



## **Air Bag--Induced Injuries: From the Malignant to the Benign Air Bags: Life Savers, or Full of Hot Air?**

Although the air bag was designed as a supplemental restraint system, the technology has resulted in hundreds of serious and fatal injuries. The emergency physician must be aware that this lifesaving device also has the potential to induce devastating injuries. The lecturer will discuss the forces associated with deployment, review injury patterns, and discuss implications for patient care.

- Describe mechanisms by which air bag--induced injuries occur in adult and pediatric patients.
- Identify risk factors associated with air bag--induced injuries and deaths.
- Describe protective measures against air bag--induced injuries.
- Identify injury patterns associated with air bag deployment.

WE-133  
Wednesday, October 13, 1999  
9:00 AM - 9:55 AM  
Room # N236  
Las Vegas Convention Center

### **FACULTY**

William S Smock, MD, FACEP

Assistant Professor and Director,  
Clinical Forensic Medicine Training  
Program, Department of Emergency  
Medicine, University of Louisville  
School of Medicine, Louisville,  
Kentucky

***Air Bag Induced Injuries:***  
*From the malignant to the benign*

William S. Smock, M.D., M.S.  
Department of Emergency Medicine  
University of Louisville School of Medicine  
Louisville, Kentucky 40292  
502-852-5689  
bsmock@pol.net

---

---

---

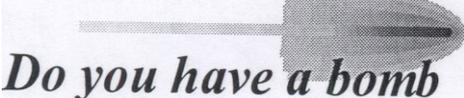
---

---

---

---

---



***Do you have a bomb***  
***in your car?***

---

---

---

---

---

---

---

---



***NHTSA estimates that***  
***over 4400 lives have***  
***been saved by air***  
***bags.***

---

---

---

---

---

---

---

---



*Air Bags Can Be  
Very Dangerous To  
Your Health*

---

---

---

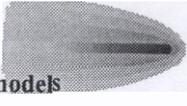
---

---

---

---

*History of Air Bag Induced  
Injuries*

- 
- 1970's Deaths in animal **models**
  - **1970's** Warnings from engineers
  - 1980's "nearly 100% risk for severe injury"
  - 1990 First occupant death
  - 1990's Increasing number **of driver** and passenger deaths

---

---

---

---

---

---

---



*When were the automobile  
manufacturers aware that  
injury and death were likely to  
the near position occupant?*

---

---

---

---

---

---

---

## 19 72 Ford Warning

- “The right front seat should **be used only** by persons who **are more** than **five** feet tall and are in sound health. Small persons and those who **are** aged or **infirm** should be seated in the rear seat.”

---

---

---

---

---

---

---

---

## Injuries in the animal model

- 48.8 kg swine with sternum against air bag module
  - 17 rib fractures
  - 2 cardiac perforations
  - Splenic laceration
  - Liver hematoma
  - Death within 30 minutes
- SAE 902324

---

---

---

---

---

---

---

---

“ many of the exposures ~~were~~ at loading severities beyond the level representing an estimate of nearly 100% risk of severe injury.”

– SAE 902324

---

---

---

---

---

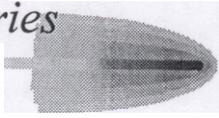
---

---

---

## Range of Injuries

- Superficial abrasions
- Corneal abrasions
- Retinal detachments
- Forearm fractures
- Finger/Hand amputation
- C-spine fractures
- Lacerated liver/spleen
- Cardiac rupture
- DAI/SDH
- Decapitation



---

---

---

---

---

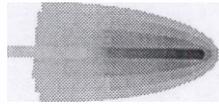
---

---

---

144 “confirmed” and 40  
“unconfirmed” deaths by  
deploying air bags.

- NHTSA 8/99



---

---

---

---

---

---

---

---

## 88 Passenger Deaths

- 82 children (27 restrained by lap/shoulder or child seat)
  - 6 adults (2 restrained by lap/shoulder)
- NHTSA 8/99



---

---

---

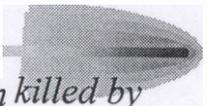
---

---

---

---

---



*62 adults have been killed by  
deploying air bags in low and  
moderate speed collisions.*

NHTSA 8/99

---

---

---

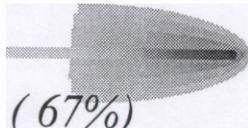
---

---

---

---

---



*36 of the 54 (67%)  
drivers were killed were  
5 '4" or shorter*

---

---

---

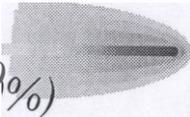
---

---

---

---

---



*15 of the 19 (79%)  
restrained drivers killed  
were 5 '4" or shorter*

---

---

---

---

---

---

---

---

*Is the vertically  
challenged driver at  
risk?*



---

---

---

---

---

---

---

*Two Sources of Injuries:*

- Air Bag
  - “Punch out”
  - “Membrane Forces”
- Module Cover



---

---

---

---

---

---

---

*Deployment Speed*

- Up to 210 mph



---

---

---

---

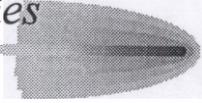
---

---

---

## *Forearm Injuries*

- Finger amputation
- Finger fractures
- Hand fractures
- Forearm fractures
- Forearm **amputations**
- **Humeral** fractures



---

---

---

---

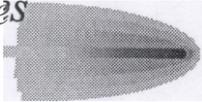
---

---

---

## *Occular Injuries*

- **Corneal** abrasions
- Chemical burn/irritation
- Retinal detachment
- Globe rupture



---

---

---

---

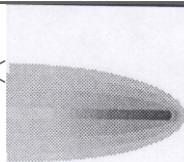
---

---

---

## *Cranial Injuries*

- Skull fractures
- **Subdural hematomas**
- **DAI**
- Decapitation



---

---

---

---

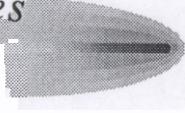
---

---

---

## *Cervical Injuries*

- Fractures (upper)
- Dislocation (upper)



---

---

---

---

---

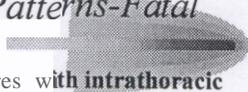
---

---

---

## *Driver Injury Patterns-Fatal*

- Multiple rib fractures with **intrathoracic** and **intraabdominal** injuries
- Traumatic brain with skull and cervical spine fractures
- Cardiac injury without rib fractures



---

---

---

---

---

---

---

---

*All pediatric patients  
died from cranial and  
cervical trauma.*



---

---

---

---

---

---

---

---

*2 decapitations*

- **2 year old** on lap of passenger in **95 Geo Metro**
- **1 year** old in forward facing child seat in **95 VW Jetta**



---

---

---

---

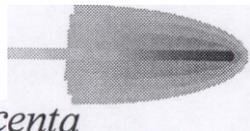
---

---

---

---

*1 case of placenta  
abruption in unrestrained  
29 yo driver of 1992 Ford  
Taurus*



---

---

---

---

---

---

---

---

*Case Studies:*



---

---

---

---

---

---

---

---

*1991 Ford Taurus*

- 35 yo restrained **female driver**
- **5'2"** and 110 pounds
- Seat full forward

---

---

---

---

---

---

---

---

*Driver 's Injuries:*

- Subdural **hematomas**
- Cortical contusions
- Cerebral edema with midline shift
- Bilateral **corneal** abrasions
- Massive facial edema with abrasions and contusions
- Bilateral breast contusions

---

---

---

---

---

---

---

---

*1995 Geo Metro*

- 4 year old male
- Front seat passenger
- Lap belt restrained

---

---

---

---

---

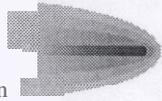
---

---

---

*Injuries:*

- **Atlanto-occipital** dislocation
- Brainstem transection
- Subdural hemorrhage
- Multiple rib fractures
- Liver laceration
- **Splenic** laceration
- Clavicle fracture



---

---

---

---

---

---

---

*1996 Toyota Camary*

- **4 year old male**
- **Front seat passenger**
- **Lap belt restrained**



---

---

---

---

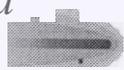
---

---

---

*1995 Nissan Altima*

- **35 year old female**
- **Front seat passenger**
- **Lap/shoulder restrained**



---

---

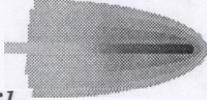
---

---

---

---

---



*Did the automobile  
manufactures adequately warn  
the public of the risks  
associated with air bag  
deployment?*

---

---

---

---

---

---

---



*Who should  
disconnect their  
air bag?*

---

---

---

---

---

---

---



*How close is  
too close?*

---

---

---

---

---

---

---



*What is the Risk-Benefit ratio?*

---

---

---

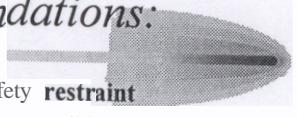
---

---

---

---

---



*Recommendations:*

- Always wear safety **restraint**
- Sit back as far as possible
- **NEVER place** hand, **arms** on or near air bag **cover**
- Tilt steering wheel toward chest
- **Recline seat back**
- **Pedal extenders**

---

---

---

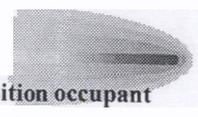
---

---

---

---

---



*Remedies ?*

- Sensor to detect near **position occupant**
- Increase threshold for **deployment**
- Cutoff switch
- Decreased inflation forces
- **Education and warnings**
- **Redesign of horn button**

---

---

---

---

---

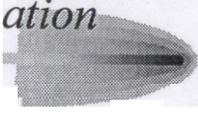
---

---

---

*NHTSA Information*

- [www.nhtsa.dot.gov](http://www.nhtsa.dot.gov)
- Auto Safety Hotline 800-424-9393



---

---

---

---

---

---

---

*Questions?*



---

---

---

---

---

---

---