

Caesarean section and risk of asthma and allergy in adulthood

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This study evaluated the relationship of caesarean section to the risk of asthma in adulthood. The data were based on a prospective birth cohort born in northern Finland in 1966. In 1997, when the members of the cohort were 31 years old, information on current doctor-diagnosed asthma and other allergic disorders was obtained from 1953 subjects by a self-administered questionnaire and skin prick test. Caesarean section had a strong effect on current doctor-diagnosed asthma in adulthood with an adjusted odds ratio (OR) of 3.23 (95% CI 1.53, 6.80). However, no substantial effects were observed for atopy, hay fever, and atopic eczema.

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Key words: Asthma, allergy, caesarean section, birth cohort, Finland

It has been suggested that the microbial flora can affect the balance between T_H1/T_H2 lymphocytes in early childhood, which in turn may be associated with the occurrence of allergic diseases in later life.¹ The colonization of microbial flora varies between babies born by means of caesarean section and babies born by means of normal vaginal delivery.² We have observed that caesarean section was associated with a 40% higher risk of asthma at the age of 7 years compared with those who were delivered by means of a normal vaginal delivery.³ The aim of this analysis was to examine the association between caesarean section and prevalence of asthma, atopy, and other allergic disorders in subjects who were 31 years old with the use of data derived from a prospective Finnish birth cohort.

Abbreviations used

BMI: Body mass index

OR: Odds ratio

METHODS

The cohort consisted of 12,058 living births in 1966. Among those births, 11,635 children survived to the age of 31 years. In 1997, 8463 surviving members who were living in northern Finland and the capital area were invited to a clinical examination, and 6025 (71.2%) attended the examination. Data on self-reported current doctor-diagnosed asthma, current hay fever, current atopic eczema, and other current information including smoking, physical activities, and vocational training were collected with a questionnaire, and current anthropometric information was obtained from clinical examinations. Information on atopy was assessed by skin prick tests for three common allergens in Finland, ie, birch, cat, and timothy grass, and for house dust mite (*Dermatophagoides pteronyssinus*).⁴ Pre- and perinatal data, including the mother's demographics, life style, body mass index (BMIs), and age at menarche and parental allergic history, as well as the newborn's size at birth were available for the whole cohort. Parental allergy was defined as yes if either of the parents had asthma, allergic rhinitis, or atopic eczema. Obstetric data, including data on caesarean section, were collected from delivery hospitals for all "nonnormal" births, ie, perinatal deaths or babies born with low birth weight (<2500 g) or pre- or postmaturely (<38 or >42 gestation weeks) and for a 10% random sample of "normal" births.⁵ This analysis was restricted to 1953 subjects with complete data on both allergic disorders at the age of 31 years and obstetric data. Of these subjects, 1056 belonged to the normal birth group, and 897 belonged to the nonnormal birth group.

Differences in prevalence of asthma and other allergic diseases were examined between those subjects who were born by means of caesarean section and those born by means of vaginal deliveries. All vaginal deliveries, normal and nonnormal (including vacuum extraction or forceps and augmentation for breech presentation), were combined into a single category. There were little differences among different categories of vaginal delivery in the prevalence of outcomes. Odds ratios (ORs) and 95% CIs were estimated with the use of multivariate logistic regression analyses that allowed for potential confounders. A dichotomous variable that indicated normal and nonnormal birth was included in all analyses.

RESULTS

The mean maternal age of the analyzed cohort was 27.8 years, and 65% of mothers had an education of 8 years or less. The prevalences of current doctor-diagnosed asthma, atopy, current hay fever, and current

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TABLE I. Associations of being born with caesarean section and risk of asthma and other allergic diseases in adulthood

Outcomes	No. of caesarean sections	No. of vaginal deliveries	Crude OR (95% CI)	Adjusted OR* (95% CI)
Asthma				
Yes	14 (13.6%)	84 (4.5%)	3.73 (1.83, 6.20)	3.23 (1.53, 6.80)
No	89	1766		
Atopy				
Yes	32 (31.1%)	606 (32.8%)	0.96 (0.62, 1.48)	0.96 (0.59, 1.56)
No	71	1244		
Hay fever				
Yes	20 (19.4%)	331 (17.9%)	1.14 (0.69, 1.90)	1.28 (0.73, 2.24)
No	83	1519		
Atopic eczema				
Yes	14 (13.6%)	204 (11.0%)	1.31 (0.73, 2.35)	1.19 (0.62, 2.28)
No	89	1646		

*ORs adjusted for maternal age, maternal BMI before the pregnancy, maternal age at menarche, parity, maternal smoking during pregnancy, paternal social class, American Pediatric Gross Assessment Record score, birth weight, and current BMI, smoking, physical activities, and vocational training (as categorical variables), gestational age (as a continuous variable), sex, parental allergic history, and the variables indicating normal and nonnormal birth (as binary variables).

atopic eczema were 4.6%, 36.4%, 16.3%, and 7.3%, respectively, for men, and 5.5%, 28.9%, 19.7%, and 15.1%, respectively, for women. Of the 1953 subjects, 1719 (88%) had been born by means of a normal vaginal delivery, 103 (5.3%) had been born by means of a caesarean section, and the rest had been born by means of a nonnormal vaginal delivery, which included 44 deliveries (2.3%) with vacuum extraction or forceps and 87 deliveries (4.5%) with augmentation for breech presentation.

Caesarean section had a strong association with current doctor-diagnosed asthma at the age of 31 years (the adjusted OR was 3.23, 95% CI 1.53, 6.80). However, this was not the case for atopy, hay fever, or atopic eczema (Table I).

DISCUSSION

On the basis of our findings, the effect of caesarean section on microbial flora and the T_H1/T_H2 balance is probably not the mechanism underlying the association between caesarean section and asthma because no associations were observed with atopy and other allergic diseases. It is known that respiratory problems are increased in childhood among premature babies and may also be increased among babies born to mothers with obstetric complications.³ However, at least part of these problems is transient. These analysis involved adults still having asthma at the age of 31 years, which suggests a long-lasting effect. It is possible that unknown factors associated with caesarean section or the consequences of caesarean section may explain the association observed. Alternatively, it could be hypothesized that fetuses that will later develop asthma

may express this in utero, which could lead to obstetric complications and increased risk of caesarean section. It should be noted that almost all caesarean sections in Finland in the 1960s were the result of emergency situations. Only 5% of babies in this cohort were born by means of caesarean section, but currently in Finland the rate in some hospitals is 5 times higher. This analysis is based on a prospective cohort study with data collection of exposures started during women's pregnancies and outcomes obtained when the subjects were 31 years old. However, the information on caesarean section was available for only those "special births" and 10% of a random sample of normal births. The observed strong association of caesarean section with the risk of asthma in adulthood and the fact that caesarean section rates have greatly increased during the last few decades suggest the need for further study on the association between caesarean section and asthma.

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