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The Trouble with Air Bags

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In the most recent proceedings of the Association for the Advancement of Automotive Medicine (AAAM), Dalmotas and colleagues reported on the alarming number of nonfatal injuries incurred by occupants of vehicles equipped with air bags -- the so called supplemental restraint systems.¹

As most readers know, air bags are designed to be used in conjunction with the seat belt and shoulder harness; not as a substitute for buckling up. I have discussed these systems in previous articles, pointing out that in a contest of survivability restraint systems provide more safety by themselves than do air bags by themselves; that as emissaries of public safety, doctors should remind their patients of this fact.

Meanwhile, we have all heard of the tragic child and infant deaths occurring in passenger side air bag-equipped vehicles. These episodes have brought serious concerns about air bag safety to the attention of American lawmakers. Many of these child and infant deaths could have been prevented had child and infant carrier car seats been placed in the rear seat as they were designed to be, and had the older children sitting in front passenger seats been wearing their belts and shoulder harnesses properly.

Others who are at special risk of air bag injury are drivers of very short stature. Because they sit so close to the air bag module, they may be struck with the harder plastic module cover as the air bag deploys. The air bag deploys at speeds of 165-210 mph. It may strike the driver and drive the head up and back into extension, sometimes with tragic results. There are several dozen cases on record now where short women were killed by such injuries in slow collisions (e.g., under 20 mph impacts).

By far the largest group of air bag injuries are of the nonfatal variety: from degloving injuries or amputations of the fingers, and minor facial injuries, to the more severe upper extremity (and, in the cases of the passenger side systems, lower extremity) multiple fractures. These latter injuries usually result from having the hand (or feet) directly over the air bag module cover as it deploys. In many cases drivers and passengers were in the process of straight-arming the module cover for self-protection.

As pointed out by Dalmotas and colleagues, these sometimes disabling and very serious injuries are much more common than the type that are more newsworthy, and are beginning to raise serious concerns about the overall usefulness of air bag systems as they exist in their present state of technology. Many of the reported injuries have occurred at relatively low speeds where injuries would not have likely occurred had restraint belts alone been used. In fact, 73% of these injuries occurred in velocity change ranges of under 15.5 mph.

Fortunately, TRW and several other companies have been working on improved air bag systems for several years and prototypes are already being tested. Sensors will first identify whether an adult passenger or child resides in the passenger front seat. For child car seats or in cases of no occupant, the sensor will disable the passenger side air bag. For drivers, the sensors will determine the proximity to the air bag module cover and tune or modulate the air bag deployment speed. For taller drivers seated farther back, the air bag will deploy at optimal full speed. In some designs, sensors in the seat will weigh the occupant. In others, IR or ultrasound sensors will also measure the seated height and position of the occupant so that, for example, if the occupant were bent forward, the air bag deployment would be instantaneously modulated should deployment occur at that moment.

Finally, as our technology improves, the array of sensors arranged in the front of the vehicle that actually trigger the air bag deployment will become more sophisticated. A central on-board computer, using a series of algorithms, will consider several parameters before air bag deployment and modulation: the speed of the collision (this will probably be gauged by another new system -- the intelligent vehicle highway system), the amount and speed of crush, the presence, size, height, and position of occupants, and whether they are wearing their restraint belts.

These systems are not far off on the technological horizon, nor pie in the sky, Buck Rogers science fiction. All have already been tested. Manufacturers, on the other hand, may be hesitant to employ any systems that increase the production costs of their cars unless they are mandated by federal safety regulations. Quick fixes are liable to appear in the meantime, such as manual disabling switches so that parents can disable passenger side air bag systems.

Reference

1. Dalmotas DJ, Hurly RM, German A. Supplemental restraint systems: Friend or foe to belted occupants. 40th Annual Proceedings of the Association for the Advancement of Automotive Medicine, Oct 7-9, 1996, Vancouver, BC.

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