuscitated at birth, the numbers of infants who died, were disabled, developed cerebral palsy, developed hydrocephalus, were blind, were deaf, or had cognitive/language scores assessed were analyzed by IVH grade. The relative risk of each outcome was calculated (relative to the risk for infants without IVH). RESULTS Grades 2, 3, and 4 IVH were significantly associated with an increased overall mortality, primarily in the neonatal period, and the risk increased with increasing grade of IVH. Grade 4 IVH was significantly associated with an increased risk of disability (RR 2.00, $p < 0.001$), and the disability appeared to be primarily due to cerebral palsy (RR 6.07, $p < 0.001$) and cognitive impairment (difference in mean MDI scores between Grade 4 IVH and no IVH: -19.7, $p < 0.001$). No infants with Grade 1 or 2 IVH developed hydrocephalus, and hydrocephalus and CSF shunting were not associated with poorer outcomes when controlling for IVH grade. CONCLUSIONS Grades 1 and 2 IVH have much better outcomes than Grades 3 or 4, including a 0% risk of hydrocephalus in the Grade 1 and 2 IVH cohort. Given the low risk of selection bias, the results of this study may be helpful in discussing prognosis with families of very preterm infants diagnosed with IVH.

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