Seat Belt Injuries
Nicole VanDerHeyden, MD, PhD
The Headlines

“Man nearly cut in half by seat belt”

“Women dies from strangling by seat belt”

“Seat belt most likely cause of paralysis in child”

“Young girl killed by seat belt”

“Man trapped in burning car by seat belt”
The Facts

Unrestrained drivers are **6.6X** more likely to die and **24X** more likely to suffer serious injuries than restrained drivers.

Unrestrained passengers are **3.3X** (back seat) to **5.1X** (front seat) more likely to die and also more likely to suffer serious injuries.

Injury patterns differ for unrestrained and restrained drivers and passengers.

Injury and death increases disproportionately with speed in unrestrained victims.

Injury and death increases disproportionately with age in unrestrained victims.
Restrained versus unrestrained Seat belt usage ~ 60%
Motor Vehicle Collisions are the leading cause of death in Americans ages 4 – 34.

60 – 70% of deaths involve unrestrained or improperly restrained occupants
### Top 10 Leading Causes of Death in the United States for 2004, by Age Group

**National Highway Traffic Safety Administration's National Center for Statistics and Analysis**

<table>
<thead>
<tr>
<th>Rank</th>
<th>Category</th>
<th>Deaths</th>
<th>Cause</th>
<th>Number of Deaths</th>
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<tr>
<td>1</td>
<td>Perinatal Period</td>
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<td>Malignant Neoplasms</td>
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<td>3</td>
<td>Heart Disease</td>
<td>421</td>
<td>Suicide</td>
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<td>Homicide</td>
<td>325</td>
<td>Accidental Poisoning</td>
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<td>5</td>
<td>Influenza, Pneumonia</td>
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<td>Heart Disease</td>
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<td>Septicemia</td>
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<td>Nephritis, Nephrosis</td>
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<td>Heart Disease</td>
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<td>8</td>
<td>MV Traffic Crashes</td>
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<td>Heart Disease</td>
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<td>Stroke</td>
<td>127</td>
<td>Heart Disease</td>
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<tr>
<td>10</td>
<td>Malignant Neoplasms</td>
<td>74</td>
<td>Heart Disease</td>
<td>2,167</td>
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</tbody>
</table>

**Note:**
- MV Traffic Crashes: Motor vehicle traffic crashes.
- Nontraffic Crashes: Nontraffic crashes.
- Exposure to Smoke/Fire: Exposure to smoke or fire.
- Chronic Lwtr Resp Dis.: Chronic lower respiratory disease.
- Heart Disease: Heart disease.
- Septicemia: Septicemia.
- Nephritis, Nephrosis: Nephritis or nephrosis.
- All Causes: All causes.

**Source:**
- National Center for Health Statistics (NCHS), CDC, Mortality Data 2004.
- Note: Causes of death are based on the National Center for Health Statistics (NCHS) Revised Classification of Causes of Death. The ranking differs from the one used by the NCHS for its reports on leading causes of death by expanding cut unintentional injuries into separate causes of death, such as motor vehicle traffic crashes, accidental falls, motor vehicle nontraffic crashes, etc. Accordingly, the rank of some causes of death will differ from those reported by the NCHS. This difference will mostly be observed for minor causes of death in older age groups.
Seatbelt History

- **1956** Ford introduced “safety package”
  - included lap belts for all occupants
- **1964** Lap belts standard equipment
- **1967** Volvo demonstrated effectiveness of 3-point restraint system
  - No deaths at speeds < 60 mph vs. 12 mph with only lap belts.
- **1973** 3-point seat belt becomes the industry standard.
Child Restraints

- **1933** First child car seats “convenience not safety”
- **1968** Dangers of “adult” seat belts recognized.
- **1972** First mandated child car seats

- **1995** Child booster seat requirements introduced.
- **1998** Air-bag legislation restricts infants and children from front seats.
Comparison of a 4 1/2 - 5 1/2 yr old 50th percentile Girl & Boy Anthropometry to the 5th percentile Female & 50th Percentile Male Adult

Lap Belt Submarining Sequence

The shoulder belt should go over the shoulder and across the middle of your child’s chest. It should not touch the neck.

The lap belt should fit low over the hip bones, under your child’s belly area.

Your child’s knees should bend comfortably over the edge of the vehicle seat.
Air Bag Safety:

Buckle everyone

Children sit in back

0 – 9 Kg

9 - 22 Kg

< 4’9”
Seatbelts and pregnancy

Injuries sustained in a motor vehicle collision are the leading cause of maternal death and a major cause of late term fetal death.
According to the National Highway and Traffic Safety Administration (NHTSA), over the past 10 years, safety belts have prevented some 55,600 deaths; 1,300,000 injuries and saved more than $105 billion in costs.

90% of those living in the West buckle up vs. 85% in the rest of the country

90% of teenage girls and 83% of teenage boys buckle up.
Seatbelts Prevent Ejection or Injury to Other Occupants of Car

79% of ejected victims die or suffer serious injuries.

An unrestrained back seat occupant increases the risk of a fatal injury to the driver by 18%.

"By the way...what is the minimum stopping distance at 60 MPH?"
3 pt Seatbelts Prevent Head Injuries

Facial lacerations and fractures

Skull fractures

Intracranial bleeding

Epidural  Intraparenchymal  Subdural
3 pt seatbelts prevent solid organ injuries

High grade liver and spleen lacerations occur less frequently with decreased amount of intra-abdominal hemorrhage.
Lap belts alone are not adequate and increase certain types of injuries.

Spine fractures due to hyperflexion

Bowel injuries due to compression of bowel between abdominal wall and spine with blowout.
Seat Belt Syndrome

Skin abrasions and ecchymosis of the neck, chest and abdomen on presentation indicate internal injury in 30% of patients.

- Neck injuries
- Chest injuries
- Abdominal injuries
- Thoracolumbar spine injuries
Seat Belt Syndrome

- Neck abrasions
  - Carotid artery
  - Vertebral artery
  - Larynx
  - Cervical spine
Seat Belt Syndrome

• Chest injuries
  – 1st rib fracture
  – Clavicle fracture
  – Aortic injuries
  – Heart injuries
Seat Belt Syndrome

- Abdominal injuries
  - Bowel injuries
  - Abdominal Wall Hernias
Seat Belt Syndrome

- Abdominal injuries cont
  - Diaphragm injuries
Seat Belt Syndrome

- Abdominal injuries cont
  - Abdominal Wall Hernias
Seat Belt Syndrome

• Abdominal injuries cont
  – Delayed or missed injuries
  – Ischemic colon w/stricture
  – Mesenteric tears w/internal hernia
Seat Belt Syndrome

- Spinal injuries
  - Chance fractures
    - anterior compression
    - posterior distraction

Crash type: Frontal impact

17-year old high school student sustained severe abdominal injuries and fracture of the lumbar spine while wearing a lap belt in the center rear position in this 1991 Ford Escort.
Diagnosis of Seat Belt Related injuries

- High index of suspicion
- Neck
  - CT and CTA C-spine
- Chest
  - CXR and CT chest
- Abdomen
  - FAST? vs CT abdomen
- Spine
  - CT abdomen with reconstructions
CT vs FAST exam

- FAST can only detect >250 ml free fluid
- FAST cannot detect most bowel injuries
Unrestrained injury pattern

• Head, face and neck
  – Skull fractures, intracranial hemorrhages
  – Facial fractures and lacerations
  – Neck fractures

• Chest
  – Rib fracture, hemopneumothorax

• Abdomen
  – Solid organ (liver and spleen)

• Spine and extremity
  – Multiple fractures
Lap belt only injury pattern

- Head, face and neck
  - Skull fractures, intracranial hemorrhages
  - Facial fractures and lacerations
  - Neck fractures
- Chest
  - Rib fractures
- Abdomen
  - Hollow viscous injury
- Spine and extremity
  - Thoracolumbar fractures
3 point Restraint Injury Pattern

• Head, face and neck
  – Minimal injuries, forehead laceration
  – Whiplash

• Chest
  – Rib fracture,
  – Aortic injuries

• Abdomen
  – Hollow viscous injury
  – Diaphragm rupture
  – Abdominal wall hernia

• Spine and extremity
  – Minimal injuries
“If you can’t be perfect, at least survive your mistakes”.
Doctors can fix broken bones and guts, not broken brains. Irreversible brain damage is just that — irreversible.

It just looked so uncool to wear a seat belt in the Batmobile."
Case #1

• 6 year old male, lap belt only, rear seat
• Patient’s car was T-boned at intersection
• Patient was hypotensive, unresponsive at scene. Seat belt sign noted.
• Patient transported to Salem hospital, fast exam was positive for free fluid.
• Patient taken immediately to the OR where he was found to have a laceration of a large mesenteric vein with 1 liter of blood in abdomen.
• No spine injuries on subsequent imaging.
• Recovered and discharged to home in 3 days.
Case #2

- 21 yr old female
- Head on MVC 40 mph, restrained, prolonged extrication Full Trauma Activation
- Hypotensive
- SOB, chest pain
- Seat belt sign
- RLE pain w/open fracture at ankle
- Chest tube
Pneumothorax on Left

Chest tube
Aortic transection
Case #2 continued.

- CT revealed complex aortic arch intimal tear without mediastinal hematoma involving origin of L, grade II liver lac with free intraperitoneal blood
- Open distal tibia/fibula fractures
- Required transfer to Portland for complex open repair of her aorta but did well and was discharged to home.
- **No** head injuries or facial lacerations
Case #3

- 24 yr old male, restrained back seat passenger
- High-speed MVC into tree.
- Four victims, driver was intoxicated
- Hypotensive, SOB, chest pain, abdominal pain

  - Seat belt sign
  - Obvious bulge left flank
  - Full thickness skin necrosis
- Disrupted spine lig.
- Avascular L kidney
- Free fluid in abdomen
- Full thickness abdominal wall hernia
- Diaphragmatic hernia
Case #3 continued

• OR revealed
  – Completely disrupted left abdominal wall
  – Diaphragmatic hernia
  – Avascular kidney and spleen
  – Perforated colon
    (w/ rib fragment)
  – Devascularized ileum
  – Perforated jejunum

Damage control surgery
Stapled bowel
Packed abdominal wall