OBLIQUE CRASHES IN CIREN

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Objective

- **Review newer oblique cases from CIREN**
- **Update prior field analysis on oblique crashes**
  - **Newer Case review**
    - Crash Injury Research and Engineering Network (CIREN) cases
    - Revised criteria
      - Vehicles **must** have available AB at the driver position
        - Available steering wheel, roof rail and seat back ABs required
      - Right oblique (far side cases included)
      - AIS 2+
  - **Original NHTSA analysis with optimal restraint availability**
    - Original criteria (Rudd et al. 2011)
      - Belt restrained driver, AIS 3+ head, chest, KTH (2+ lower leg/ankle reviewed)
      - Frontal crash taxonomy used (Halloway 2011)
      - Over / underride excluded

NHTSA Oblique Crash Research

New case output

- 85 CIREN cases
  - Driver only
  - Left or right offset
  - 3 ABs available
  - AIS2+
- 68 cases (44 - left / 24 - right)
  - After override / underride filter applied
- 32 cases (Rudd 2011 criteria for LO)
  - 20 left offset / 12 right offset
    - Head AIS3+
    - Chest AIS3+
    - KTH 3+
      - Lower leg/foot/ankle 2+

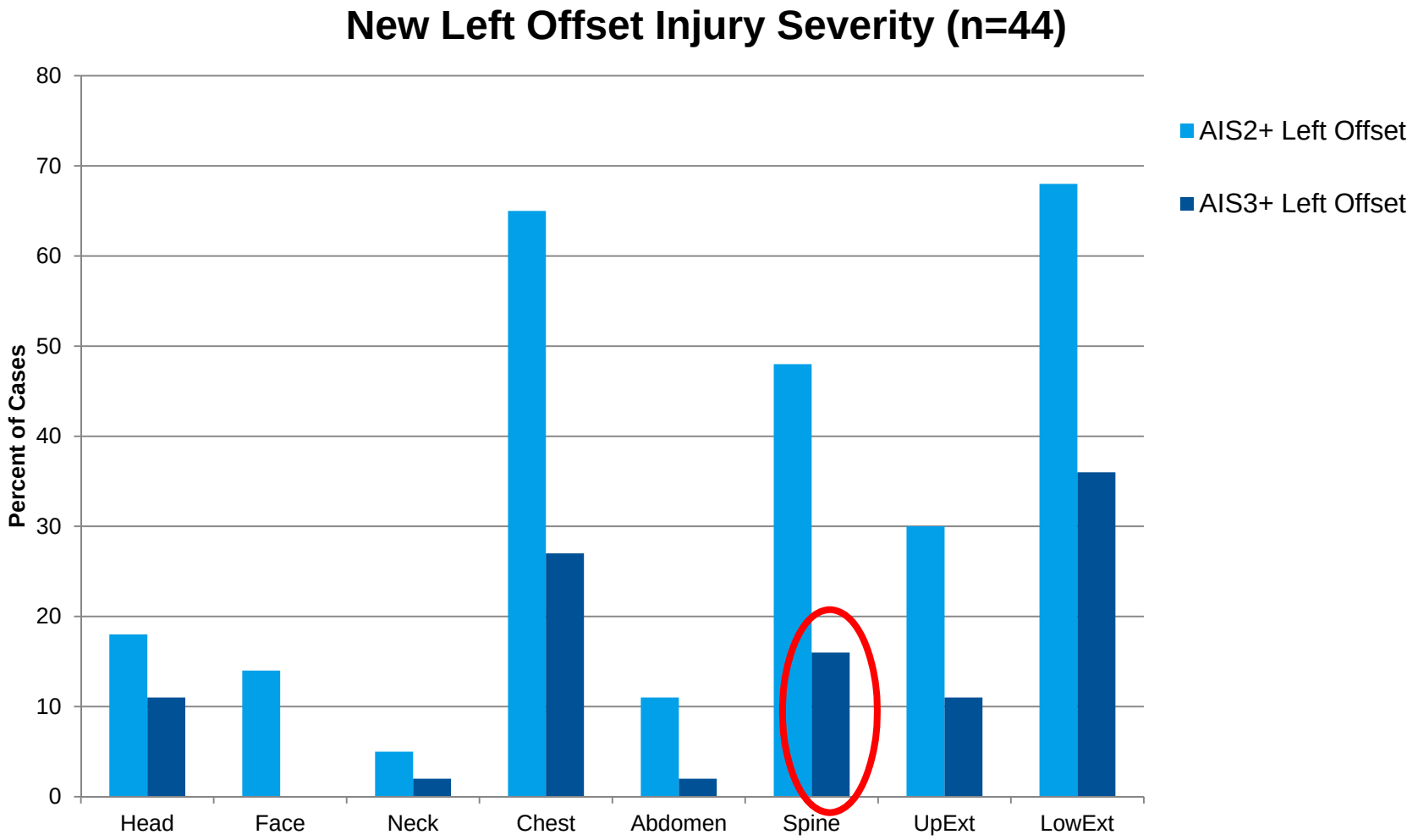
No current cases were included in the original Rudd research

New Cases - Optimal Restraint Availability

44 New Left Offset Cases / 24 Right Offset

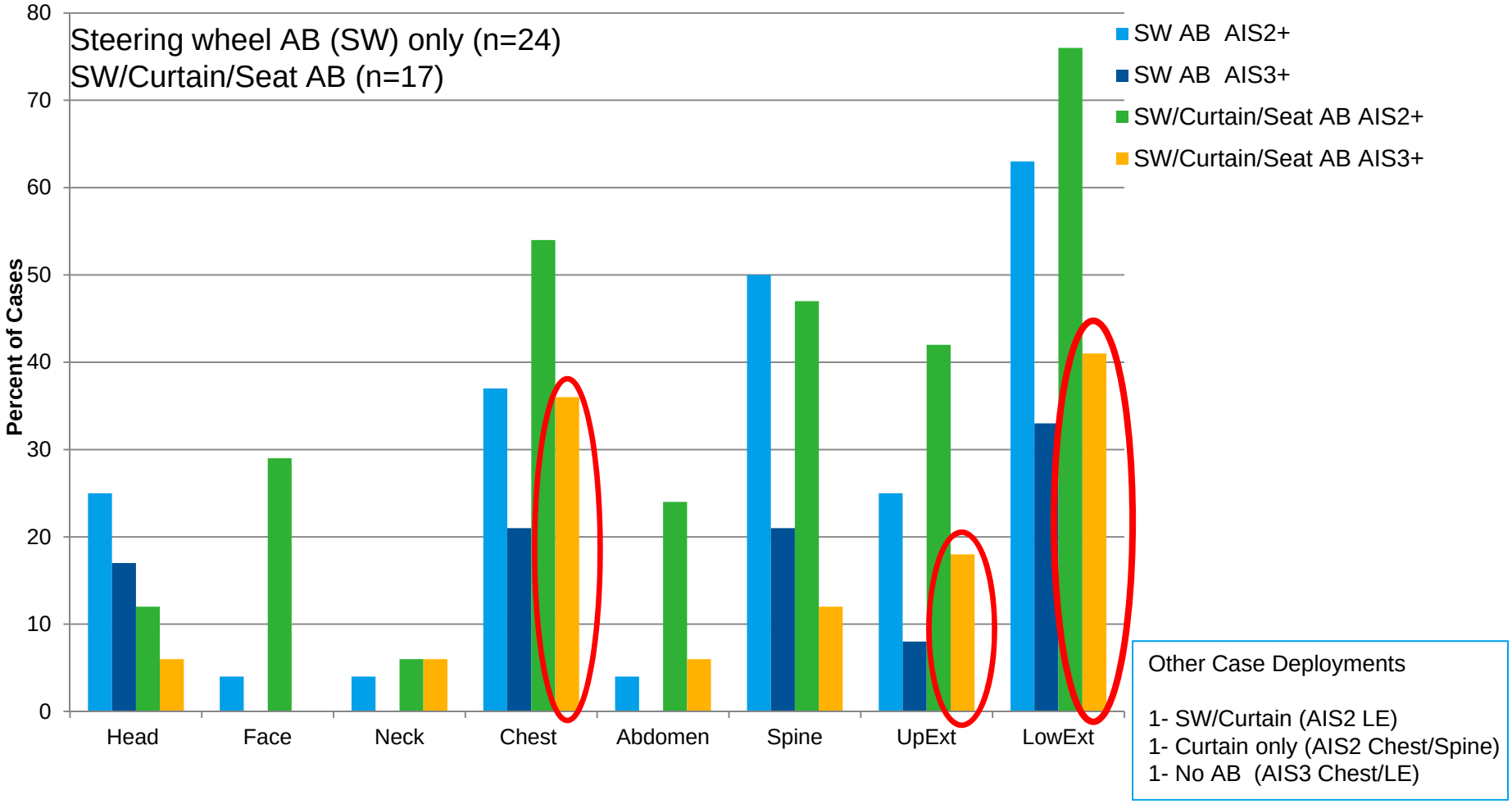
	Left Offset	Right Offset
% male	30	38
Min age	*18*	*20*
Max age	*90*	*81*
Mean age	*55*	*51*
Min MAIS	2	2
Max MAIS	5	4
Mean MAIS	2.8	2.8
Min ISS	*4*	*5*
Max ISS	*41*	*26*
Mean ISS	*15*	*13*
% fatal	7	0*
Mean Delta-v	*49 kph* *30.4 mph*	*43.3 kph ** *26.9 mph*
Model year or newer (50%+)	2007	2007

New Cases - Optimal Restraint Availability



New Cases - Optimal Restraint Availability

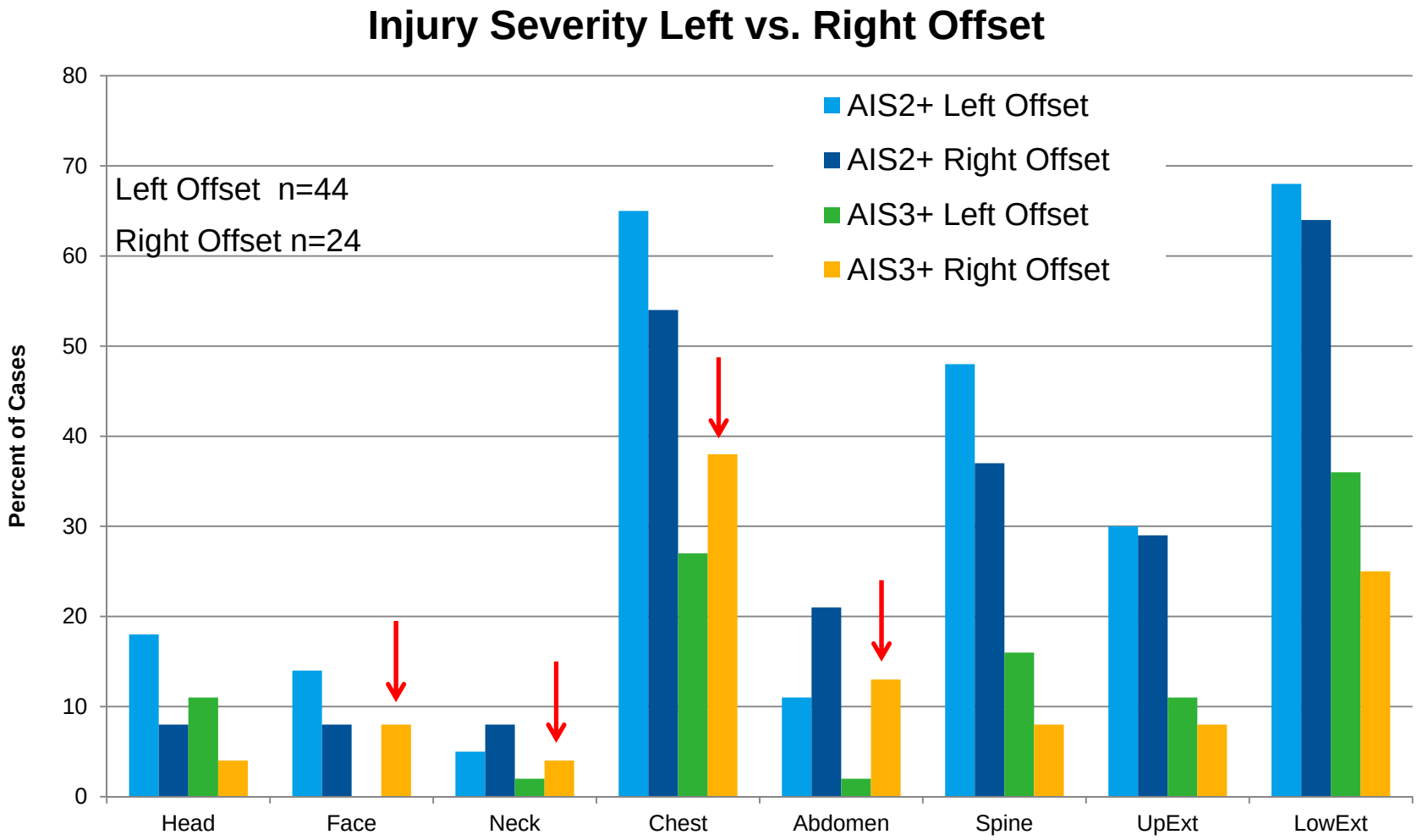
New Left Offset Injury Severity and Air Bag Deployment



Other Case Deployments

1- SW/Curtain (AIS2 LE)
1- Curtain only (AIS2 Chest/Spine)
1- No AB (AIS3 Chest/LE)

New Cases - Optimal Restraint Availability



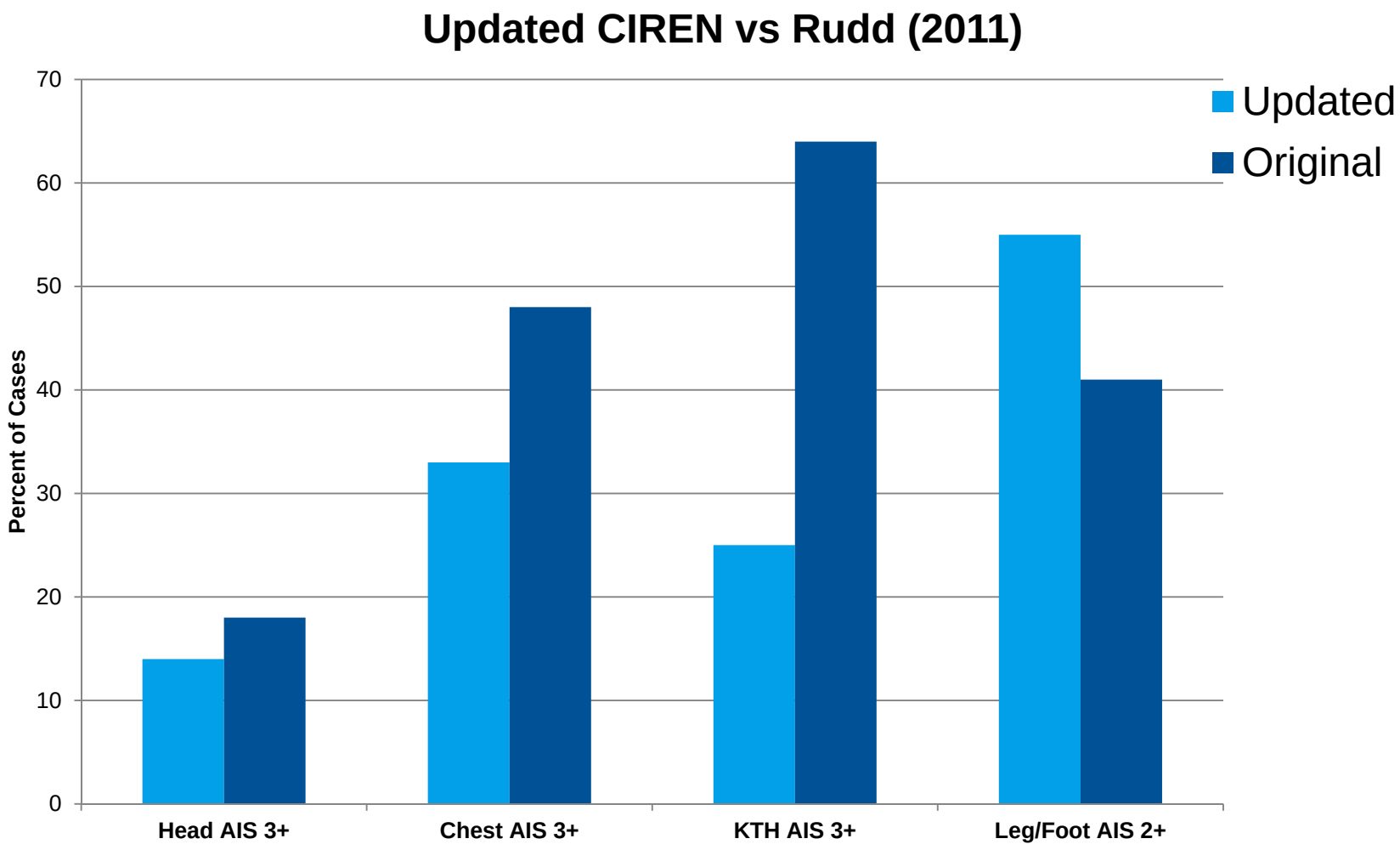
Left Offset – Rudd Comparison

Left Offset Cases AIS3+ (Head/Chest/KTH)

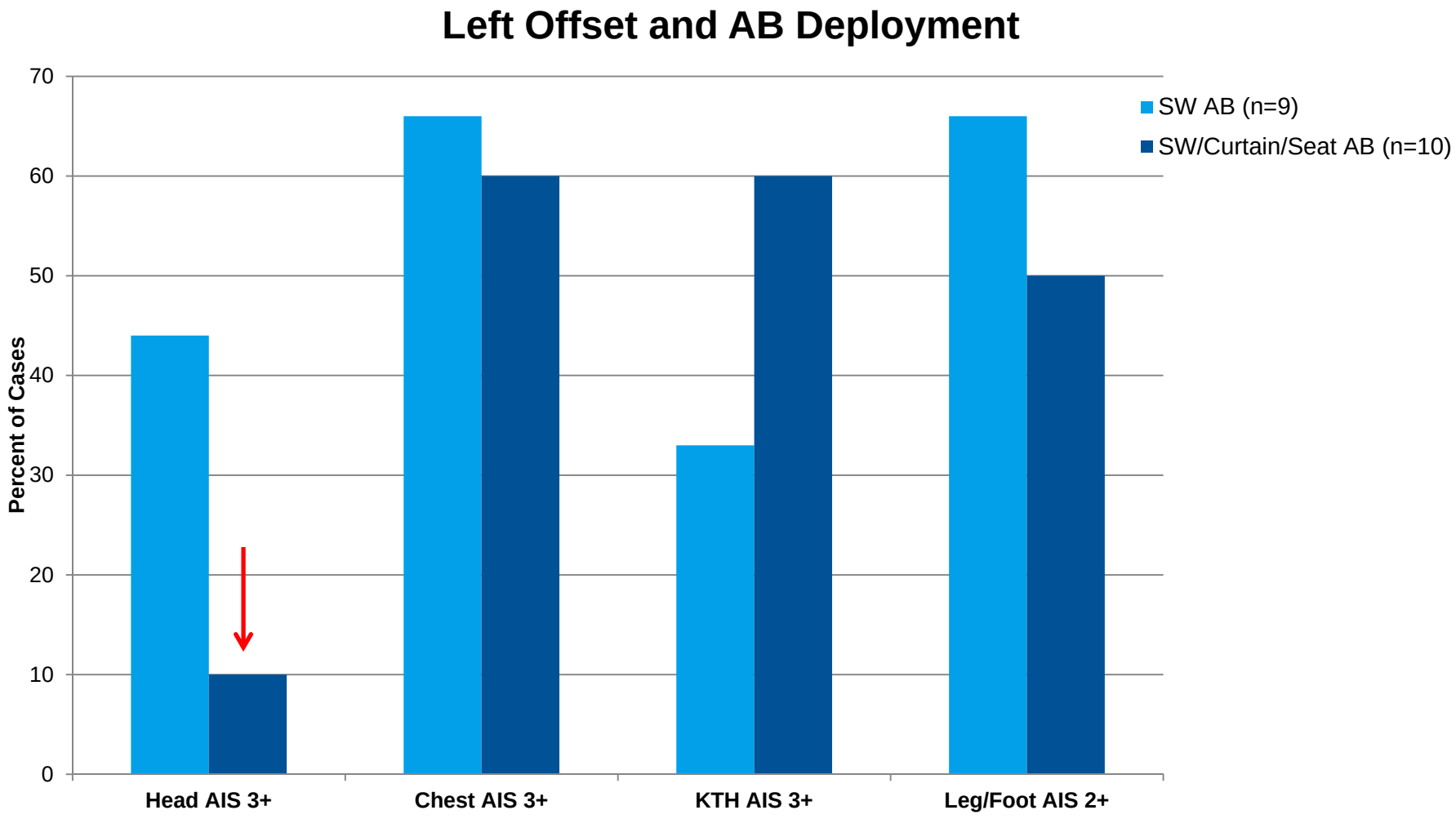
	Updated CIREN	Original CIREN	Original NASS
n	20	89	63
% male	*30**	*53.9*	*47.6*
Min age	18	17	15
Max age	90	83	79
Mean age	54	45	41
Min ISS	*9*	*9*	*9*
Max ISS	*41*	*43*	*50*
Mean ISS	*20.3*	*19.7*	*18.2*

None of the current cases were included in the original Rudd review

Left Offset – Rudd Comparison

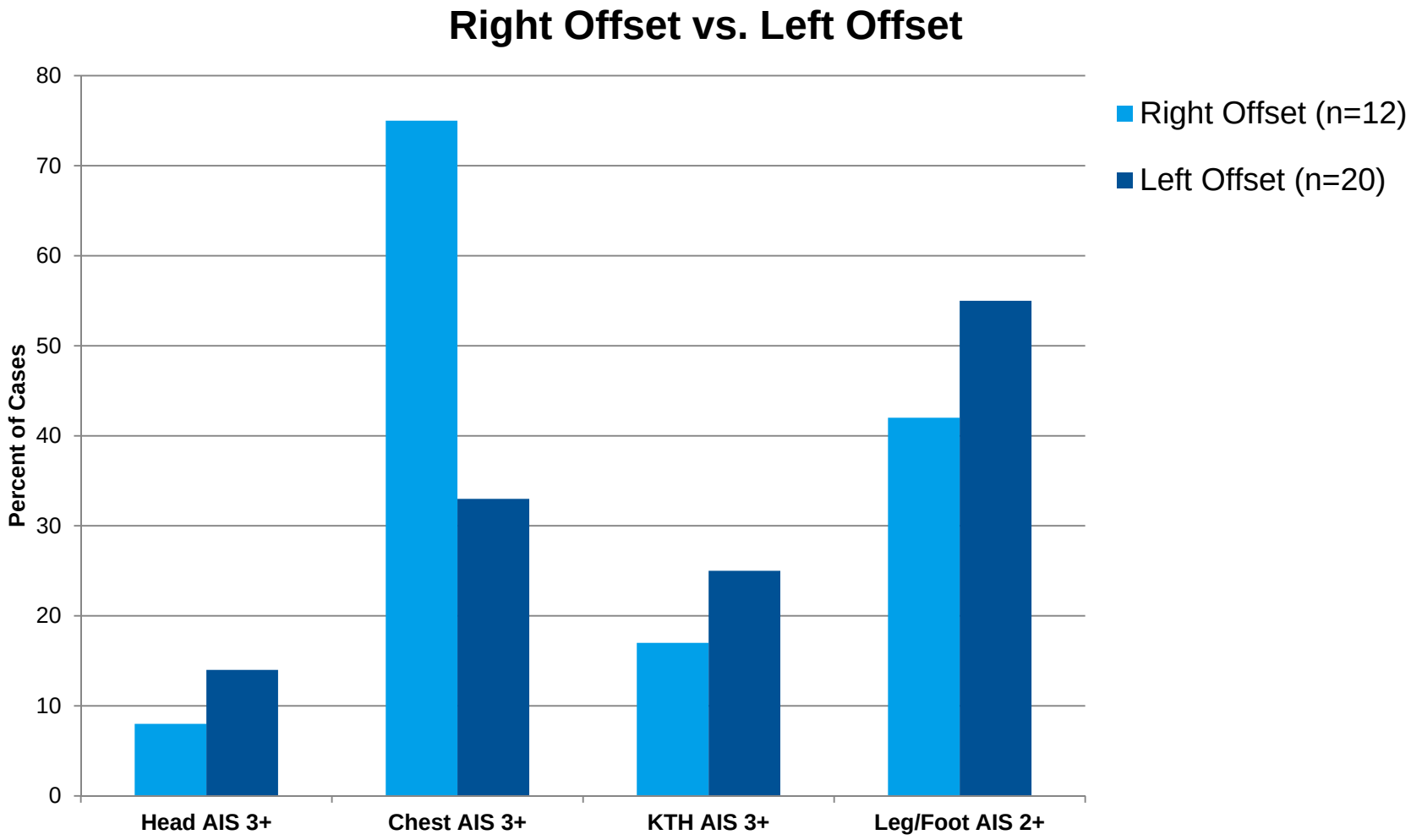


Left Offset – Rudd Comparison



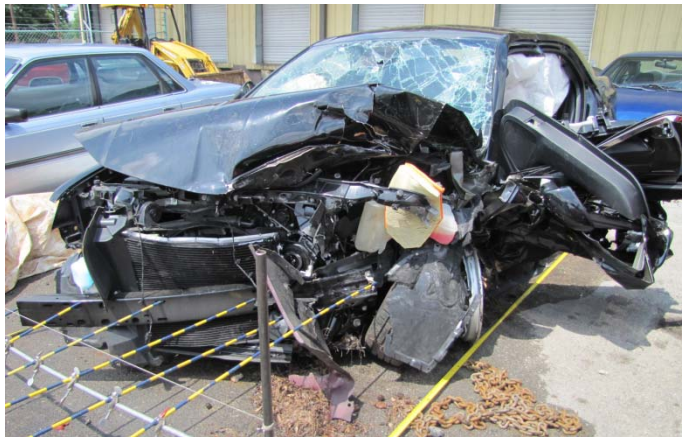
1 case w/ No AB deployments = Chest and Leg/Foot

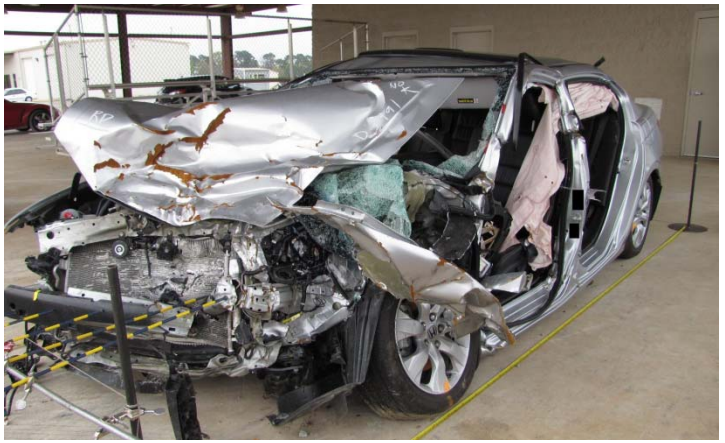
Rudd Comparison with Right Offset



Left Offset Case Examples

Case Vehicle	2013 Chrysler 300	2010 Honda Accord
Belted driver	31 yo female	33 yo female
HT/WT	5’6” / 178 lbs.	5’7” / 126 lbs.
AB Deployment	SW/Curtain/Seat	SW/Curtain/Seat
MAIS	3	5
ISS	10	38
V2	2003 Nissan Maxima	2003 Dodge Durango
Delta-V	31.6 mph	23.6 mph (rated low)





Left Offset Cases

2010 Honda Accord
AIS3+
- Head
+ Chest
+ KTH

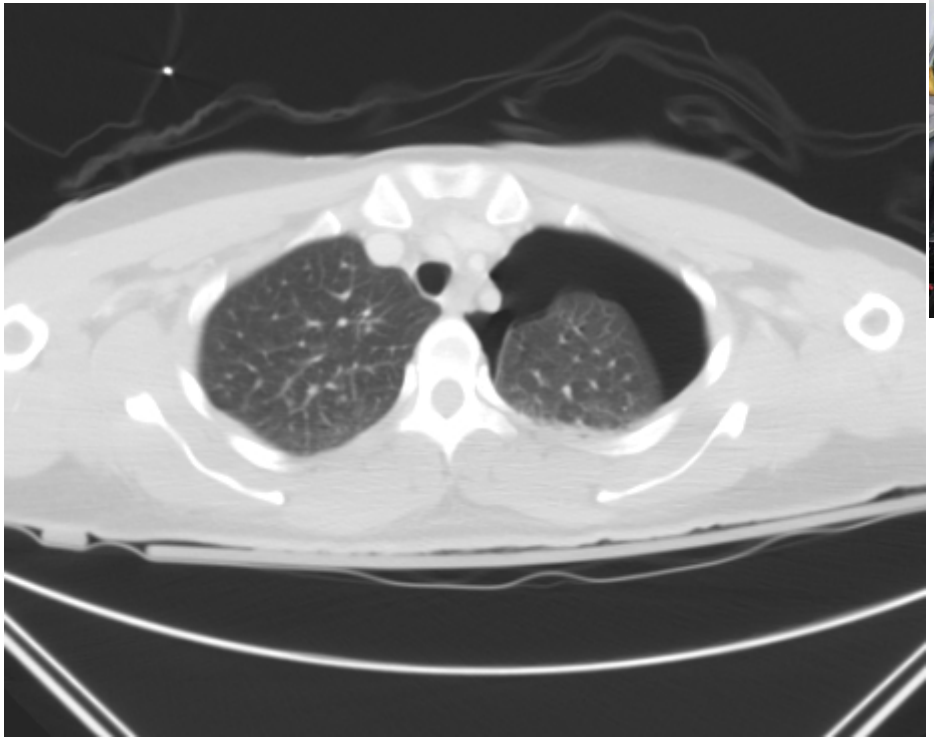
AISCODE	Description	Aspect
4422045	Thoracic injury, pneumothorax, tension; massive air leak	Left
7522743	Ulna fracture, shaft, complex; comminuted; segmental, open	Left
8532713	Femur fracture, shaft, complex; comminuted; segmental; Winquist IV	Left
4414072	Lung, contusion, unilateral, minor; <1 lobe	Left
4502022	Rib fracture or fractures, without flail, any location unilateral or bilateral, two ribs [OIS I]	Left;Posterior Rib;L Rib 3;L Rib 1
5418222	Liver, laceration, simple capsular tears; <=3cm parenchymal depth; <=10cm long; minor; superficial [OIS II]	Right;Right Lobe
8562512	Acetabulum fracture, partial articular (involving one column)	Left
6502202	Vertebra, cervical spine, fracture with or without dislocation but no cord involvement, transverse process	Posterior/Back/Dorsal;Left Process;C7
6504202	Vertebra, thoracic spine, fracture with or without dislocation but no cord involvement, transverse process	Superior/Upper;Left Process;T3;T2
7521132	Ulna fracture, proximal (olecranon)	Right
7521512	Radius fracture, proximal, extra-articular; radial neck	Right
8575612	Cuneiform fracture, fracture line into one joint surface	Right
8576612	Cuboid fracture, fracture line into one joint surface	Right
8581532	Metatarsal fracture, one of four lateral metatarsals fracture, extra-articular or shaft	Right
2106021	Skin/subcutaneous/muscle, face, laceration, minor; superficial	Left Forehead;Left
7102021	Skin/subcutaneous/muscle, upper extremity, abrasion	Hand/Digits;Left
7106021	Skin/subcutaneous/muscle, upper extremity, laceration, minor; superficial	Forearm;Left
7720321	Elbow joint, dislocation, with radial head involvement [proximal radioulnar]	Left

2013 Chrysler 300
AIS3+
-Head
-Chest
+KTH

AISCODE	Description	Aspect
8532513	Femur fracture, shaft, simple; spiral; oblique; transverse; Winquist I	Left
8542712	Tibia fracture, shaft, complex; comminuted; segmental; Winquist IV	Right
8544712	Fibula [malleoli] fracture, above joint [suprasyndesmotic]; isolated shaft, head or neck; Weber C	Right
7523512	Radius fracture, distal, extra-articular [includes styloid]	Left
7524612	Carpus fracture, bone other than scaphoid	Left
8572522	Talus fracture, extra-articular; talus neck, open	Right
8102021	Skin/subcutaneous/muscle, lower extremity, abrasion	Knee;Right

Left Offset Cases

Chest AIS3+ - 2010 Honda Accord



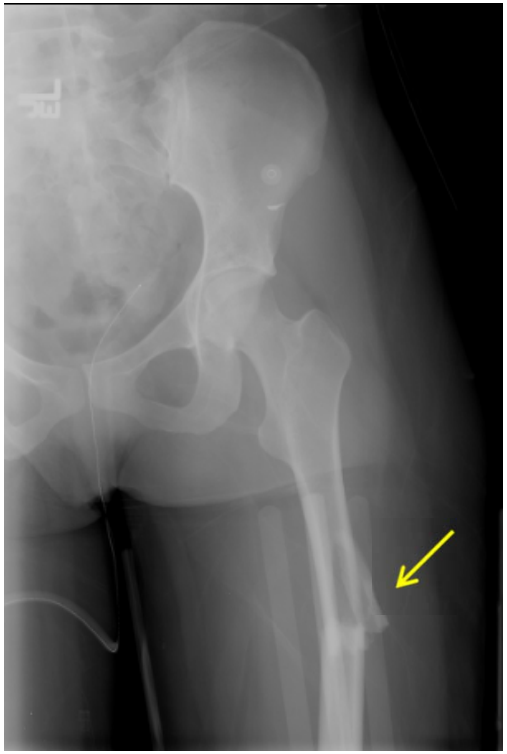
- Large left side pneumothorax (3) and posterior lung contusion (2).
- Left 1st and 3rd rib fractures (2)
  - Involved physical component (IPC) = Thoracic belt

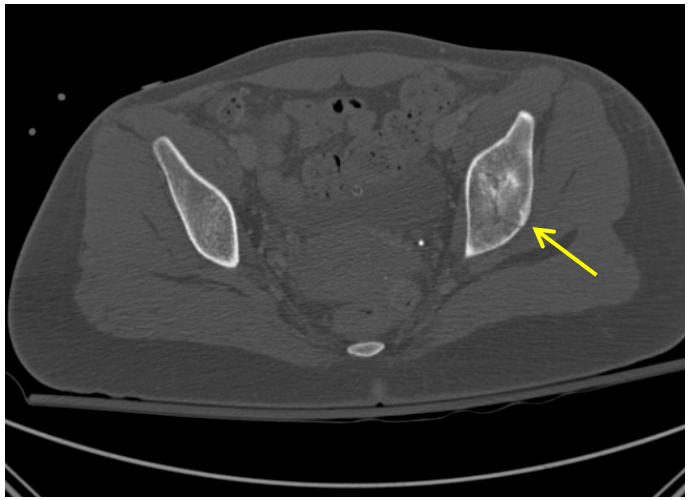
Left Offset Cases

KTH AIS3+

2010 Honda Accord

- Left femur shaft fracture (3)
- Left posterior column acetabular fracture (2)
  - IPC = Lower instrument panel

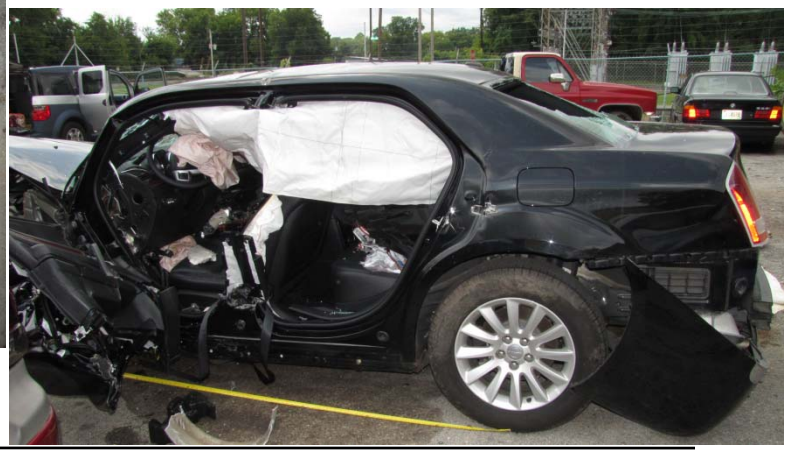




Left Offset Cases

2013 Chrysler 300

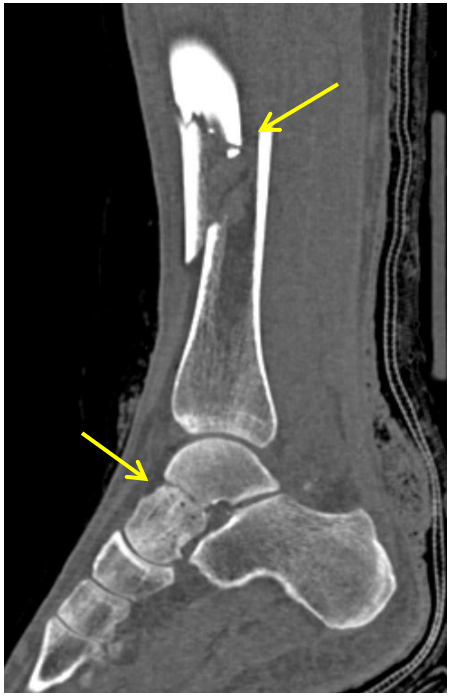
- Left femur shaft fracture (3)
  - IPC=Lower instrument panel



Left Offset Cases

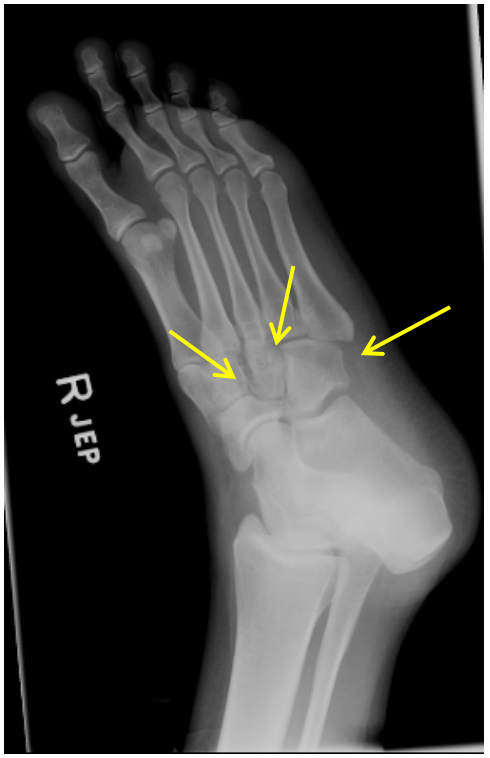
Lower Leg / Foot

2013 Chrysler 300



- Right tibia/fibula shaft fracture
  - IPC = Lower IP & Pedal
- Right talar neck fracture (open)
  - IPC = Pedal

2010 Honda Accord



- Right cuboid articular fracture
- Right cuneiform fractures (med/lat)
- Right 2nd metacarpal fracture
  - IPC = Floor pan

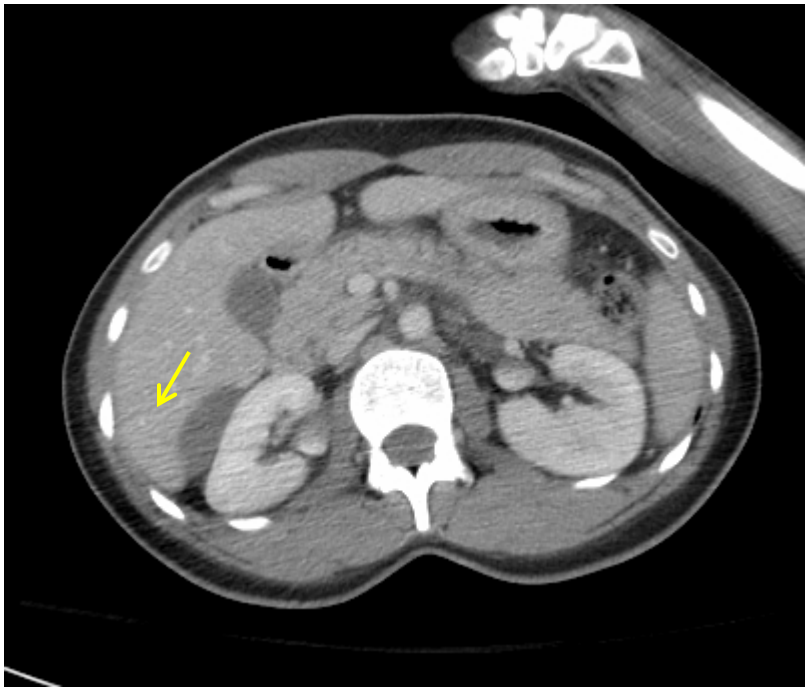
Left Offset Cases

Other Significant Injury

2010 Honda Accord

- Right ulna fracture (2)
- Right radial neck fracture (2)
- Right radial head dislocation
  - IPC = Left IP

- Left ulna fracture (3)
  - IPC = UFQ Door
  - IPC = Left IP



- Liver capsule laceration (2)
  - IPC = Thoracic belt

Conclusions – CIREN Cases

New case review

- **AIS3+ injury is highest in lower extremity, chest and spine for the newest left offset cases**
- **AIS3+ injury is highest in lower extremity, chest and upper extremity in the newest left offset cases with SW/Curtain/Seat air bag deployment**
- **AIS3+ injury is higher in chest, abdomen, face and neck for right offset vs. left offset crashes**

Rudd 2011 comparison

- **New cases indicate decrease injury frequency with the exception of AIS2 lower leg injury**
- **Air Bag coverage / deployment appears most effective for head injury reduction**
- **Right offset indicates a large increase in chest injury compared to left offset**

Thank You

Questions -