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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. *J Hand Surg Am.* 2013 Mar;38(3):435-446.e1. doi: 10.1016/j.jhssa.2012.12.019.

Upper extremity spasticity in children with cerebral palsy: a randomized, double-blind, placebo-controlled study of the short-term outcomes of treatment with botulinum a toxin.

Koman LA, Smith BP, Williams R, Richardson R, Naughton M, Griffin L, Evans P.

Department of Orthopaedic Surgery, Department of Physical Therapy/Occupational Therapy, and Public Health Services, Wake Forest School of Medicine, Winston-Salem, North Carolina.

PURPOSE: Botulinum A toxin (BoNT-A) injections are used widely to manage lower extremity spasticity in children with cerebral palsy. However, their use in the upper extremity is less well defined. This randomized, double-blind, placebo-controlled clinical trial evaluated the safety and efficacy of upper extremity intramuscular injections of BoNT-A in a cross-section of children with varying levels of function. **METHODS:** Upper extremity function of study participants (N = 73; M:F = 47:26; age range, 3-18 y) was evaluated using the House Classification system (scores, 0-8, where a higher score indicates higher functional ability). Three groups of children were identified based on their House scores: 0-2 (n = 10), 3-5 (n = 54), and 6-8 (n = 9). Following randomization, children received a BoNT-A or placebo injection at baseline. Injections were administered at 8 and 20 weeks if clinically indicated. Occupational therapists evaluated study participants at screening, at baseline, and at 4, 8, 14, 20, and 26 weeks. Physician evaluations occurred at baseline and at 8, 20, and 26 weeks. The Melbourne Assessment of Unilateral Upper Limb Function evaluated the quality of upper extremity function before and after injections and served as the primary outcome variable. **RESULTS:** The majority of study participants underwent 3 injection sessions. Muscles injected were individualized based on each child's particular spasticity pattern. A statistically higher percentage of children receiving BoNT-A injections showed an improvement in the Melbourne assessment at 26 weeks compared with the children receiving placebo. The range, frequency, and severity of postinjection adverse events were similar in both groups. **CONCLUSIONS:** Children receiving BoNT-A injections demonstrated clinically meaningful short-term improvements in upper extremity function. Injections were well tolerated and safe. In contrast to other studies, study participants underwent multiple injection sessions based on their individual spasticity patterns.

TYPE OF STUDY/LEVEL OF EVIDENCE: Therapeutic I.

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2. BMJ Case Rep. 2013 Feb 20;2013. pii: bcr2012008120. doi: 10.1136/bcr-2012-008120.**Knee extensor disruption in mild diplegic cerebral palsy: a risk for adolescent athletes.**

Elhassan Y, O'Sullivan R, Walsh M, O'Brien T.

Department of Gait Laboratory, Central Remedial Clinic, Dublin, Ireland.

We report three cases of adolescent boys with mild diplegic cerebral palsy (CP) who suffered disruption of the knee extensor mechanism. Two had fractures of the patella and the third a fracture avulsion of the tibial tubercle combined with an undisplaced fracture of the patella. All three had gait analysis prior to sustaining the fractures and were known to have mild knee crouch. Each participated in sport including football. Each suffered an acute deterioration in gait resulting in a referral for repeat gait analysis, and x-ray of the affected knee. With the increased involvement of children with CP in sporting activities, especially children with mild knee crouch, we caution that knee extensor rupture might be an increasing problem.

[PMID: 23429018](#) [PubMed - in process]

3. J Child Neurol. 2013 Feb 17. [Epub ahead of print]**Improvements in Children With Cerebral Palsy Following Intrathecal Baclofen: Use of the Rehabilitation Institute of Chicago Care and Comfort Caregiver Questionnaire (RIC CareQ).**

Baker KW, Tann B, Mutlu A, Gaebler-Spira D.

Private Practice, Columbus, GA, USA.

Implantation of an intrathecal baclofen pump is recommended for children with cerebral palsy as a means to improve care and comfort when other options fail to control severe hypertonia. Making an assessment of a child's spasticity-related limitations in both routine care and activity is a necessary component of selection of intrathecal baclofen candidates. The Rehabilitation Institute of Chicago Care and Comfort Caregiver Questionnaire (RIC CareQ) is a validated, easy-to-use questionnaire that elicits information about the ease of daily activity and caregiving in patients with severe spasticity. Questionnaires completed by caregivers and patients at a pediatric physiatry spasticity clinic over an 11-year period were reviewed to evaluate whether the Rehabilitation Institute of Chicago Care and Comfort Caregiver Questionnaire captured improved caregiving and comfort of children with cerebral palsy and severe spasticity following intrathecal baclofen pump implantation. The Questionnaire scores showed improvement after intrathecal baclofen pump implantation, consistent with subjective reports of patient and caregiver satisfaction.

[PMID: 23420651](#) [PubMed - as supplied by publisher]

4. Pediatr Infect Dis J. 2013 Feb 20. [Epub ahead of print]**Infectious Complications of Intrathecal Baclofen Pump Devices in a Pediatric Population.**

Dickey MP, Rice M, Kinnett DG, Lambert R, Donauer S, Gerber MA, Staat MA.

Division of Infectious Diseases, Cincinnati Children's Hospital Medical Center, Cincinnati, Ohio, United States and Division of Clinical Physical Medicine and Rehabilitation, Cincinnati Children's Hospital Medical Center, Cincinnati, Ohio, United States, 3Division of Biostatistics and Epidemiology, Cincinnati Children's Hospital Medical Center, Cincinnati.

BACKGROUND: Intrathecal baclofen (ITB) is an effective therapy for spasticity and dystonia in pediatric populations; however, there are associated infectious complications. **METHODS:** Patients who had an initial ITB device implanted at our center were followed to determine the proportion of patients with infectious and non-infectious complications, identify risk factors for infection and describe the clinical presentations, treatment and outcomes of infectious complications. **RESULTS:** Over the 15 year study period, 139 patients had an initial ITB device placed. The mean age at placement was 13.6 years (range- 6 months to 41 years). In the first year of follow-

up, 83% had no complications or secondary procedures, 17% had at least one secondary procedure and 5% had an infectious complication. The median time until infection was 14 days (mean 33 ± 42 days). Patients with secondary spasticity or dystonia were more likely to have infections than patients with cerebral palsy (86% vs. 14%; $p < 0.0001$). In the 94 patients with a first secondary procedure, 29% had at least one other procedure and 8% had an infection in the one year follow-up. Overall, 24 patients had 27 infections; 22% superficial, 33% deep and 45% organ space. *Staphylococcus aureus* was isolated in 50% of those with cultures obtained. Explantation was required in 59% of patients with an infection and differed by infection type: superficial (17%), deep (44%) and organ space (92%) ($p = 0.004$). **CONCLUSIONS:** Infectious complications were relatively uncommon; however, when present, frequently led to the explantation of the ITB pump device.

[PMID: 23429557](#) [PubMed - as supplied by publisher]

5. NeuroRehabilitation. 2013 Jan 1;32(1):17-26. doi: 10.3233/NRE-130819.

Effects of the progressive walking-to-running technique on gait kinematics, ultrasound imaging, and motor function in spastic diplegic cerebral palsy - an experimenter-blind case study.

Lee NG, Jeong SJ, You JS, Cho KH, Lee TH.

Department of Physical Therapy, College of Health and Welfare, Woosong University, Daejeon, Republic of Korea.

PURPOSE: The purpose of this study was to investigate the effects of the progressive walking-to-running technique (PWRT) in a child with spastic diplegic cerebral palsy (CP). **DESIGN:** A single case study with pre-/post-test. **SUBJECT:** An 11-year-old male, diagnosed with spastic diplegic CP. **METHODS:** The PWRT was provided for 60 minutes a day, 2 times a week for 12 weeks. Gross motor function tests, ultrasound imaging, hand-held dynamometer, and the Vicon motion capture system were used to determine motor function, muscle size and strength, and gait kinematics.

RESULTS: Gross motor function was improved after the intervention. The size of right and left rectus femoris and tibialis anterior muscles in their contracted states were enhanced by 1.36, 5.09, 83.74, and 54.37%, respectively. Associated muscle strength was also increased by 58.8, 30.8, 28.0, and 118.2% in both rectus femoris and tibialis anterior muscles. Left stride length, walking speed, maximal flexion-extension angular excursion of the hip joint were enhanced by 95.7, 87.8, and 100.4% after PWRT, respectively. **CONCLUSIONS:** Our novel walking-running training paradigm was effective for restoring gait and running ability in a child with spastic diplegic CP.

[PMID: 23422455](#) [PubMed - in process]

6. NeuroRehabilitation. 2013 Jan 1;32(1):9-15. doi: 10.3233/NRE-130818.

Five-times-sit-to-stand test in children with cerebral palsy: Reliability and concurrent validity.

Kumban W, Amatachaya S, Emasithi A, Siritaratiwat W.

Improvement of Physical Performance and Quality of Life Research Group, Faculty of Associated Medical Sciences, Khon Kaen University, Khon Kaen, Thailand.

BACKGROUND/PURPOSE: Five-times-sit-to-stand test (FTSST) is a reliable tool for measuring lower limb functional strength and balance ability. However, reports of the reliability of FTSST in children with cerebral palsy have been scarce. The purposes of this study were (1) to investigate the test-retest and inter-rater reliability of the FTSST and (2) to investigate the correlation between the FTSST and standard functional balance tests in children with cerebral palsy. **STUDY DESIGN:** Cross-sectional study. **MATERIALS AND METHODS:** Thirty-three school children aged from 6 to 18 years with Gross motor functional classification system expanded and revised version (GMFCS-E&R) level I to III were recruited. Reliability of the FTSST and concurrent validity between FTSST and Timed up and go test (TUG) and Berg balance scale (BBS) were determined using the Pearson product moment correlation. **RESULTS:** The intra-class correlation coefficient (ICC) for test-retest and inter-rater reliability of FTSST were 0.91 and 0.88 respectively. FTSST showed moderate correlation with TUG ($r = 0.552$, $P < 0.01$) and with BBS ($r = -0.561$, $P < 0.01$). **CONCLUSION:** FTSST is a reliable assessment tool and correlates with functional balance ability tests in children with mild to moderate cerebral palsy.

[PMID: 23422454](#) [PubMed - in process]

7. NeuroRehabilitation. 2013 Jan 1;32(1):1-8. doi: 10.3233/NRE-130817.

The effect of vibration therapy on spasticity and motor function in children with cerebral palsy: A randomized controlled trial.

Katusic A, Alimovic S, Mejaski-Bosnjak V.

Day-care Centre for Rehabilitation "Mali dom-Zagreb", Zagreb, Croatia.

As the motor system relies heavily on deep sensory stimulation, recent studies have investigated the effect of vibration stimuli. Although research suggests a positive influence of vibration on motor performance in individuals with neurological disorders, there are very limited numbers of studies in children with cerebral palsy (CP). The objective of the present study was to evaluate the effects of sound wave vibration therapy on spasticity and motor function in children with CP. In this 3-month trial, 89 children with spastic CP were randomized to either continue their physiotherapy treatment (PT) or to receive vibration therapy twice a week in addition to their PT program. The randomization was stratified according to the Gross Motor Function Classification System (GMFCS) level to ensure similar functional ability. Children were assessed at baseline and after the 12-week intervention period. The outcomes measured were spasticity level as assessed by Modified Modified Ashworth Scale (MMAS) and gross motor function as assessed by Gross Motor Function Measurement (GMFM-88). Subgroup analysis was performed for the GMFCS. Significant differences between groups were detected for changes in spasticity level and gross motor function after the three months intervention. In conclusion, vibration therapy may decrease spasticity and improve motor performance in children with CP. The results of the present trial serve as valuable input for evidence-based treatments in paediatric neurorehabilitation.

[PMID: 23422453](#) [PubMed - in process]

8. Prilozi. 2012 Dec;33(2):153-61.

Prevention, management and rehabilitation of patients with cerebral palsy.

Poposka A, Georgieva D, Dzoleva-Tolevska R, Georgiev A.

PHI University Orthopaedic Diseases Clinic, Medical Faculty, Ss. Cyril and Methodius University, Skopje, R. Macedonia.

The aim of this paper is to present the importance of orthopaedics in the prevention, treatment and rehabilitation of persons with cerebral palsy. Material and methods: The paper is based on a study realized at the University Orthopaedic Clinic, Medical School, Ss. Cyril and Methodius University in Skopje, with application of documentary analysis, observation and clinical analysis of 76 patients with cerebral palsy, aged between 1 and 15 years. Results: Orthopaedics is a surgical field of medicine, in which context there have been, are and will be, as a challenge, many questions for the present and future generations. Data analysis pointed out that surgical treatment in combination with conservative treatment give a hope that a definite or prolonged cure is possible, with maximal and possibly preserved function of the loco-motor system or, in the most serious cases, abatement of the impaired locomotor system symptoms. Summary: Early diagnosis and appropriate application of surgical treatment enable better functioning of persons with cerebral palsy by maximal exploitation of their remaining abilities. Key words: cerebral palsy, orthopaedics, early diagnosis, treatment, rehabilitation, multidisciplinary approach.

[PMID: 23425878](#) [PubMed - in process]

9. Case Rep Neurol Med. 2013;2013:141983. doi: 10.1155/2013/141983. Epub 2013 Feb 3.**Positron emission tomography-computer tomography scan used as a monitoring tool following cellular therapy in cerebral palsy and mental retardation-a case report.**

Sharma A, Sane H, Paranjape A, Gokulchandran N, Kulkarni P, Nagrajan A, Badhe P.

Department of Medical Services and Clinical Research, NeuroGen, Brain and Spine institute Private limited, Surana Sethia-Hospital and Research Centre, Suman Nagar, Sion Trombay Road, Chembur, Mumbai 400071, Maharashtra, India.

Cerebral palsy (CP) is one of the non-progressive neurological diseases caused by damage to the brain tissue at birth, which leads to physical, cognitive and perceptive symptoms. Even after lifelong medical and therapeutic management there are residual deficits which affect the quality of life of the patients and their families. We examined a maximally rehabilitated, 20 year old male suffering from CP and Mental Retardation (MR). He had diplegic gait and Intelligence Quotient (IQ) score of 44 with affected fine motor activities, balance, speech and higher functions. Positron Emission Tomography-Computer Tomography (PET-CT) scan identified frontal, temporal, parietal, occipital, left cerebellar lobes, amygdala, hippocampus, and parahippocampus as the affected areas. He was treated with cellular therapy of Autologous Bone Marrow Derived Mono-Nuclear Cells (MNCs) transplantation followed by multidisciplinary rehabilitation. Six months following therapy, PET-CT scan showed significant increase in metabolic activity in all four lobes, mesial temporal structures and left cerebellar hemisphere, also supported by clinical improvement in IQ, social behavior, speech, balance and daily functioning. These findings provide preliminary evidence to support the efficacy of cellular therapy for the treatment of CP with MR. PET-CT scan can also be viewed as an impressive tool to monitor the effects of cellular therapy.

[PMID: 23431488](#) [PubMed - in process]

10. Appl Neuropsychol Child. 2013 Jan;2(1):33-42. doi: 10.1080/21622965.2012.682852. Epub 2012 Apr 26.**Mullen scales of early learning: the utility in assessing children diagnosed with autism spectrum disorders, cerebral palsy, and epilepsy.**

Burns TG, King TZ, Spencer KS.

Department of Neuropsychology/Neurosciences Division, Children's Healthcare of Atlanta and Emory University School of Medicine, Atlanta, Georgia.

A group of 47 patients diagnosed with neurodevelopmental disorders were compared to 47 age-, gender-, and racially matched typically developing children to examine the frequency of impairment across domains of the Mullen Scales of Early Learning (MSEL). The MSEL is a comprehensive measure of cognitive functioning designed to assess infants and preschool children between the ages of birth to 68 months. In the neurodevelopmental group, the sample was composed of children 2 to 4 years of age who were diagnosed with autism spectrum disorders (ASD; n = 19), cerebral palsy (CP; n = 14), and epilepsy (EPI; n = 14). A sample of 47 matched controls, taken from the normative sample of the MSEL, was used as a comparison group. Each one of the clinical groups comprising the neurodevelopmental sample demonstrated statistically significant delays across domains relative to the respective matched control group ($p < .001$). Children failed to demonstrate a "signature" profile for a diagnosis of ASD, CP, or EPI. The clinical sensitivity of the MSEL and the need for obtaining specific intervention services for children diagnosed with these conditions are presented. Finally, these results are discussed within the context of the clinical sensitivity of the MSEL in working with these clinical populations.

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11. *Res Dev Disabil.* 2013 Feb 14;34(4):1346-1356. doi: 10.1016/j.ridd.2013.01.010. [Epub ahead of print]

Prevalence and risk markers of behavior problems among adults with intellectual disabilities: A total population study in Örebro County, Sweden.

Lundqvist LO.

Örebro University and Örebro County Council, Örebro, Sweden. Electronic address: lars-olov.lundqvist@orebroll.se.

The aim of the present study was to investigate the prevalence of behavior problems among people with administratively defined intellectual disability (ID) and identify possible risk markers for behavior problems using the Behavior Problems Inventory (BPI). Sixty-two percent of the ID population (n=915) had a behavior problem (self-injurious, stereotyped, or aggressive/destructive behavior) and 18.7% had a behavior problem identified as challenging behavior, resulting in a prevalence of 80.3 per 100,000 in the base population. The most pronounced risk markers for behavior problems were severity of ID, autism, night sleep disturbances, sensory hypersensitivity, communication dysfunction, social deficits, psychiatry involvement, and psychotropic medication. About 50% of people with behavior problems were on psychotropic drugs. Protective markers were Down's syndrome and, to some extent, cerebral palsy. The results were largely consistent with those reported in previous studies. Findings not previously reported were that prevalence of aggressive/destructive behavior peaked among those =70 years. Highlighting groups within a population at particular risk has implications for management and treatment of individuals with behavior problems.

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Prevention and Cure

12. *BJOG.* 2013 Feb 19. doi: 10.1111/1471-0528.12164. [Epub ahead of print]

Non-infectious risk factors for different types of cerebral palsy in term-born babies: a population-based, case-control study.

Ahlin K, Himmelmann K, Hagberg G, Kacerovsky M, Cobo T, Wennerholm UB, Jacobsson B.

Perinatal Center, Department of Obstetrics and Gynecology, Institute of Clinical Sciences, Sahlgrenska Academy, Sahlgrenska University Hospital/Östra, Göteborg, Sweden.

OBJECTIVE: To identify non-infectious antenatal and perinatal risk factors for cerebral palsy (CP) and its subtypes in children born at term. **DESIGN:** A population-based, case-control study. **SETTING:** The western healthcare region of Sweden. **POPULATION:** A population-based series of children with CP born at term during 1983-94 (n = 309) was matched with a control group (n = 618). **METHODS:** A total of 62 variables, maternal characteristics, and prepartal, intrapartal and postpartal variables were retrieved from obstetric records. Both univariate and multivariate analyses were performed for spastic and dyskinetic CP, and for the total CP group. **MAIN OUTCOME MEASURES:** Cerebral palsy (CP) and subtypes. **RESULTS:** Univariate analysis resulted in 26 significant risk factors for CP. Birthweight (OR 0.54, 95% CI 0.39-0.74), not living with the baby's father (OR 2.58, 95% CI 1.11-5.97), admittance to a neonatal intensive care unit (NICU) (OR 4.43, 95% CI 3.03-6.47), maternal weight at 34 weeks of gestation (OR 1.02, 95% CI 1.00-1.03) and neonatal encephalopathy (OR 69.2, 95% CI 9.36-511.89) were found to be risk factors for CP in the total CP group in our multivariate analysis. Factors during the periods before, during and after delivery were all shown to increase the risk of spastic diplegia and tetraplegia, whereas mostly factors during the period before delivery increased the risk of spastic hemiplegia, and only factors during delivery increased the risk of dyskinetic CP. Admittance to an NICU was a risk factor for all CP subtypes. **CONCLUSIONS:** The risk factor pattern differed by CP subtype. The presented risk factors may be useful indicators for identifying children at risk of developing CP, and helpful for targeting individuals for early intervention programmes.

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13. Cytokine. 2013 Feb 13. pii: S1043-4666(13)00041-0. doi: 10.1016/j.cyto.2013.01.011. [Epub ahead of print]

Association of Interleukin 6 gene polymorphisms with genetic susceptibilities to spastic tetraplegia in males: A case-control study.

Chen M, Li T, Lin S, Bi D, Zhu D, Shang Q, Ma C, Wang H, Wang L, Zhang Y, He L, Zhu C, Xing Q.

Children's Hospital and Institute of Biomedical Science, Fudan University, Shanghai 201102, China; Bio-X Center, Key Laboratory for the Genetics of Developmental and Neuropsychiatric Disorders, Shanghai Jiaotong University, Shanghai 200030, China.

BACKGROUND: Cerebral palsy (CP) is a group of non-progressive motor impairment and permanent disorders causing limitation of activity and abnormal posture. It may be caused by infection (such as chorioamnionitis), asphyxia or multiple genetic factors. The Interleukin 6 gene (IL6) was suggested to be involved in the susceptibilities to CP risk as a kind of proinflammatory cytokine. **OBJECTIVE:** To explore the genetic association between the polymorphisms of the IL6 gene and CP in the Chinese population. **METHODS:** A total of 542 CP patients and 483 healthy control children were recruited in this study to detect five single nucleotide polymorphisms (rs1800796, rs2069837, rs2066992, rs2069840, and rs10242595) in the IL6 locus. Genotyping of SNPs was performed by the MassArray platform-based genotyping approach. The SHEsis program was applied to analyze the genotyping data. **RESULTS:** Of the five selected SNPs, no significant allelic and genotypic association was found between CP patients and controls. However, subgroup analysis found significant differences in allele frequencies between spastic tetraplegia in males compared with controls at rs1800796 (OR=1.39, P=0.033, P=0.099 after SNPSpD correction) and rs2069837 (OR=1.58, P=0.012, P=0.035 after SNPSpD correction). The frequencies of the C allele of rs1800796 and the A allele of rs2069837 were greater in males with spastic tetraplegia than in the controls. The two SNPs haplotype rs1800796 (G) - rs2069837 (G) were also associated with a decreased risk of spastic tetraplegia in males (OR=0.619, P=0.009, P=0.027 after Bonferroni correction). **CONCLUSION:** Genetic variation of the IL6 gene may influence susceptibility to spastic tetraplegia in males and its role in cerebral palsy deserves further evaluation in a large-scale and well-designed study.

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14. J Pediatr. 2013 Feb 14. pii: S0022-3476(13)00009-7. doi: 10.1016/j.jpeds.2012.12.097. [Epub ahead of print]

Outcomes of Small for Gestational Age Infants Born at <27 Weeks' Gestation.

De Jesus LC, Pappas A, Shankaran S, Li L, Das A, Bell EF, Stoll BJ, Laptook AR, Walsh MC, Hale EC, Newman NS, Bara R, Higgins RD; Eunice Kennedy Shriver National Institute of Health and Human Development Neonatal Research Network.

Department of Pediatrics, Wayne State University, Detroit, MI.

OBJECTIVE: To determine whether small for gestational age (SGA) infants born at <27 weeks gestational age (GA) are at increased risk for mortality, morbidity, and growth and neurodevelopmental impairment at 18-22 months corrected age. **STUDY DESIGN:** This was a retrospective cohort study from National Institute of Child Health and Human Development Neonatal Research Network's Generic Database and Follow-Up Studies. Infants born at <27 weeks GA between January 2006 and July 2008 were included. SGA was defined as birth weight <10th percentile for GA based on Olsen growth curves. Infants with birth weight =10th percentile for GA were classified as non-SGA. Maternal and infant characteristics, neonatal outcomes, and neurodevelopmental data were compared in SGA and non-SGA infants. Neurodevelopmental impairment was defined as any of the following: cognitive score <70 on the Bayley Scales of Infant Development III, moderate or severe cerebral palsy, bilateral hearing loss (with and without amplification), or blindness (bilateral vision <20/200). Logistic regression analysis was applied to evaluate the

associations between SGA status and death or neurodevelopmental impairment. RESULTS: The SGA group comprised 385 infants; the non-SGA group, 2586 infants. Compared with mothers of non-SGA infants, mothers of SGA infants were more likely to have a high school education, prenatal care, cesarean delivery, pregnancy-induced hypertension, and antenatal corticosteroid exposure. Compared with non-SGA infants, SGA infants had higher mortality and were more likely to have postnatal growth failure, prolonged mechanical ventilation, and postnatal steroid use. SGA status was associated with increased risk of death or neurodevelopmental impairment (OR, 3.91; 95% CI, 2.91-5.25; $P < .001$). CONCLUSION: SGA status in infants born at <27 weeks GA is associated with an increased likelihood of postnatal steroid use, mortality, growth failure, and neurodevelopmental impairment at 18-22 months corrected age.

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15. Turk J Pediatr. 2012 Sep-Oct;54(5):458-64.

Morbidity in early adulthood among low-risk very low birth weight children in Turkey: a preliminary study.

Can G, Bilgin L, Tatti B, Saydam R, Coban A, Ince Z.

Division of Neonatology, Department of Pediatrics, Istanbul University, Istanbul Faculty of Medicine.

The objective of this study was to assess low-risk very low birth weight (VLBW) children, before the era of modern neonatal intensive care in Turkey, during adolescence. Forty-one VLBW adolescents were compared with 40 adolescents who had normal birth weight. The physical and neuromotor development, educational achievement and psychosocial status were assessed at a mean age of 17 +/- 1.6 years. VLBW adolescents were shorter than normal birth weight adolescents ($p = 0.01$). A major neurological abnormality (cerebral palsy) was seen in 12% and a minor neurological abnormality (tremor, coordination, behavioral and speech disorders) in 17%. VLBW adolescents had higher rates of visual problems (56% vs. 5%). School failure was present in 27%. There were no differences in behavioral problems or quality of life between the two groups, but VLBW adolescents did have a lower self-esteem score. Neurodevelopment and growth sequelae were a significant problem in VLBW adolescents. As early intervention might help to prevent or ameliorate potential problems, long-term follow-up is essential.

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