Preliminary Analysis of Shoulder Traumas from the CIREN Database

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CIREN Database Query

- CIREN database query
  - All vehicles MY 2000 or newer
  - Left or right side impact as highest ranked CDC
  - Cases with DV and/or BES estimate
  - No rollover event
  - Belted ‘nearside’ row one occupants
    - Drivers, RF passengers
  - Associated injuries
Case Summaries

- Injury codes not differentiated by AIS version
- Shoulder injuries include injuries to the shaft of the humerus:
  - The AIS 1998 coding scheme does not distinguish injuries to the proximal humerus
- Pelvis differentiated from LE injuries two ways:
  - By filter for any 1998/2005 code that meets the Bio-tab definition of hip or pelvis
  - By review of radiology data for the 61 cases with shoulder injury
  - No corrections for injuries noted as not coded or miscoded were made
  - 439 pelvis/hip injuries were coded to the AIS 1998 standard
  - 35 pelvis/hip injuries were coded to the AIS 2005 standard
Query Results: 334 Occupants in Nearside Impacts

Object Struck

- 279, 84% - Vehicle to Vehicle & Other
- 55, 16% - Pole
Query Results: 334 Occupants in Nearside Impacts

Shoulder Injury vs. No Shoulder Injury

- Shoulder Injury: 61 (18%)
- No Shoulder Injury: 273 (82%)

Shoulder Injury

No Shoulder Injury
Query Results: 61 Occupants with Shoulder Injury

Object Struck

- 54, 89% Vehicle to Vehicle & Other
- 7, 11% Pole
Query Results: 273 Occupants without Shoulder Injury

Object Struck

- 225, 82% Vehicle to Vehicle & Other
- 48, 18% Pole
Vehicle Type, With and Without Shoulder Injury

- **With Shoulder Injury:**
  - **Passenger Cars:** 87%
  - **SUVs/Pickups/Vans:** 13%

- **Without Shoulder Injury:**
  - **Passenger Cars:** 78%
  - **SUVs/Pickups/Vans:** 22%
Delta-V Range, With and Without Shoulder Injury

Mean Delta-V With Shoulder Injury: 39 km/h
Mean Delta-V Without Shoulder Injury: 34 km/h
Occupants w/o Shoulder Injury: MAIS2+ Injuries, by Body Region*

- Head/Face: 140
- Neck/Spine: 78
- UpEx: 23
- Chest: 167
- Abdomen: 104
- Pelvis: 160
- LoEx: 58

N = 273

*Pelvis Injuries Include Proximal Femur FX
Occupants With and Without Shoulder Injury: AIS2 Injuries by Body Region*

With Shoulder Injury N = 61
Without Shoulder Injury N = 273

*Pelvis Injuries Include Proximal Femur FX
61 CIREN Cases w/ Shoulder Injury

- Occupants in passenger cars sustain the great majority of shoulder injuries
- 30 (49%) of impacts involved a collision partner of a larger size
- 7 (11.5%) of impacts involved a tree/pole
- 8 (13%) of impacts were oblique impacts/partial ejection
61 CIREN Cases: Impact Types

- 43 Drivers with shoulder injury
  - LY SOI and other = 8
  - Pole = 4
  - Mismatch between body size class = 21
  - Equivalent body size class = 10
  - Barrier = 1

- 18 Passengers with shoulder injury
  - Pole = 3
  - Mismatch between body size class = 9
  - Equivalent body size class = 5
  - Barrier = 1
43 Drivers with Shoulder Injury: MAIS to Each Body Region*

*Pelvis Injuries Include Proximal Femur FX
18 Passengers with Shoulder Injury: MAIS to Each Body Region*

*Pelvis Injuries Include Proximal Femur FX
Drivers with MAIS2+ Injuries*

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N = 43

*Pelvis Injuries Include Proximal Femur FX
Passengers with MAIS2+ Injuries*

N = 18

*Pelvis Injuries Include Proximal Femur FX
PC vs. Tree  Driver Passenger and Composite
N= 7

Driver = 4
Passenger = 3
Composite = 7
PC vs. Heavy-Medium Truck/Bus/Semi Drivers

N = 7

- Head/face
- Neck/spine
- UE
- Thorax
- Abdomen
- Pelvis/LE

L4 & L5 TP FX
L3-Sp SP FX

Driver
PC vs. PC Driver, Passenger and Composite

N = 12

Driver = 7
Right-front Passenger = 5
Composite = 12
PC vs. Tree w/ & w/o Shoulder Injury

w/ SI Composite: N = 7

w/o SI Driver: N = 15
Conclusion

- Shoulder may act as a load path:
  - somewhat protects the thorax
  - exposes the abdomen
- Collision partner aggressiveness more relevant than object struck
- More SUV/Pickups/Vans without shoulder injuries (13% versus 22%)
- More passenger cars with shoulder injuries (87% versus 78%)
- CIREN does not provide adequate basis to evaluate SAB/curtains
- Research is needed to gauge relation between height of belt-line w.r.t. occupant shoulder position
- Pelvic injury analyses different in AIS 1998 and 2005
- Dummy measurement implications – shoulder, abdomen, and pelvis