Air Bags, Seat Belts Cut Hospital Costs, ICU Days

BY JEFF EVANS
Senior Writer

HOT SPRINGS, VA. — Greater use of air bag restraints in motor vehicle accidents may not only save lives and reduce the rates of most injuries and infectious complications, but also save trauma centers millions of dollars, according to a review of patients treated at a trauma center over an 11-year period.

Air bags were found to reduce injuries to all parts of the body except the extremities. If all unrestrained patients admitted to the trauma center had used seat belts and air bags, more than $14 million would have been saved in costs of treating infections, as well as almost $50 million in ICU stays.

Since the National Highway Transportation and Safety Administration mandated airbags for the front driver's side in 1989 and the front passenger side in 1998, "there has been a fair amount of controversy that's developed about their safety," Dr. Timothy C. Fabian reported at the annual meeting of the Southern Surgical Association.

While most studies of motor vehicle accidents at the scene of the accident have found significantly lower odds of death with the use of seat belts alone or seat belts combined with air bags, some studies have shown only very modest or no benefit from air bags alone.

"All these studies are basically analyses of accidents at the scene. What we chose to do was look at patients admitted to a level I trauma center to see outcomes on those individuals," said Dr. Fabian, chairman of the surgery department at the University of Tennessee Health Science Center, Memphis.

"It's sort of closing the loop to some degree … compared to previous studies," said Dr. Fabian, who also is one of the founders of the Elvis Presley Memorial Trauma Center at the Regional Medical Center at Memphis.

In a study of 14,390 victims of motor vehicle accidents who were taken to the Presley Memorial Trauma Center during 1996-2006, investigators divided the patients into those who were unrestrained (7,881), used an air bag alone (692), used a seat belt alone (4,909), or used both seat belt and air bag (908).

Compared with unrestrained patients, injuries to several body regions (brain, face, cervical spine, and chest), but not the extremities, significantly decreased with the use of an air bag alone, a seat belt alone, or a seat belt and air bag combined. Injuries to the extremities significantly increased with the use of an air bag alone or in conjunction with a seat belt, but not with a seat belt alone. Abdominal injuries declined significantly only with use of an air bag alone or in combination with a seat belt.

Hospital mortality, as well as number of days in the ICU and hospital, declined significantly as the level of restraint increased.

The age of drivers and the percentage of drivers who were female increased with the level of protective restraints that were used, but the investigators adjusted all their analyses for these variables as well as the year of injury.

The percentages of patients who developed ventilator-associated pneumonia and bacteremia followed the same pattern as injuries and mortality, with significantly lower rates as the level of protection increased.

By using data from an analysis of the economic impact of infection control, Dr. Fabian and his associates determined that hospital costs increased by about $10,000 for each episode of ventilator-associated pneumonia and about $34,000 for each episode of bacteremia (Am. J. Infect. Control 2005;33:542-7). When these costs were indexed to 100 motor vehicle accident patients, the costs of providing care to unrestrained patients rose by nearly $300,000. The use of air bags and seat belts alone or in combination substantially decreased that amount.

Patients who used both seat belts and air bags were estimated to save about $60,000 in the cost of ICU stays, which were valued at about $35,000 per day.

During the 11-year study period, if all 7,881 unrestrained patients had used seat belts and air bags, the trauma center would have saved more than $14 million in infectious morbidity costs and about $47 million in ICU stays, according to Dr. Fabian and his colleagues.

Other studies have shown that air bags decrease deaths at the scene of an accident, which "probably does mean we have more patients coming to the trauma center," said Dr. Regan F. Williams, one of Dr. Fabian's coinvestigators. "What we chose to really concentrate on [in this study] is once the patients got to the trauma center. So this in no way is supposed to be a population-based study." ■

High Cytokine Level After Torso Trauma Linked to Organ Failure

BY BRUCE JANCIN
Denver Bureau

COLORADO SPRINGS — A pattern of dramatically elevated serum cytokine levels within the first 6 hours following major torso trauma appears to identify patients at increased risk for subsequent multiple organ failure more effectively than do the Injury Severity Score and other traditional predictors, Dr. David W. Mercer said at the annual meeting of the Western Surgical Association.

High cytokine values in the first 6 hours after torso trauma were more predictive than the Injury Severity Score.

DR. MERCER

These early changes in cytokine production not only mark a high-risk patient subset, but may also point the way to novel therapies aimed at preventing multiple organ failure (MOF), the leading cause of death among acutely injured patients in the ICU, added Dr. Mercer, professor and vice chairman of the department of surgery and chief of general surgery, trauma, and critical care at the University of Texas, Houston.

He presented a prospective, observational study of 48 patients with major torso trauma who underwent a standardized shock resuscitation protocol with measurement of numerous serum cytokines via multiplex suspension immunoassay every 4 hours for the first 24 hours after beginning resuscitation.

In all, 11 patients developed MOF, of whom 7 died. In contrast, death occurred in only 1 of 37 patients without MOF. That's an in-hospital mortality of 64% in the MOF group and less than 3% in the non-MOF group. In addition, the MOF group had an average of 3.5 ICU-free days, compared with 17.8 days for non-MOF patients.

None of the traditional predictors of MOF—Injury Severity Score, age, admission hemoglobin, base deficit, and international normalized ratio—differed significantly between patients who subsequently developed MOF and those who didn't.

However, levels of both inflammatory and anti-inflammatory cytokines were markedly elevated in the MOF group within 6 hours after trauma. Among them were the inflammatory cytokines interleukin-6 and IL-8, tumor necrosis factor–α, and interferon-γ, as well as the anti-inflammatory cytokines IL-10 and IL-1-receptor antagonist. Also elevated in the MOF group were several nontraditional cytokines: eotaxin, a chemotactic agent for eosinophils; granulocyte colony-stimulating factor; and granulocyte-macrophage colony-stimulating factor.

For years, Dr. Mercer has studied the hypothesis that shock-induced gut inflammation and the resultant derangement of the gut's normal barrier and immune defense mechanisms play a major role in the pathogenesis of MOF. Recently, he has shown that ketamine, an anesthetic with anti-inflammatory actions, inhibits lipopolysaccharide-induced gastric dysfunction and prevents endotoxic shock from progressing to MOF (Eur. Surg. Res. 2007;40:184-9).

Dr. Mercer added that the case for routinely measuring early cytokine levels in the ICU would become much stronger should future work show that therapies aimed at reversing the cytokine elevations actually prevent MOF. ■

Age, Shock Index Combine to Predict Trauma Mortality

BY ROBERT FINN
San Francisco Bureau

HUNTINGTON BEACH, CALIF. — In patients older than 55 years, multiplying a patient's age by the Shock Index—a ratio of heart rate to systolic blood pressure—provides a better predictor of 48-hour mortality than using the Shock Index alone, Dr. Ben L. Zarzaur said at the Academic Surgical Congress.

The Shock Index has long been known to provide a better predictive rule of thumb than heart rate or blood pressure alone, Dr. Zarzaur said. Better still are several measures such as the Injury Severity Score, the Revised Trauma Score, and the Trauma Injury Severity Score—but they use relatively complex equations and can be difficult to calculate in the resuscitation room.

In contrast, the Shock Index (SI) is simple to calculate but does not take into account the effect of patient age.

Dr. Zarzaur of the Presley Memorial Trauma Center at the University of Tennessee, Memphis, and his colleagues conducted a retrospective cohort study involving 16,077 patients, aged 18-81 years, who were admitted to the trauma center between 1996 and 2005. All were victims of blunt trauma, and all arrived with a palpable pulse of at least 10 beats per minute and a systolic blood pressure of at least 30 mm Hg.

The investigators excluded victims of neurotrauma, those who were admitted more than 24 hours after the injury, and those whose records lacked data on pulse rate and blood pressure.

They divided the patients into two groups: those who were 55 years old or younger and those older than 55 years. The mean age of the younger patients was 34 years and that of the older patients was 67 years.

The primary outcome measure was death within 48 hours, and the investigators used the need for a blood transfusion during that time period as a secondary outcome. They analyzed the area under the receiver operating curve (ROC), a statistical method that quantifies the balance between sensitivity and specificity, to determine which measures were best.

Among the younger patients, SI alone had a significantly larger ROC area than did pulse rate, systolic blood pressure, or age multiplied by SI. An SI score greater than 0.8 successfully predicted significant early mortality and transfusion in this age group.

In the older patients, on the other hand, age multiplied by SI had a larger ROC area than did the other measures. When age was multiplied by SI, a resulting product that was 50 or greater successfully predicted significant early mortality and transfusion in the older patients.

Dr. Zarzaur declared that he had no financial conflicts related to the study. ■