Airbag Deployment and Improperly Restrained Children: A Lethal Combination

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Quiñones-Hinojosa, Alfredo MD; Jun, Peter MD; Manley, Geoffrey T. MD, PhD; Knudson, Margaret M. MD; Gupta, Nalin MD, PhD
From the Departments of Neurological Surgery, San Francisco Injury Center, University of California, San Francisco.

FROM ABSTRACT:

Background: Airbag deployment is an acknowledged mechanism of serious trauma in children involved in motor vehicle crashes.

From a review of national databases, we determined the number and types of fatal and nonfatal injuries to children caused by airbag deployment and child restraint system use. We also reviewed the relevant literature and provide information useful for caregivers and health care professionals in hopes of reducing future injuries.

Methods: We retrospectively reviewed 263 reported cases in which airbag deployment caused fatal or nonfatal injuries in children from reports released by the National Highway and Transportation Safety Administration and the National Pediatric Trauma Registry. Data were collected from January 1993 to December 2002 and imported into a database program for analysis.

Results: Of the 263 pediatric injuries caused by airbag deployment, 159 were fatal and 104 were nonfatal.

Head injuries were most frequent, involving 170 children (64.6%), followed by spinal injuries, involving 100 children (38.0%).

For children in their first year of life, head injuries were the sole mechanism of fatality.

Of all children studied, only six (2.3%) were properly restrained.

Conclusion: Airbag deployment in motor vehicle crashes is a well-recognized mechanism of morbidity and mortality in the pediatric population.

Most injuries include trauma to the head and spine, which can have significant long-term consequences.

Although the reported incidence of such injuries is decreasing, many children are improperly restrained.

In our study, only 2.3% of children were properly restrained, suggesting that proper child restraint and seating position could have prevented most injuries.

THESE AUTHORS ALSO NOTE:

Since 1993, when a 6-year-old girl was killed by a deploying airbag following a minor motor vehicle crash (MVC), the harmful impact of car airbags on children has become widespread.

"Children involved in low-velocity MVCs with airbag deployment are at a higher risk for serious injury or death than if the airbag had not deployed at all."

Injuries from airbags range from minor to fatal.

In nearly all injured children, they were unrestrained or were improperly restrained in the front seat.

Shoulder-lap belts are inadequate in protecting children.

"The improper use of child restraint systems (CRSs) in association with airbag deployment remains a public health concern."

This study included patients younger than 19 years of age at the time of the MVC. The restraint status for each case was categorized as proper, improper, or unrestrained.

These authors identified 263 cases of injury associated with airbag deployment between 1993 and 2002:
159 were fatal and 104 were nonfatal.

"The young children group [ages 4-7 years] had the highest number of fatal (43.3%) and nonfatal (34.6%) injuries."

"For fatal cases, head injuries were the sole cause of death for the infant group, where as a combination of injuries were seen in other age groups."

"Fatal injuries included skull and cervical spine fractures, subdural hemorrhages, diffuse axonal injuries, cord transections, and decapitations."

Only 5.7% of the fatal and 19.2% of the nonfatal injuries did not involve either the head or the spine.

Of the 159 fatalities:
69.2% children were unrestrained
29.6% were improperly restrained
0.6% was properly restrained **[Very Important]**

Of the 104 nonfatal injuries:
41.3% children were unrestrained
50% were improperly restrained
4.8% were properly restrained

DISCUSSION

"Children situated in the front seats are highly susceptible to airbag-mediated trauma."

Sadly, "frequently children ages 6 to 12 years old and children traveling alone with the driver are still seated in the front," which is the vulnerable position.

The highest number of fatal and nonfatal injuries was in the young children group, ages 4 – 7 years. Studies indicate that children 4 to 7 years of age are in the front seat 29% of the time and, "more disturbingly, that infants and toddlers were still being placed in the front seat 15% and 10% of the time, respectively."

"The patterns of injury can be explained by the mechanism mediating airbag trauma. Most injured children younger than 1 year of age were secured in a rear-facing CRS in the front seat. In these cases, the airbag strikes the CRS and continues to expand, crushing the child's head between the CRS and the upright back of the passenger seat."

"For older children, braking before impact causes the child to shift forward placing him or her closer to the dashboard. When the airbag deploys, the face and frontal cranium receive the impact causing violent hyperextension of the cervical spine resulting in injury."

"Younger children are particularly vulnerable to injuries of the head and neck because their short stature places their head at the same level as the airbag, their flat occipital condyles allow for easier subluxation, and their immature cervical musculature reduces neck stability."

"This anatomy subjected to the force of an airbag expanding at speeds of up to 250 miles per hour can have devastating consequences."

"An interview involving 600 parents showed that 96% of parents believed their children were properly secured when, in actuality, only 20% were properly secured."

"We found that 97.7% of those children injured or killed by airbag deployment were either improperly secured or completely unrestrained."

Children younger than 13 years of age should ride in the back seat with an appropriate CRS, which affords the most protection for children of any age, "with a 46% reduction in the mortality rates for properly restrained children in vehicles with dual airbags."

There is an additional reduction in mortality of 10 to 20% when children are placed in the center of the back seat as opposed to the outward positions.

"Airbags were originally designed to protect a 5-foot 11-inch man weighing 170 pounds."

Since 2006, all new vehicles are equipped with smarter airbags that can discriminate between young passengers or CRSs in the front seat by their weight or incorporating on/off switches or other safety technologies. However, more than 105 million (49.6%) of the 212 million vehicles currently in the United States do not have these smart airbags.

"The introduction of side airbags further emphasizes that the safest position is the rear middle seat."

Because of the data collection limitations of this study, it may have underestimated the "true magnitude of airbag-mediated injuries in the population."

CONCLUSION

"MVCs are the leading cause of death in children older than 1 year of age in the United States."

"In 2001, approximately 266,000 children were injured as passengers in MVCs."

"Airbag deployment is a lethal mechanism of head and neck trauma in pediatric patients involved in MVCs."

"Nearly all children killed were improperly restrained, which led us to conclude that proper restraint status at the time of impact could have prevented these deaths."

KEY POINTS FROM DAN MURPHY

1) Airbag deployment is an acknowledged mechanism of serious trauma in children involved in motor vehicle crashes.

2) 65% of airbag injuries to children involve the head.

3) 38% of airbag injuries to children involve the spine.

4) For children in their first year of life, head injuries are the only mechanism of fatality.

5) "Children involved in low-velocity MVCs with airbag deployment are at a higher risk for serious injury or death than if the airbag had not deployed at all."

6) Injuries to children from airbags range from minor to fatal.

7) 97.7 % of airbag-injured children are unrestrained or improperly restrained in the front seat.

8) Shoulder-lap belts are inadequate in protecting children.

9) "Children situated in the front seats are highly susceptible to airbag-mediated trauma."

10) Sadly, "frequently children ages 6 to 12 years old and children traveling alone with the driver are still seated in the front," which is the vulnerable position.

11) The highest number of fatal and nonfatal injuries in the young children group was in ages 4 – 7 years. Studies indicate that children 4 to 7 years of age are in the front seat 29% of the time and, "more disturbingly, that infants and toddlers were still being placed in the front seat 15% and 10% of the time, respectively."

12) Most injured children younger than 1 year of age were secured in a rear-facing CRS in the front seat. The airbag strikes the CRS and continues to expand, crushing the child's head between the CRS and the upright back of the passenger seat.

13) "For older children, braking before impact causes the child to shift forward placing him or her closer to the dashboard. When the airbag deploys, the face and frontal cranium receive the impact causing violent hyperextension of the cervical spine resulting in injury."

14) "Younger children are particularly vulnerable to injuries of the head and neck because their short stature places their head at the same level as the airbag, their flat occipital condyles allow for easier subluxation, and their immature cervical musculature reduces neck stability."

15) Airbags expand at speeds of up to 250 miles per hour.

16) Nearly all parents believe their children are properly restrained, but actually only 20% are.

17) Children younger than 13 years of age should ride in the back seat with an appropriate CRS, which affords the most protection for children of any age.

18) The safest position for all children is in the center of the back seat.

19) Airbags are designed to protect a 5-foot 11-inch man weighing 170 pounds.

20) "MVCs are the leading cause of death in children older than 1 year of age in the United States."

21) "In 2001, approximately 266,000 children were injured as passengers in MVCs."