OBSTETRICS

Perinatal implications of motor vehicle accident trauma during pregnancy: identifying populations at risk

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OBJECTIVE: The purpose of this study was to examine the association between restraint use, race, and perinatal outcome after motor vehicle accidents (MVAs) during pregnancy.

STUDY DESIGN: The Duke Trauma Registry and medical records were searched for information on pregnant women at >14 weeks' gestation who were involved in an MVA and who received care through the Emergency Department and the Obstetric Units. Between January 1994 and December 31, 2010, 126 women were identified. Variables that were collected included type of trauma, gestational age at presentation, and delivery outcomes. A prognostic study was performed that evaluated the associations between maternal demographics, details of the accident that included restraint use, and maternal treatment that was related to the accident in relationship to perinatal outcome.

RESULTS: There was no difference in the mean age or median gravidity or parity by race among pregnant women who were cared for after an MVA. There was no difference in mean age or racial distribution between women who were restrained compared with women who were unrestrained; unrestrained women were more likely to be nulliparous. Unrestrained women were more likely to require nonobstetric surgery that was related to the trauma. The overall rate of placental abruption was 6%. There were 6 intrauterine fetal deaths, 3 each in the unrestrained (25%) and restrained groups (3.5%; $P = .018$). Airbags deployed in 17 accidents. Among the 7 women with placenta abruption, 4 women (57%) experienced air bag deployment.

CONCLUSION: Lack of restraint use during pregnancy is associated with an increased risk of fetal death.

Key words: accident, perinatal outcome, pregnancy, restraint use

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Traumatic injury is the leading cause of maternal and/or fetal death and occurs in up to 8% of all pregnancies in the United States[1]; fetal loss occurs in 0.03-0.09% of these cases.[2] Motor vehicle accidents (MVAs) are the most common cause of nonobstetric trauma.[3] Approximately 16,999 major and minor injury-related hospitalizations among pregnant women occurred in the United States in 2002; delivery occurred in 38% of those hospitalizations.[4]

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Maternal injuries pose risk for mother and fetus.[3,5] The primary cause of fetal death is maternal death followed by placental abruption.[5] In one study, placenta abruption accounted for 42% of fetal deaths; 11% of fetal death was related to maternal death.[3]

Previous studies have suggested that the lack of a seat belt or other restraints increases the risk of both maternal[6] and fetal[7] morbidity and death. A retrospective cohort of nonseverely and severely injured women indicated that those women who were injured severely were at a 17-fold increased risk for abruption and a 20-fold increase risk for fetal death.[6] Pregnant women who did not wear a seat belt during an automobile crash were 1.3 times more likely to have a low birthweight infant, twice as likely to have excessive maternal bleeding, and 2.8 times more likely to experience a fetal death than women who wore a seat belt during a crash.[7] In another study, the relative risk estimate of fetal death was 4.1. Of the 7 fetal deaths in the unrestrained group, 4 deaths occurred within 1 day of the accident (3 of the deaths were from maternal injury, and the other 4 were from placental abruption).[8]

Studies that have examined the demographics of automobile accidents suggest that restraint use may be lower among ethnic minorities.[6,9] However, few if any of the studies on perinatal outcome after automobile crashes has examined the relationship between racial demographics and restraint use. As such, this study was conducted to examine the association between restraint use, race, and obstetric and nonobstetric factors on maternal and perinatal outcome.

Materials and Methods

After we obtained institutional review board approval, we queried the database that is maintained by the Duke University Hospital Emergency Department and the Obstetrical Unit with the use of the search terms *pregnancy* and *trauma* for the records of women who were involved in an MVA and who received care through the emergency and obstetrics facilities. The trauma registry has existed since January 1994 and collects information on pregnancy, race, type of injury

TABLE 1
Demographic data by restraint status

Characteristic	Restrained	Unrestrained	*P* value[a]
Age, y[b]	24.0 ± 5.3	21.9 ± 5.8	.229
Gravidity, n[c]	2 (1, 3)	1 (1, 2)	.029
Parity, n[c]	1 (0, 2)	0	.011
Race/ethnicity, n/N (%)			.865
White	21/111 (18.9)	3/12 (25.0)	
African American	67/111 (60.4)	7/12 (58.3)	
Hispanic, other	23/111 (20.7)	3/12 (16.7)	
Driver, n/N (%)	69/111 (62.2)	3/13 (23.1)	.007
Backseat, n/N (%)	9/111 (8.1)	6/13 (46.2)	< .001
Airbag, n/N (%)	16/110 (14.5)	1/13 (7.7)	.469
Ejected, n/N (%)	0/112	3/13 (23.1)	< .001

[a] Student *t* test for comparison of means; Wilcoxon sign-rank test for comparison of medians; χ^2 test or Fisher exact test for categoric variables; [b] Values are given as mean ± SD; [c] Values are given as median (quartile).

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(blunt, penetrating), cause of injury (eg, MVA, gunshot, stabbing, fall), and patient disposition, which includes admission. The registry report in cases of MVA contains information on restraint use, air bag deployment, and ejection from the vehicle. From this review, we identified 126 women who were examined after an MVA and who were >14 weeks' gestation. Women who were <14 weeks' gestation were excluded because the obstetrics service typically is not consulted unless there is an acute pregnancy-related complication. Five patients met the gestational age criteria but did not have complete medical information and/or the final disposition was unknown. Records were reviewed, and data were collected and cross reviewed by 2 of the authors for demographics, accident characteristics and timing, nonobstetric surgery, obstetric and clinical outcomes at the time of discharge from the hospital or Emergency Department, which included pregnancy complications and maternal, fetal, and neonatal death.

After the initial evaluation and stabilization in the Emergency Department, the obstetrics team was consulted and involved in the immediate and hospital care. The condition of the women was evaluated, observed, and monitored obstetrically, based on published guidelines.[10] For those women who were >20 weeks' gestation, external fetal heart rate and tocodynameter monitoring for uterine contractions were reviewed by computer tracing after 2003 and by archive hard copy before 2003. The tocodynameter was evaluated for uterine activity that included irritability and/or contractions. Contractions were characterized as ≥1 contractions in a 10-minute segment of tracing. *Perinatal death* was defined as an intrauterine fetal death at >20 weeks' gestation or death of a newborn infant within 30 days of delivery.

The need for nonobstetric maternal surgery, transfusion, and maternal length of stay after admission were used as surrogates for the severity of injuries. We did not use a standardized injury severity scoring system by diagnosis code, nor was it recorded in the retrospectively reviewed data base. Use of this severity scoring system designed to predict survival after motor vehicle crashes in nonpregnant populations has been criticized when used in pregnant cohorts to misclassify the severity and impact of injury.[6] Because of the variation in the use of fetal heart and contraction monitoring and specific Kleihauer Betke testing for maternal fetal bleeding, these results were not used in the analysis of perinatal outcome.

Descriptive statistics were calculated as means with SDs, medians and ranges, and percentages, where appropriate. Continuous variables were compared with the use of the Student *t* test or Wilcoxon sign-rank tests; categoric variables were compared with the use of χ^2 test or Fisher exact test, as appropriate. All analyses were performed with JMP 9 software for Macintosh (version 9.0; SAS Institute, Inc, Cary, NC). A probability value < .05 was considered significant.

RESULTS

Between Jan.1, 1994 and Dec. 31, 2010, 126 pregnant women were cared for at Duke University Medical Center after an MVA. Table 1 shows a comparison of demographic data by restraint status. There was no difference in mean age or racial distribution between women who were restrained compared with unrestrained. However, unrestrained women were more likely to be nulliparous. Among those women who were the driver, more were significantly likely to be restrained compared with unrestrained; those women riding in the backseat were more likely to be unrestrained. Of the 3 women who were ejected from the vehicle after an MVA, all were unrestrained.

Table 2 shows the racial demographics of the MVA population that included 24 white women (19.0%), 75 African American women (59.5%), 24 Hispanic women (19.0%), 1 woman of "other" race (0.8%), and 2 women of unknown race (1.6%). There were no significant differences in age, gravidity, or parity by race/ethnicity. There was also no difference by race in the number of women who were the driver, were in the backseat, were ejected, or experienced air bag deployment.

The median gestational age at examination after an MVA did not differ by restraint status. Of the 39 women with available urine toxicology results, only 1 woman had a positive screen (cocaine, benzodiazepines, and methadone). There were also no differences in symptoms of abdominal pain by restraint status; 54% of the restrained women had abdominal pain, compared with 73% of the women who were unrestrained. Two women lost consciousness after the MVA; both women were restrained (Table 3).