ORTHOPAEDIC TRAUMA IN PREGNANT WOMEN EXPOSED TO MOTOR VEHICLE CRASHES

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Purpose: Motor vehicle collisions are the most frequent source of high-energy trauma in pregnant women. Early studies examining belt use rates and injury rates for pregnant women subject to motor vehicle crashes frequently group all subjects together regardless of where they are seated in the vehicle. More recent studies have shown that injury type and rates differ between front row occupancy from that in the second row. In addition, the steering wheel and driver airbag pose additional sources of both injury prevention and risk. It has also been found that pregnant women are frequently drivers in collisions. Therefore, the purpose of our study was to examine motor vehicle collision trauma in pregnant drivers, with focus on orthopaedic injuries.

Methods: The National Automotive Sampling System - Crashworthiness Data System (NASS-CDS) is an open data set collected by the National Highway Transportation Safety Administration. The data documents crash, vehicle, and vehicle occupants for 5000 crashes per year. The crashes are assigned a weighting that reflects the probability of sampling the event, so that the weighted data provides estimates for national rates of crashes and injuries. Injuries in the data set are described using the Abbreviated Injury Scale, which provides general descriptions of injuries and severity ratings based on threat to life. In this study the 2008 definitions for the Abbreviated Injury Scores (AIS) were utilized and these were also used to calculate the injury severity score (ISS).

The current study examined a subset of these cases involving women ages 16 to 45 that were involved in motor vehicles collisions from the year 2011 to 2015. Collisions involving vehicles produced prior to 2000 were excluded from our sample as airbags and seatbelts in older vehicles are significantly different from current designs. This created a set of vehicle occupants who experienced similar safety systems (e.g. presence of a steering wheel and airbag) and this seating position provided the largest data set in comparison to right front or second row seating. These cases were split into two cohorts: one involving pregnant women and the other nonpregnant woman. For these vehicle occupants the rate of polytrauma (defined as an Injury Severity Score (ISS) greater than 15), significant injury (defined as any injury rated AIS≥2 in an occupant,) and length of hospital stay (days) were compared. Injury types (body regions and descriptions) were also examined to attempt to identify common patterns.

Injury frequencies were compared between pregnant and nonpregnant drivers using Rao-Scott chi-square tests, which account for the sample design.

Results: The subset of drivers utilizing the lap and shoulder belt was composed of 1,444,436 non-pregnant and 29,888 pregnant women (raw counts 2077 and 82, respectively). The rate of polytrauma was 0.58% [95th CI: 0-1.42%, raw counts 2/83] in the pregnant drivers, which was
not significantly different (p=0.355) from that of the non-pregnant group at 0.07 [95th CI: 0.16-0.42, raw count 45/2193]. However, the rate of significant injury in the pregnant drivers at 1.02% [0.00-2.04%, raw 6/82] was significantly lower (p=0.004) than the rate in non-pregnant drivers [4.70; 95th CI 2.04-7.36, raw 229/2077].

The rate of skeletal injury in the pregnant group was 0.99%, with fractures present in most pregnant drivers with significant injuries (defined as at least one injury rated AIS 2). Upper extremity fractures were the most common orthopaedic injury, occurring in 0.53% of these pregnant drivers. It was common to find fractures along with other injuries and uncommon to find a fracture alone.

In regard to hospital stay, the pregnant drivers had higher rates of staying 1 or more days (p=0.002), at 15.13% [5.07-25.18%, raw 23/83] versus 1.26 [1.84-5.77, raw 187/2132]. This difference did not remain when stays of 3 or more days were considered (p=0.398), with pregnant women at 0.84% [0.00-1.74, 6/83] and nonpregnant at 0.51% [0.28-0.74, 76/2132].

**Conclusions:** Our data shows that rates of severe injury were similar between pregnant and nonpregnant drivers. The overall rate of injury identified in this study at 1.02% is lower than earlier estimates in the range of 5% from older NASS_CDS data. This likely reflects our exclusion of unrestrained occupant as well as limiting the review to only drivers, However, it may provide evidence of improvements in vehicle safety over recent years. The rate at which women in each group stayed in the hospital three or more days also showed no significant difference. This suggests that pregnancy does not strongly influence the incidence or treatment duration of severe injury. The finding that injury rates were not significantly different between the groups is similar to that previously reported. However, others have found that pregnant women have lower rates of extended hospital stays. The study authors used six days to define an extended hospital stay and did not control for seat belt use compared to our utilization of three days due to smaller sample size.

Fractures were shown to be a common injury in the restrained pregnant drivers, with upper extremity injuries occurring most frequently. This is consistent with two earlier studies that found similar results but did not consider seat position and restraint use. While fractures in the extremities do not pose a high mortality risk, they do pose treatment challenges as physicians seek to balance maternal health and long-term function with the health of the fetus.

There are several limitations of this study. The first is the relatively small sample size. While it is likely that crash severity and crash direction play a role in injury risk, the sample of cases is insufficient to include these factors in the analysis. Another limitation is that treatment and treatment outcomes for the cases here are not available.