

# Airbag Injuries in Infants and Children: A Case Report and Review of the Literature

**ABSTRACT.** Airbags have saved an estimated 2620 lives as of November 1997. However, airbags also have caused a number of injuries and deaths and have received a lot of publicity from the NHTSA and the media as a result. The majority of the injuries have occurred when seat belts and shoulder harnesses were not used properly in conjunction with airbags. This article describes an injury that apparently occurred despite use of an age-appropriate, state-of-the-art child protection seat. *Pediatrics* 1998;102(1). URL: <http://www.pediatrics.org/cgi/content/full/102/1/e2>; *airbag, injuries, NHTSA, infants, children.*

ABBREVIATIONS. NHTSA, National Highway Traffic Safety Administration; GCS, Glasgow Coma Score; CT, computed tomography; ICP, intracranial pressure.

## CASE PRESENTATION

A previously healthy 15.5-kg boy, age 3 years, 11 months, presented with facial abrasions and coma after a motor vehicle incident. The patient was belted in the front passenger seat in a forward-facing, five-point restraint car seat. The collision occurred at ~30 miles per hour when an oncoming car turned left in front of the car in which the patient was an occupant. Driver and passenger airbags were deployed. The patient was found at the scene to have facial abrasions and a decreased mental status. He was transported to the local hospital. Initial hospital assessment showed an isolated head injury, with a presenting Glasgow Coma Score (GCS) of 6. He was then transported to a tertiary care facility for additional evaluation and treatment.

Other passengers in the car included the patient's mother, who received a minor knee injury, and an infant sibling in a rear-facing car seat placed in the back seat, who was not injured.

The patient was noted to have a GCS of 5 and required bag-mask-valve ventilation during transport to the tertiary care facility. He was intubated and underwent computed tomography (CT). Results of head CT showed a nondisplaced right parietal skull fracture and several small areas of intracranial hemorrhage. CT scans of the face, cervical spine, abdomen, and pelvis were normal.

The patient was admitted to the pediatric intensive care unit, with the GCS remaining at 5 to 6. A neurosurgery specialist was consulted. When sedation was withheld, the patient was moving all extremities, with intermittent decorticate posturing. An intraparenchymal pressure monitor was placed, revealing an initial intracranial pressure (ICP) of 40 mm Hg. The patient underwent aggressive management for increased ICP, including osmotic diuresis, sedation, paralysis, and hyperventilation to  $P_{CO_2}$  30 torr to maintain an ICP of <20 torr. Inotropic support was initiated to maintain a cerebral perfusion pressure of >60 torr. Even with aggressive management, the patient continued to have an ICP value approaching the mid-60s. A ventriculostomy was placed and pentobarbital coma started, and dopamine and neosynephrine were used to optimize the cerebral perfusion pressure. A repeat head CT scan was obtained, which showed more edema,

small ventricles, and a small quadrigeminal cistern, with less well-defined gray/white interface in some areas.

## OUTCOME

The patient was weaned from pentobarbital on hospital day 10 and extubated on hospital day 14. Maximal recovery during hospitalization included random movements of all extremities, localization of pain, random vocalization, and eye-opening. He was transferred to a rehabilitation facility on hospital day 20, where he is currently undergoing therapy.

## DISCUSSION

On July 17, 1984, Federal Motor Vehicle Safety Standard §208 was amended to require that automatic occupant protection (airbags or automated belts) be phased into passenger cars during 1987 to 1990. It also stated that by the 1999 vehicle model year, all passenger cars and light trucks would be required to have both driver and passenger airbags. At the same time, the NHTSA began to encourage national seat belt use through education and state seat belt laws and their enforcement. Since that time, there has been an estimated increase in seat belt use from 11% in 1980 to 68% in 1995.<sup>1</sup>

There also has been an increase in the number of vehicles with driver and passenger airbags. An airbag deploys at 1/20th of a second after a frontal or near frontal impact generating forces equivalent to striking a brick wall, head-on, at 10 to 15 miles per hour. At 4/20th of a second after impact, the airbag deflates, with the entire cycle lasting <1 second.<sup>1</sup> The NHTSA estimates that nearly 2620 lives have been saved by the deployment of airbags,<sup>2</sup> but this has not come without cost.

From April 1993 to January 1997, the NHTSA has investigated eight serious injuries and nine deaths in infants and six serious injuries and 27 deaths in children as a result of being improperly restrained in the front passenger seat during a minor impact causing airbag deployment<sup>3</sup> (Table 1). There also have been three serious airbag-related injuries and 19 deaths in adults<sup>3</sup> that have been investigated by the NHTSA (Table 2). The tables show that isolated head injuries occur more frequently in the infant population compared with neck and torso injuries. This is not surprising because the infant is usually seated in a rear-facing car seat, which places the head nearest to the deploying airbag. Older children appear to receive cervical spine as well as head injuries, perhaps secondary to whiplash effect. Injuries in older children occurred when they were not restrained in such a way that preimpact braking brought their head near to the deploying airbag. Adults are sus-

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**TABLE 1.** Fatal and Serious Injuries in Infants and Children: Cases From Special Crash Investigation Team, NHTSA

Age in Years	Number	Injury Site <sup>a</sup>				Outcome
		Head	Cervical-Spine	Decapitation	Abdomen	
<1	17	17	—	—	—	9 Fatal
1–2	3	1	1	2	—	3 Fatal
3–4	13	11	5	—	1	8 Fatal
5–6	12	6	8	—	—	11 Fatal
>7	5	2	4	—	—	5 Fatal

<sup>a</sup> Discrepancies in numbers are because of multiple injuries.

**TABLE 2.** Fatal and Serious Injuries in Adults: Cases From Special Crash Investigation Team, NHTSA

Age in Years	Number	Injury Site <sup>a</sup>			Outcome
		Head/ Cervical-Spine	Torso <sup>b</sup>	Cardiac	
<20	1	1	—	—	1 Fatal
20–29	3	2	1	—	1 Fatal
30–39	4	2	1	1	4 Fatal
40–49	5	4	1	—	4 Fatal
50–59	2	1	2	—	2 Fatal
60–69	1	—	1	—	1 Fatal
70–79	6	2	5	1	6 Fatal

<sup>a</sup> Discrepancies in numbers are because of multiple injury sites.

<sup>b</sup> Torso indicates multiple bilateral rib fractures with abdominal and/or thoracic cavity injuries, including one placental abruption in a 29-year-old woman.

ceptible to head and neck injuries, and to a significant increase in torso injuries.<sup>4–6</sup>

The NHTSA has proposed the following airbag modifications in response to the increase in infant and child morbidity and mortality from airbags: 1) deactivating passenger airbags, 2) manual cut-off switches, 3) decreased-velocity airbag inflation, and 4) the eventual use of smart airbags that deploy at varying speeds in response to the forces generated by the impact. These proposals primarily affect manufacturers and dealers; thus, until they are in place, public education is paramount in preventing airbag tragedies.

Used appropriately, airbags are safe and effective in preventing injuries in accidents. As primary health care providers, we should increase our efforts to educate our patients and families regarding airbag safety by having literature available and discussing the following points with families in detail. Current recommendations from the NHTSA are:

1. Infants in rear-facing car seats should always be in the back seat.
2. Children younger than 12 years should always ride in the back seat with the appropriate restraint.
3. Drivers and adult passengers should always wear lap and shoulder belts.
4. Occupants should maintain 10 inches of space between themselves and the center of the air bag.

More information on airbag safety and recommendations about child safety seats can be obtained from local and state police, and from the NHTSA.

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