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An Overview of Small for Gestational Age Births: Etiology, Assessment, and Treatment

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Abstract

Small for Gestational Age (SGA) births often lead to negative perinatal health consequences that Appropriate for Gestational Age (AGA) births do not. While associated consequences such as higher mortality and morbidity rates, lower Intelligence Quotients (IQ), lower cortical brain volume, and a variety of diseases may result from being born SGA, impacts are most often not severe enough to negatively impact SGA individuals' ability to achieve educational or social success. If SGA assessments for intrauterine assessment are used and risk factors are understood, perinatal health outcomes can be improved, and negative outcomes can be mitigated. Identified treatments for reducing negative SGA health outcomes include micronutrition management through diet and supplementation, while other methods such as growth hormone treatment are met with controversy. Canada has become active in increasing perinatal surveillance to reduce SGA outcomes through initiatives like the Canadian Perinatal Surveillance System, promoting SGA research awareness and creating a public standard for perinatal care.

Keywords: Small for Gestational Age (SGA); Intrauterine Growth Restriction (IUGR); Perinatal; Morbidity; Mortality; Premature

Introduction

Small for Gestational Age (SGA) children are children born with birth weight and or birth length 2 standard deviations (the lowest 10th percentile) below the average for their sex based on population data [1]. Many SGA births are related to Intrauterine Growth Restriction (IUGR) and are frequently associated with higher mortality and morbidity rates [2]. SGA infants can be born pre-term or to term, with pre-term often having more negative consequences [2,3]. The purpose of this discussion is to highlight the etiology and health consequences of SGA births, and illustrate ongoing assessment and treatment options that may mitigate negative perinatal health outcomes in these situations.

Etiology and SGA Risk Factors

Placental insufficiency is referred to as a principle cause of IUGR leading to SGA births [4]. IUGR is a process of reduced fetal growth velocity resulting in a fetus' inability to reach an appropriate level of growth or development [3]. IUGR related to placental insufficiency results in chronic fetal hypoxia leading to brain sparing [4]. Brain sparing is an adaptive fetal survival response that directs inefficient cardiac output to favour vital organs like the brain during intrauterine development [4]. According to Miller et al., [4], because the process of brain sparing restricts development of less vital areas for neonate survival, it is apparent the adaptive measure may lead to abnormal neonatal development in restricted areas.

Other risk factors leading to SGA births include higher maternal age [5], moderate alcohol consumption [6], and smoking [1,7]. Research suggests the damage from SGA influencing behaviors can be mitigated if stopped during early gestation. For example, Mc Cowan et al., [1] have found similar SGA birth rates between smokers and non-smokers if smokers quit by 15 weeks gestation.

Health Consequences

Animal research and post-mortem studies on humans have found neurological deficits related to being born SGA [3]. These studies have illustrated that SGA children with documented IUGR show a reduction in total brain volume and cells, most pronounced in cerebral cortical gray matter [3]. Neurological consequences include reduced myelination and delayed neuronal migration to the cortex [4] as well as decreased hippocampi volume [8]. When to term SGA individuals

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reach adolescence, even with postnatal catch-up growth, studies using magnetic resonance imaging show SGA adolescents have lower cerebral cortical volume correlated with reduced cognitive outcomes than Appropriate for Gestational Age (AGA) adolescents [9]. In addition, the development of certain diseases, such as hyaline membrane disease, occurs more often in SGA children than AGA children [10].

Developmental Consequences

SGA premature infants have been found to be at a higher risk for developmental, cognitive, and mother-infant relationship difficulties during early development [11]. Young adults born SGA have demonstrated lower Intelligence Quotients (IQ) in areas such as verbal comprehension, understanding of figurative language, and memory compared to those born AGA [12]. Fortunately, neurological differences found between SGA and AGA children's cerebral cortical volume has not been found significant enough to impact physical growth, educational or social success [9]. Most SGA children experience catch-up growth by the age of 2 and only 10 % remain short statured [13].

Treatment

High intake of green leafy vegetables, fruit, and high maternal milk consumption during gestation has been associated with reduced risk of SGA births as found in a rural Indian birth cohort study [14]. This suggests micronutrients from these foods are essential between 18- and 28-weeks' gestation [14]. From this, studies using micronutrient supplementation have gone on to show similar success inroducing low birth weight and SGA births [15].

For SGA born individuals who do not achieve catch up growth, it has been suggested that growth hormone therapy may help. Seeing that 60 % of children born SGA have low growth hormone and insulin growth factor-1 levels [13], addressing low levels of growth factors may prove useful in stimulating development. A Netherlands birth cohort study following growth hormone treatment outcomes at 2- and 8-years follow-up periods found most SGA born individuals (70 %) reached normal height after the 2-year follow-up [13]. Over time, IQ scores and self-perception improved significantly in SGA born individuals, and those closer to achieving normal height experienced fewer problem behaviors [13]. de Bie et al., [3] caution that these changes in IQ may be due to changes in test instruments used as participants age or the Flynn effect (generational IQ changes), suggesting there is no conclusive evidence growth hormone treatment in SGA children is effective.

Ballard Maturational Assessment Scale

Developed by Dr. Jeanne Ballard, the Ballard Maturational Assessment is a validated gestational age scoring test used to distinguish between a healthy AGA infant and SGA infants [16]. The assessment is divided in to physical and neuromuscular criteria, examining neuromuscular maturity (e.g., posture or joint flexibility) and physical maturity (e.g., skin and genital development) criteria [16]. Each assigns a score to 6 different intrauterine change criteria, the sum of which gives an estimate of the gestational age between 26 to 44 weeks [16]. Using this test can help detect developmental abnormalities and predict intrauterine development of an infant. If abnormalities are detected, treatment approaches can be catered to help mend the specific development abnormality.

Canadian Efforts

Canadian researchers have recognized perinatal factors that lead to increased parental and infant morbidity and mortality and have initiated a program to strengthen maternal health surveillance [17]. The Canadian Perinatal Surveillance System (CPSS) has been adopted as a new method for improving the reporting and monitoring of perinatal health outcomes in Canada, publicly identifying the health risks associated with maternal and fetal development using Canadian national statistics [18]. Canadian research reported through the CPSS program is used to identify and communicate key risk factors that require quality perinatal surveillance to reduce the risk of SGA birth rates, including factors like gestational diabetes and parental hypertension [17].

Conclusion

Overall, the determinants for SGA birth outcomes are the result of complex interactions between extra uterine and intrauterine perinatal factors. While intrauterine measurements of gestational age, like the Ballard Scale, are useful in determining SGA from AGA infants, SGA births do tend to lead to negative perinatal health consequences. While the SGA label may not always lead to life course persistent outcomes, it is important for Canadian researchers, doctors, and parents to verse themselves on the potential risk factors and treatments options to reduce perinatal harm from SGA births. Programs like the CPSS have become important initiatives in creating a communicative and informative environment to address perinatal health outcomes and begin creating a maternal surveillance standard in Canada.

References

1. Mc Cowan L, Horgan R. Risk factors for small for gestational age infants. Best Prac Res Clin Obstet Gynaecol. 2009; 23: 779-793.
2. Pulver L, Guest-Warnick G, Stoddard G, Byington C, Young P. Weight for Gestational Age Affects the Mortality of Late Preterm Infants. Pediatrics.2009; 123: 1072-1077.
3. de Bie H, Oostrom K, Delemarre-van de Waal, H. Brain Development, Intelligence and Cognitive Outcome in Children Born Small for Gestational Age. Horm Res Paediatr. 2010; 73: 6-14.
4. Miller S, Huppi P, Mallard C. The consequences of fetal growth restriction on brain structure and neurodevelopmental outcome. J Physiol. 2016; 594: 807-823.
5. Odibo A, Nelson D, Stamilio D, Sehdev H, Macones G. Advanced Maternal Age Is an Independent Risk Factor for Intrauterine Growth Restriction. Am J Perinatol. 2006; 23: 325-328.
6. Jaddoe V, Bakker R, Hofman A, Mackenbach J, Moll H, Steegers E, et al. Moderate Alcohol Consumption during Pregnancy and the Risk of Low Birth Weight and Preterm Birth. The Generation R Study. Ann Epidemiol. 2007; 17: 834-840.
7. Kleijer M, Dekker G, Heard A. Risk factors for intrauterine growth restriction in a socio-economically disadvantaged region. The Journal of Maternal-Fetal and Neonatal Medicine. 2005; 18: 23-30.
8. Lodygensky G, Seghier M, Warfield S, Tolsa C, Sizonenko S, Lazeyras F, et al. Intrauterine Growth Restriction Affects the Preterm Infant's Hippocampus. Pediatric Research2008; 63: 438-443.
9. Martinussen M, Fischl B, Larsson H, Skranes J, Kulseng S, Vangberg T, et al. Cerebral cortex thickness in 15-year-old adolescents with low birth weight measured by an automated MRI-based method. Brain. 2005; 128: 2588-2596.
10. Procianoy RS, Garcia-Prats J, Adams J, Silvers A, Rudolph A. Hyaline

membrane disease and intraventricular haemorrhage in small for gestational age infants. Arch Dis Child. 1980; 55: 502-505.

11. Feldman R, Eidelman A. Neonatal State Organization, Neuromaturation, Mother-Infant Interaction, and Cognitive Development in Small-for-Gestational-Age Premature Infants. Pediatrics. 2006; 118: 869-878.

12. Viggedal G, Lundalv E, Carlsson G, Kjellmer I. Neuropsychological follow-up into young adulthood of term infants born small for gestational age. Med Sci Monit. 2004; 10: 8-16.

13. van Pareren Y, Duivenvoorden H, Slijper F, Koot H, Hokken-Koelega A. Intelligence and Psychosocial Functioning during Long-Term Growth Hormone Therapy in Children Born Small for Gestational Age. J Clin Endocrinol Metab. 2004; 89: 5295-5302.

14. Rao S, Yajnik C, Kanade A, Fall C, Margetts B, Jackson A, et al. Intake of Micronutrient-Rich Foods in Rural Indian Mothers Is Associated with the Size of Their Babies at Birth: Pune Maternal Nutrition Study. J Nutr. 2001; 131: 1217-1224.

15. Haider BA, Bhutta Z. Multiple-micronutrient supplementation for women during pregnancy. Cochrane Database Syst Rev. 2017.

16. Ballard J, Khoury J, Wedig K, Wang L, Eilers-Walsman B, Lipp R. New Ballard Score, expanded to include extremely premature infants. J Pediatr. 1991; 119: 417-423.

17. Canadian Institute for Health Information. Too Early, Too Small: A Profile of Small Babies across Canada. 2009.

18. Health Canada. Canadian Perinatal Health Report 2008. 2008.