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Is Cesarean Birth a Risk Factor for Childhood Obesity?

By

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Introduction

Difficult decisions are made by analyzing costs and benefits. For example, when introducing a new drug, providers analyze pricing and possible side effects. When a new treatment modality is available a clinician evaluates factors such as time spent in rehabilitation vs efficacy. In the case of childbirth, there has been a growing trend in elective cesarean births. In 2016, 31.9% of total United States births were cesarean.¹ Understandably, medical emergencies may necessitate cesarean delivery, however significant numbers are not medically required. The benefits of convenience and utilization of modern medical/surgery methods have popularized cesarean birthrates. It is possible that the costs, being long-term health of the patients involved, have not been clearly communicated to expectant mothers. Medical providers should identify and assess the tradeoffs associated with cesarean birth in order to provide patients the knowledge to make an informed decision regarding their children's health.

In the U.S., the percentage of children and adolescents affected by obesity has tripled since the 1970's. In fact, nearly 1 in 5 American school age children is obese.² Clearly, this statistic is cause for major concern. Globally, the number of overweight or obese infants and young children increased over 59% from 1990 to 2016. If current trends continue, the number of overweight or obese infants and young children globally will increase to 70 million by 2025.³ While indicators of overweight/obesity have risen dramatically, so has the popularity of cesarean births.

Most would agree that obesity is among one of the greatest challenges that providers face in healthcare. Most often the focus is on diet and activity as the primary factors responsible for weight management. Is it possible that the type of birth method predisposes a child to a life of uphill battles in management of weight and comorbidities? Overweight and obese children likely develop into obese adults increasing the likelihood of developing diabetes and cardiovascular disease at a younger age.⁴ Is there global evidence that otherwise healthy babies, who have been born by c-section compared with those born naturally, are at risk for obesity over the course of their childhoods?

C-section – A Significant Factor Responsible for Childhood Obesity

The cesarean birth method has shown to elevate early childhood body mass index (BMI). A Massachusetts study included over 1,000 mother-child pairs and focused on early childhood development, with cohort data beginning at 22 weeks of gestation up to three years of age. Of the cohort, approximately 22.6% of the children were cesarean delivered. At age 3, over 15% delivered by c-section were obese compared to 7.5% of those born traditionally.⁵ The strengths of the study included a moderate sized cohort and precise data measurement of children's height and weight over the study period. Weaknesses of the study were significant since maternal BMI was self-reported and not measured, complicating the attribution of childhood obesity to mother BMI or birth method. As the study was comprised of a homogenous set of participants with high incomes and education, generalizability of the findings for more diverse population is weak. Nonetheless, this study generated significant findings that reflect a consistent correlation of cesarean birth predisposing children to obesity. This study demonstrates a clear correlation between delivery method and early childhood, and the following study demonstrates this correlation in older children.

As cesarean birth rates have risen globally, scholarship devoted to the identification of health corollaries has increased. A cohort study from the United Kingdom that began in the early 1990s and included over 10,000 mother/child pairs evaluated childhood obesity from infancy through adolescence. Exclusion due to premature deliveries (<37weeks), mothers with pre-existing diabetes, hypertension or preeclampsia were made. Adjustments for variables such as gender, parental body mass, socio-demographics, infant feeding patterns were integrated into analysis. Results showed increased adiposity beginning at six weeks continuing to 15 years of age. By 11 years of age this study demonstrated children born by cesarean delivery were 1.83 times more likely to be overweight or obese than those born naturally.⁶ The study's strength lies in the ability to identify and limit confounding factors. This UK study reflects a strong, positive correlation between delivery method as the major risk factor for significant, early childhood obesity through adolescence. The study's findings further strengthen the evidence that

birth method selection is a significant factor in the health of the global youth as they mature into young adults.

Comparisons between traditional and cesarean births studies are typically made by analyzing unique and discrete mother-child pairs. Therefore, an analysis of cesarean birth versus vaginal birth outcomes for successive children from same birth mothers provides a valuable comparison. This comparison provides fewer confounders than comparisons between diverse groups. Within-family analysis conditions are nearly ideal when making a comparison of birth method and effect on childhood obesity. The most complex confounders such as metabolic and genetic variance are mitigated. A study was developed with this fact in mind. Data from a sizable ongoing prospective cohort study, the Growing Up Today Study,⁹ was used to evaluate this correlation. When non-elective cesarean births were excluded, vaginal birth after cesarean was related to a 31% lower risk of offspring obesity compared to repeat cesarean section. In within-family analysis, individuals born by cesarean had 64% higher odds of obesity than their siblings born traditionally.⁹ Given the biological similarity between siblings, changing only the birth method results in significant overweight/obesity risk for children born via c-section. These findings suggest c-section is the most important factor in childhood obesity.

Global data have shown that the cesarean delivery method has profound consequences on childhood BMI. In fact, all of the studies referenced in this paper demonstrate this correlation. However, it is possible that other identifiable factors may further exacerbate or mitigate the growing childhood obesity epidemic propagated by increasing rates of elective, surgically assisted childbirth.

Maternal Obesity

It stands to reason that there is a possible link between maternal overweight/obesity and the likelihood of childhood obesity, regardless of birth type. Genetics play a significant role in a child's development, however maternal diet and lifestyle are important components as well.

A study comprised of births at the Boston Medical Center from 1998-2014 aimed to examine the associations of maternal pre-pregnancy BMI, delivery type and resultant child overweight/obesity. The study recruited participants post-partum (24-72 hours) and data were subsequently collected from clinical records including prenatal care, labor and delivery course, complications, and other pertinent health markers. The study included 1,441 mothers, with 961 vaginal deliveries and 480 cesarean deliveries. Data show Odds Ratio (OR) of 1.4 for children to be overweight/obese in childhood after adjustments including mother BMI if born via c-section. In evaluating the data further, odds of childhood overweight or obesity were highest in children born by cesarean delivery to obese mothers at OR of 2.8. Children born by c-section to mothers within healthy BMI had OR of 1.1, with control being naturally born from mothers of normal BMI.⁷

The data show a direct correlation among maternal BMI and birth method resulting in increased OR for childhood obesity. In each BMI grouping, children birthed by c-section had higher risk of childhood obesity. The study's strengths include a multi-ethnic urban population sample. Given that the interviews were done in person allowed for greater control of confounding variables and clearer distinction of factors. Unfortunately, the study lacked information on indications for cesarean birth. Also, the data on maternal BMI data were self-reported and not measured and recorded in EMR. Despite definitive, recorded BMI values, the U.S. study clearly demonstrates that elevated maternal BMI coupled with c-section delivery method results in higher risk for childhood overweight/obesity.

While increased maternal BMI resulted in higher risk of childhood overweight/obesity in the American study, foreign studies were reviewed for global consistency. A Canadian study involving a population of nearly 1,000 full-term infants born between 2009-2012 showed prominent correlation between childhood obesity and delivery method. Interestingly, the study also provided insight regarding correlation of maternal obesity and childhood obesity. Data showed adjusted OR of 3.33 for a child, naturally born to an overweight mother, to become overweight by one year of age. Cesarean delivered children from overweight mothers had an adjusted OR of 5.02 of being overweight at one year of age. Similar findings were demonstrated at age three for both groups.⁸ Global data suggest maternal BMI is a

significant risk factor for childhood overweight/obesity. In these studies, children birthed by c-section were grouped together, without differentiation. However, given differing growth rates and development, it is worthwhile to determine whether the sex of the child predisposes him/her to higher risk of elevated BMI.

Sex

A European study focused on BMI markers for children born by c-section at Grade 6. The study showed that children delivered by c-section had an OR of 1.86 of overweight and OR of 1.87 for obesity compared to those born naturally.¹⁰ When comparing values between sexes, the results were very interesting. Of a cohort of 917, cesarean birthed girls had increased risk for being overweight at OR of 1.99, but the boys had increased risk of being overweight (OR of 1.78) and obese (OR of 2.58).¹⁰ The study's strengths included standardized height and weight calculations and data included information about health and social values that mitigated confounding factors. There were weaknesses to the study. Most notably, the BMI references used in the analysis were outdated. CDC 2000 charts were derived from American surveys of children from 1963 – 1994, possibly skewing the interpretation of data collected. High socio-economic status of the participants also limits the generalizability of the results. However, this study leads to another important question of how family related variables, such as socio-economic status, contribute to obesity in childhood. Factors such as diet and activity level could potentially result in a stronger influence on childhood obesity than birth method, especially in situations where children live in an environment characterized by limited resources.

Social Factors

It is possible that the risks of childhood overweight/obesity are diminished over time as social factors become more impactful on a child's development. A Peruvian study was completed using data from the Young Lives Study¹¹ to assess the degree of correlation between cesarean births and family related variables. Data from 20 distinct municipalities were collected in a multi-stage, cluster-stratified,

random sampling method. Children were assessed for comparison at three stages: first at baseline, mean age of 11.7 months, and follow-ups at age 5 and age 7. Results showed that there was an increased risk of developing obesity but not overweight among children delivered by cesarean method. The degree of risk estimates decreased over time, and family related variables had a stronger effect on the risk estimates at early childhood.¹¹ Variables such as maternal education and nutritional status were thought to be more important in early childhood while diet and physical activity levels were more important as the child matured later in childhood. The strength of this research is that it included a large sample of data and presents evaluation subsequent factors affecting obesity risk post cesarean delivery. Unfortunately, there was no statistical method of correcting confounding data relating to maternal health variables such as pre and post pregnancy BMI. Additionally, data collection of children's weights did not exclude central obesity at baseline. Despite the statistical deficiencies, the study demonstrates the importance of environmental factors that can mitigate the increased risks associated with c-section and increased likelihood for childhood overweight/obesity.

Conclusion

International research demonstrates a positive correlation between cesarean birth and childhood obesity. As global obesity figures grow, healthcare costs will grow as well. A better understanding of nutrition and advances in pharmacology may help this growing epidemic however, other contributing factors must be addressed as well including birth delivery choice. Given comparative risk of procedural complication, expense, and childhood obesity, elective c-section statistical growth should be considered alarming. Continued research of gut microbiome may help healthcare providers better understand the causative factors relating to childhood obesity and birth method choice. Further, there is an immense opportunity in clinical practice to educate the public on this topic. Patients interested in having children must be educated on the global research done in this field. Explanation of pre-pregnancy obesity, birth method, and family variables can mitigate the escalating trend of overweight/obesity and comorbidities of the next generation. As clinicians, it is important to help patients consider these risk factors that will

influence each pregnancy. This is among the first choices a mother can make to directly influence the health of her child.

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