Maternal Placental Abnormality and the Risk of Sudden Infant Death Syndrome

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To determine whether placental abnormality (placental abruption or placental previa) during pregnancy predisposes an infant to a high risk of sudden infant death syndrome (SIDS), the authors conducted a population-based case-control study using 1989–1991 California linked birth and death certificate data. They identified 2,107 SIDS cases, 96% of whom were diagnosed through autopsy. Ten controls were randomly selected for each case from the same linked birth-death certificate data, matched to the case on year of birth. About 1.4% of mothers of cases and 0.7% of mothers of controls had either placental abruption or placenta previa during the index pregnancy. After adjustment for potential confounders, placental abnormality during pregnancy was associated with a twofold increase in the risk of SIDS in offspring (odds ratio = 2.1, 95% confidence interval 1.3–3.1). The individual effects of placental abruption and placenta previa on the risk of SIDS did not differ significantly. An impaired fetal development due to placental abnormality may predispose an infant to a high risk of SIDS. Am J Epidemiol 1999; 149:608–11.

Although changing sleeping position has resulted in a reduction of sudden infant death syndrome (SIDS) in many countries (1–6), the etiology for abnormal fetal development that predisposes infants to a high risk of SIDS remains elusive. Among the potential risk factors during pregnancy, intrauterine hypoxia has been hypothesized to be an important etiologic factor. However, few studies have examined this hypothesis (7). Maternal smoking during pregnancy, which, among other potential toxicities, could result in chronic intrauterine hypoxia, has been associated with an increased risk of SIDS in offspring (7, 8). Other conditions that may potentially be related to intrauterine hypoxia, such as placental abnormality, cord prolapse, and preeclampsia/eclampsia, were much less studied (9). The placenta is vital for delivering oxygen and nutrients to the fetus. An abnormal placental condition such as placenta previa (implantation of the placenta in the lower uterine segment) or placental abruption (premature separation of the normally implanted placenta prior to birth) could result in an impaired delivery of oxygen and nutrients to the fetus, thus leading to an abnormal fetal development due to inadequate supply of oxygen and essential nutrients (10–14). To examine whether placental abnormality during pregnancy is associated with an increased risk of SIDS in offspring, we conducted a population-based case-control study using the 1989–1991 California linked birth and death certificate data.

MATERIALS AND METHODS

During the period of 1989–1991, 2,107 SIDS cases with International Classification of Diseases, Ninth Revision, Clinical Modification, code 798.0 listed as the underlying cause of death were identified from the linked California birth and death certificate data. More than 96 percent of the identified SIDS cases were diagnosed through autopsy. Controls were randomly selected from infants who did not die from SIDS and matched to cases on the year of birth with a 10/1 control/case ratio. The information on prenatal diagnoses of placental abruption or placenta previa as well as other conditions was listed under the category of "Complications and Procedures of Labor and Delivery" on the birth certificate. Any infant with a
diagnosis of maternal placental abruption or placenta previa on the birth certificate was considered to have a maternal placental abnormality during pregnancy. The information on potential confounders that were available from the birth certificate data included maternal age, race/ethnicity, educational level, parity, prior miscarriage and preterm delivery, maternal smoking, presence of preeclampsia/eclampsia, gestational age at initial prenatal visit during the index pregnancy, infant low birth weight, sex, and year of birth. The information on paternal age, race/ethnicity, and educational level was also available for adjustment.

An odds ratio with its 95 percent confidence interval was used to estimate the relative risk of SIDS associated with prenatal placental abnormality. Logistic regression was used to obtain the estimates after adjustment for potential confounders (15).

RESULTS

Table 1 presents the characteristics of the study population. Compared with mothers of controls, mothers of SIDS cases were more likely to be less than 18 years old, to be black, to have had more prior live births and more than two prior miscarriages, to have smoked, to have had preeclampsia/eclampsia, or to have had inadequate prenatal care during the index pregnancy. In addition, they were less likely to have any college education. SIDS cases were also more likely to have low birth weight and to be male compared with controls.

After adjustment for maternal age, educational level, parity, prenatal smoking, prenatal care, and infant sex, maternal placental abnormality (placental abruption or placenta previa) was associated with a twofold increase in the risk of SIDS in offspring (table 2). Further adjustment for other potential confounders including birth year of infants, maternal race/ethnicity, birth interval, a history of miscarriage, preterm delivery, preeclampsia/eclampsia during pregnancy, paternal age, and infant with low birth weight did not materially change the estimate. The individual effects of abruptio placenta and placenta previa on the risk of SIDS do not seem to differ significantly (table 2).

DISCUSSION

Limitations of this study need to be kept in mind when one interprets the findings. Because the study was based on the birth certificate data, the recorded diagnosis of placental abruption and placenta previa may not be complete. Although no recent quality control data are available for the California birth certificate data, it is generally expected that the incidence of placental abruption and placenta previa is around 1–1.5 percent (10). Therefore, the incidence of 0.7 percent in the control group of this study probably reflects an underreporting of the incidence on the birth certificates. However, in order to bias the findings, this
underreporting had to be different between SIDS cases and controls. Since the birth certificates were completed before the occurrence of SIDS, it is unlikely that any differential recording was introduced because of the SIDS status. In addition, because SIDS cases had a relatively low socioeconomic status, a potential differential recording bias, if it existed, would have been more likely to result in underreporting of placental abnormality in the SIDS group than in the control group, leading to attenuation of the observed association between placental abnormality and SIDS risk. Furthermore, when placental abnormality was redefined to include excessive vaginal bleeding before labor, the incidence of placental abnormality was increased to 1 percent in the control group. However, the risk of SIDS associated with the redefined placental abnormality remained elevated (odds ratio = 1.8, 95 percent confidence interval 1.2–2.6).

The diagnosis of SIDS in the linked birth and death certificate data should be reliable because more than 96 percent of cases were diagnosed through autopsy, and all cases must be verified through a rigorous system before the final diagnosis of SIDS could be recorded on the California death certificate.

It is possible that some potential confounders such as prenatal smoking exposure may be underreported on the birth certificate, thus resulting in an incomplete control of the potential confounders. However, any residual confounding, if it existed, was unlikely to be strong enough to explain the observed twofold increased risk of SIDS associated with placental abruption or placenta previa during pregnancy, for the current adjustment for those confounders, though incomplete, resulted in essentially no change between crude and adjusted odds ratios: 2.0 and 2.1, respectively.

The findings from this study suggest that the placental problems during pregnancy may predispose an infant to a higher risk of SIDS. The mechanism for this observed association is not known at present. The placenta provides a fetus with oxygen and essential nutrients that are vital to normal fetal development. Although the etiology of placenta previa is largely unknown, it is believed that a need for increased placental surface area due to such factors as extensive endometrial scarring is probably the driving force for the formation of placenta previa (10). Therefore, placenta previa not only results in the reduced supply of oxygen and nutrients to the fetus due to decreased placental surface area, suboptimal uterine location, and bleeding, but the presence of the condition also indicates reduced uteroplacental oxygen and delivery of nutrients (10). In the case of placental abruption, the premature separation of the normally implanted placenta will result in a decreased surface area for maternal-fetal blood exchange, thus leading to a reduced supply of oxygen and essential nutrients. It is obvious that both placental abruption and placenta previa could result in or indicate a reduced supply of oxygen and essential nutrients to the fetus. Although placental abruption may result in acute fetal hypoxia compared with placenta previa which more likely leads to chronic fetal hypoxia, the effect of fetal hypoxia on fetal development, especially on the neurologic system, in terms of duration and intensity is not well understood (13, 16, 17). It is possible that both severe hypoxia for short duration and chronic mild hypoxia can result in fetal maldevelopment. Our separate analysis of the individ-

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\begin{array}{|c|c|c|c|c|c|}
\hline
\text{Factors} & \text{Cases (n = 2,028)\textsuperscript{*}} & & \text{Controls (n = 21,037)\textsuperscript{*}} & & \\
\hline
\text{} & \text{No.} & \% & \text{No.} & \% & \text{Odds ratio\textsuperscript{t}} & \% 95\% confidence interval \\
\hline
\text{Placental abnormality\textsuperscript{†}} & & & & & \\
\text{Yes} & 28 & 1.4 & 146 & 0.7 & 2.1 & 1.3–3.1 \\
\text{No} & 2,000 & 99.6 & 20,891 & 99.3 & & & \\
\hline
\text{Abruptio placenta} & & & & & \\
\text{Yes} & 16 & 0.8 & 80 & 0.4 & 1.9 & 1.1–3.3 \\
\text{No} & 2,000 & 99.2 & 20,891 & 99.6 & & & \\
\hline
\text{Placental previa} & & & & & \\
\text{Yes} & 13 & 0.7 & 69 & 0.3 & 2.3 & 1.3–4.3 \\
\text{No} & 2,000 & 99.3 & 20,891 & 99.7 & & & \\
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\textsuperscript{*} Subjects with missing data on the adjusted variables were excluded.
\textsuperscript{†} Odds ratio adjusted for maternal age, educational level, parity, prenatal smoking, prenatal care, and infant's sex. Further adjustment for birth year of infant, maternal race, birth interval, a history of miscarriage, preterm delivery, preeclampsia during pregnancy, paternal age, and infant with low birth weight did not materially alter the estimate.
\textsuperscript{†} Including abruptio placenta and placental previa. One case and three controls had both conditions.
The effects of placental abruption and placenta previa on the risk of SIDS did not differ significantly (table 2). 

Depending on the severity of the placental abnormalities, various damages to fetal development including death may occur (12, 13, 18, 19). Although the exact types of damages to live births by the placental abnormalities during pregnancy are not well documented, the central nervous system is probably a potential target because of the effect of fetal hypoxia (13, 18). A defective cardiorespiratory control system in the brainstem has been hypothesized to be involved in the etiology of SIDS (20-25). Therefore, it is conceivable that some of the neurologic damage could be severe enough, though not detectable by autopsy, to result in SIDS when extraneous risk factors such as prone sleeping position are present. Although the incidence of placental abruption and placenta previa is low, understanding the association of placental abnormality and the risk of SIDS may enhance our knowledge of the role of the placenta in determining the risk of SIDS as well as other adverse pregnancy outcomes.

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REFERENCES