OBSTETRICS

Fetal trauma in term pregnancy

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OBJECTIVE: The objective of the study was to determine the incidence and type of fetal trauma in term pregnancy in relation to method of delivery, maternal age, parity, and birthweight.

STUDY DESIGN: From the Nova Scotia Atlee Perinatal Database, fetal trauma was evaluated in all term (37 weeks or longer) singleton fetuses without major anomaly in vertex presentation over a 14-year period (1988-2001).

RESULTS: The overall risk of fetal trauma was low (2.0%); that of major fetal trauma was 0.16%. Major and minor fetal trauma was significantly increased with labor, compared with no labor (adjusted relative risks [RRs], 9.59; 95% confidence interval [CI], 1.34-68.47, and RR, 11.25; 95% CI, 5.05-25.09, respectively). Cesarean delivery was protective for major and minor fetal trauma, compared with vaginal delivery (adjusted RRs, 0.21; 95% CI, 0.12-0.40, and RR, 0.46; 95% CI, 0.39-0.54, respectively).

CONCLUSION: The risk of significant fetal trauma in term pregnancy is very low and most likely to be associated with labor and with assisted vaginal delivery.

Key words: fetal trauma, method of delivery

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Fetal trauma at delivery is a rare but significant perinatal complication. Maternal and fetal factors, such as preexisting diabetes,[1] breech presentation,[2] and birthweight,[1,3-5] have been associated with fetal trauma, and shoulder dystocia, which is most likely to occur at term, is known to be a significant risk factor for trauma such as brachial plexus palsy.[6-9] Operative vaginal delivery may be associated with other fetal trauma such as fractures or intracranial hemorrhage.[1,3,4,10-13] Although the maternal and perinatal risk factors for trauma with shoulder dystocia and breech presentation associated with vaginal delivery, as well as long-term outcomes, are well documented,[3,5,9,12,14-18] the occurrence of fetal trauma associated with other methods of delivery, separate from other serious neonatal morbidity is less clear.[19-21]

An evaluation of fetal trauma outcomes and an estimation of the magnitude of the excess risk of fetal trauma associated with method of delivery may influence clinical decision making with obstetrical interventions such as operative delivery. In this study, we assessed the effect of method of delivery on the incidence of major and minor fetal trauma using data from a large provincial database for infants born at gestational age 37 weeks or longer.

Materials and Methods

The Nova Scotia Atlee Perinatal Database is a population-based clinical database containing comprehensive coded information on pregnancy outcomes and was used to evaluate the relationship between fetal trauma and type of labor and method and mode of delivery. Maternal and newborn data, including demographic variables, procedures, maternal and newborn diagnoses, and morbidity and mortality information, are available for every pregnancy and birth (500 g or more) occurring in Nova Scotia hospitals and to Nova Scotia residents since 1988. There are approximately 10,000 live births in Nova Scotia,[22] which has a homogeneous, predominantly white population of approximately 1 million,[23] each year.

Maternal data included in this study consisted of information from pregnancies to Nova Scotia residents between 1988 and 2001. Pregnancies were included if there was a live born singleton of 37 weeks or longer. Pregnancies were excluded if there was a major fetal anomaly or if there was nonvertex presentation. Identification of fetal trauma was by clinical diagnosis and confirmed radiographically, where appropriate.

Trauma included in these analyses were intracranial hemorrhage (defined as tentorial tear, spinal cord hemorrhage, subgaleal hemorrhage, or other intracranial hemorrhage); cephalhematoma; brachial plexus injury; facial palsy; skull fractures (depressed or linear); and other fractures (clavicle, ribs, hu-

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merus, or femur). Fetal trauma was considered major trauma if 1 or more of the following were present: depressed skull fracture, intracranial hemorrhage, or brachial plexus palsy. Minor trauma was considered if 1 or more of the following were present: linear skull fracture, other fractures, facial palsy, or cephalhematoma.

Type of labor was defined as present or absent, mode of delivery was defined as vaginal or cesarean, and method of delivery was defined as spontaneous vaginal, assisted vaginal (vacuum, forceps), failed assisted vaginal (vacuum, forceps), and cesarean delivery (with and without labor). The failed assisted vaginal delivery group was classified by the first attempted obstetrical intervention, regardless of other obstetrical interventions required for delivery.

To evaluate the unique relationship of each potential confounding variable on the outcome of fetal trauma, binary logistic regressions were run. This procedure was run separately for minor trauma only and for major trauma with and without minor trauma. The variables entered in the regression models reflected both maternal and fetal measures. Maternal variables included age at delivery of 35 years or older (yes/no), nulliparity (yes/no), and type of delivery (6 categories included forceps, vacuum, failed forceps, failed vacuum, and cesarean delivery with and without labor). During the time period of the study, the vacuum soft cup was used.

The fetal measure included in the models was birthweight in the categories of less than 4000 g, from 4000 g to 4499 g, and 4500 g and more. For the yes/no variables, the referent groups were the subjects in the "no" categories. For birthweight, the category of less than 4000 g was the referent group. For type of labor, no labor was the referent group; for mode of delivery, vaginal delivery was the referent group; for method of delivery, spontaneous unassisted delivery was the referent group; for type of assisted vaginal delivery, vacuum-assisted delivery was the referent group; for type of failed assisted vaginal delivery, failed vacuum-assisted delivery was the referent group; and for cesarean delivery alone, cesarean without labor was the referent group.

Categorical variables were compared using χ^2 analysis and Fisher exact test where appropriate. Logistic regression analyses accounted for the effect of maternal age, parity, birthweight, and year of birth on the risk of trauma with type of labor or delivery. The odds ratios obtained from logistic regression models were interpreted as relative risks because outcomes considered were rare (rate less than 10%). Statistical analyses were performed using the SAS programming package for Windows (version 8.0, SAS Institute, Cary, NC) and EpiInfo (Centers for Disease Control and Prevention, Atlanta, GA). Ethical approval was obtained from the Reproductive Care Program of Nova Scotia and the Research Ethics Board at the IWK Health Centre in Halifax, Nova Scotia.

TABLE 1
Total fetal trauma among deliveries in Nova Scotia, 1988-2001

	n	Rate per 1000
Major trauma*	187	1.6
Depressed skull fracture	4	0.03
Intracranial hemorrhage	18	0.2
Brachial plexus palsy	165	1.4
Minor trauma†	2198	18.4
Linear skull fracture	7	0.06
Other fractures	235	2.0
Facial palsy	79	0.7
Cephalhematoma	1877	15.7
No trauma	117,097	—

* One major trauma with or without minor trauma.

† One or more minor traumas with or without major trauma.

RESULTS

The potential study population in Nova Scotia for the 14-year period (1988-2001) was 153,209. Twenty-two percent of the population was excluded based on the inclusion criteria of singleton (1%), term (7%), no major anomalies (3%), no fetal deaths (0.1%), and in vertex presentation (11%) to give the actual study population of 119,432. The total number of major trauma, minor trauma, and no trauma, occurring alone or in combination with other major or minor trauma, is summarized in Table 1. The overall risk of any fetal trauma was low (2.0%), and major fetal trauma occurred in 1.6 per 1000 deliveries. Brachial plexus palsy contributed the most (1.4 per 1000) to the rate of major fetal trauma; depressed skull fracture contributed the least (0.03 per 1000). Cephalhematoma contributed the most (15.7 per 1000) to the rate of minor fetal trauma and linear skull fracture contributed the least (0.06 per 1000).

No infant had more than 1 major trauma. Of those infants with a major trauma (n = 187), 27 (14%) also had 1 minor trauma, and 1 (0.5%) also had 2 minor traumas. No infant had more than 2 minor traumas. Of the 2127 newborns with 1 minor trauma only, 1847 (87%) had cephalhematoma. Of those with 2 minor traumas only (n = 21), cephalhematoma was 1 of the 2 minor traumas in all cases.

The rates of operative deliveries changed significantly from 1988 to 2001 in this population. The use of vacuum-assisted vaginal delivery increased from 0.3% to 4.8% ($P < .001$), whereas forceps-assisted vaginal delivery decreased from 13.5% to 4.5% ($P < .001$). The rates of both cesarean delivery in labor and cesarean without labor increased (10.8% vs 12.8%; $P < .001$, and 7.5% vs 10.2%; $P < .001$, respectively). The rates