SAE / Government Meeting

Washington, D.C.

May 2005

Overview of the Enhancements and Changes in the CIREN Program

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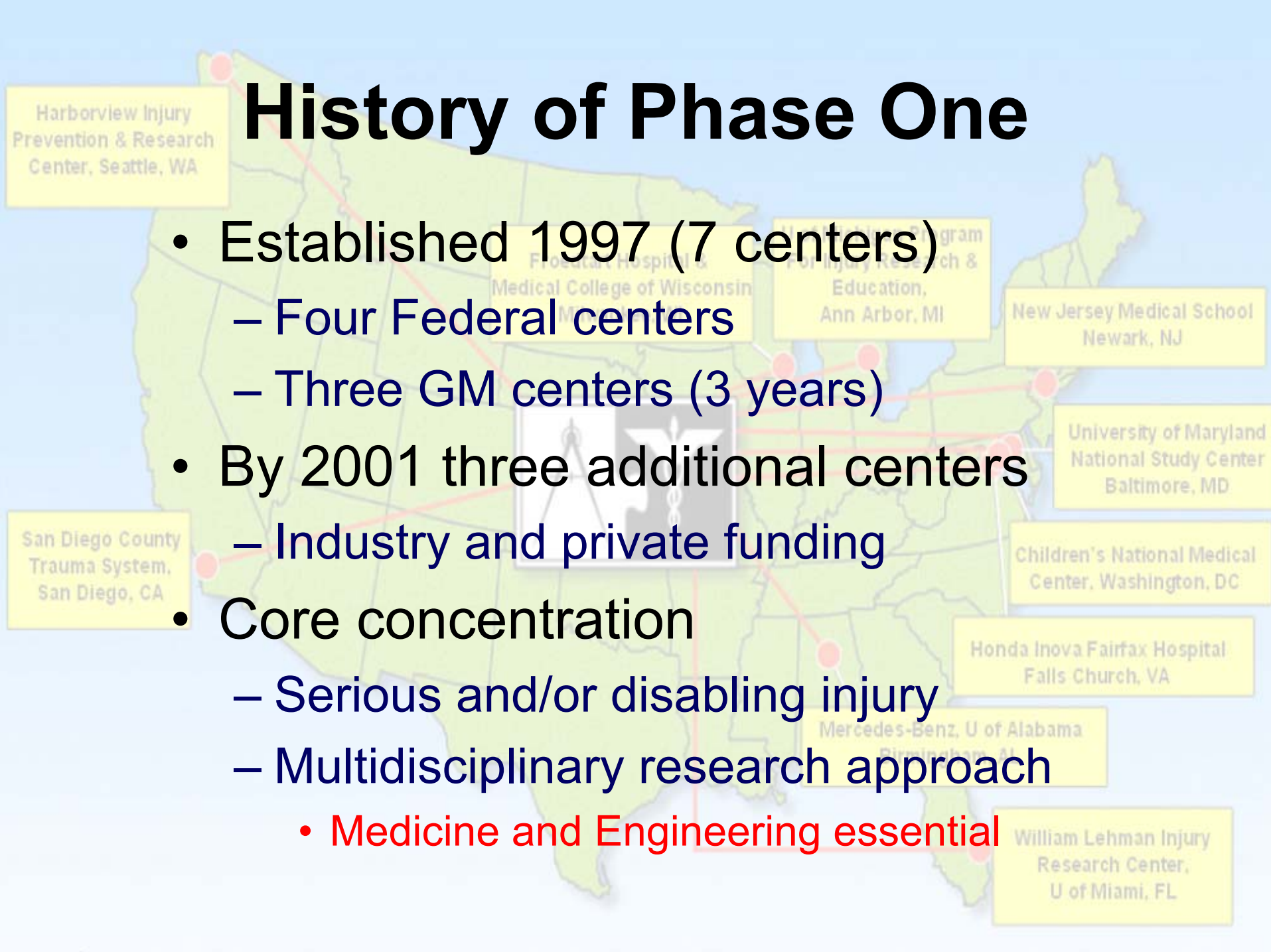
nhtsa
people saving people

History of Phase One

- Established 1997 (7 centers)
  - Four Federal centers
  - Three GM centers (3 years)
- By 2001 three additional centers
  - Industry and private funding
- Core concentration
  - Serious and/or disabling injury
  - Multidisciplinary research approach
    - Medicine and Engineering essential



Phase One Major Accomplishments

- Over 2700 cases collected
- Over 100 related peer reviewed articles
- **Multitude** of outreach activities
- Biomechanical injury analysis
- Knee-Thigh-Hip discovery/project
- URGENCY algorithm
- ATLS and Field Triage update
- ACN research
- Outcome research

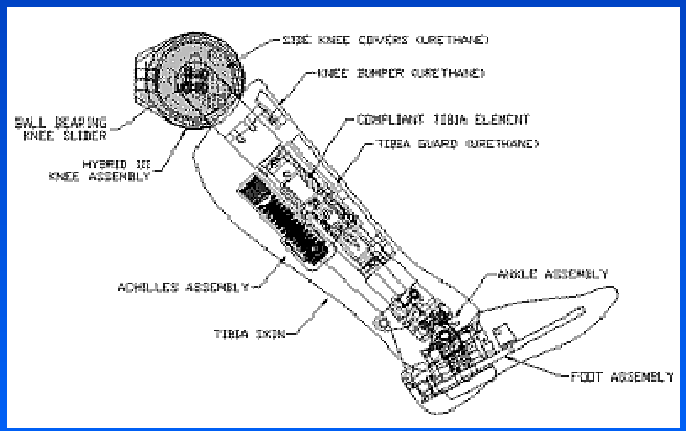
Improvements Needed

- Data timeliness
  - Streamline dataset
- Uniform data collection and case analysis
  - All centers in unison on process and procedure
- Increased engineering input and data
  - Engineering more involved
  - More engineering type data captured
- Greater access to data
  - More data exposure in NHTSA
  - Greater public access
  - Increased data access by centers

Improvements – Phase Two

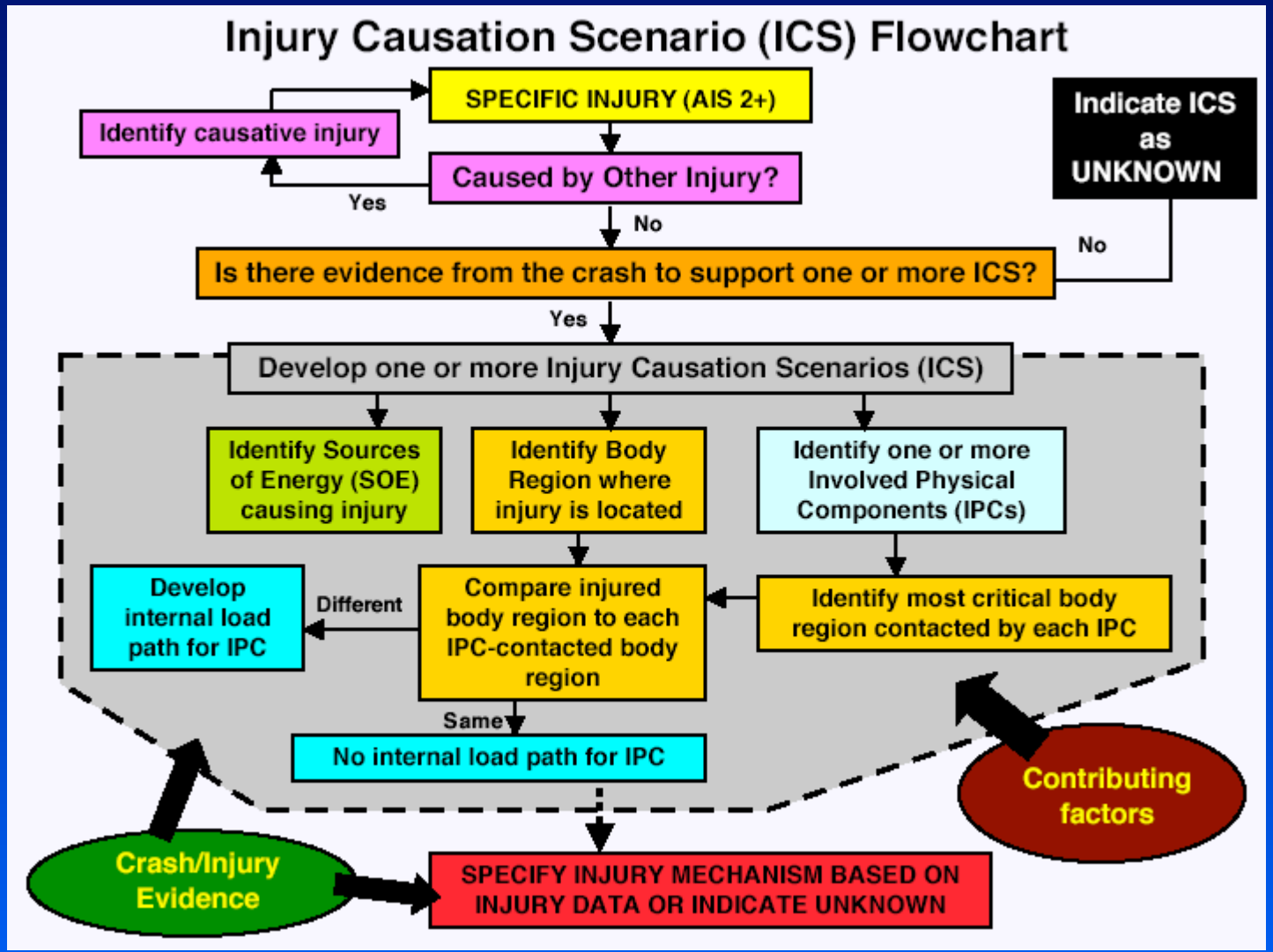
- Data timeliness
  - Updated CIREN Coding Manual
    - Eliminates non-used data points and duplication
- Uniform data collection and case analysis
  - Updated CIREN Coding Manual
    - Establishes uniform practices and definitions
- Increased engineering input and data
  - Biomechanic Tab (in development)
    - Unique engineering data on each AIS 2+ injury coded
- Greater access to data
  - Multiple new CIREN accounts within NHTSA
  - Increased public cases
  - New servers will allow all cases to be shared
    - All data and graphics available to all sites F/T

Improved Biomechanical Data



- Current data structure too general
- True biomechanical definitions needed
- Hard coded engineering data
  - Injury causation scenario (ICS)
  - Injury mechanisms

Improved Biomechanical Data



New Biomechanical Tab Flowchart

Bio Tab

Head / Face
Neck (soft tissue)
Cervical Spine
Shoulder
Upper Arm
Elbow
Forearm
Wrist
Hand
Chest
Thoracic Spine
Abdomen
Lumbar Spine / Sacrum
Pelvis
Hip Joint
Leg
Ankle
Foot

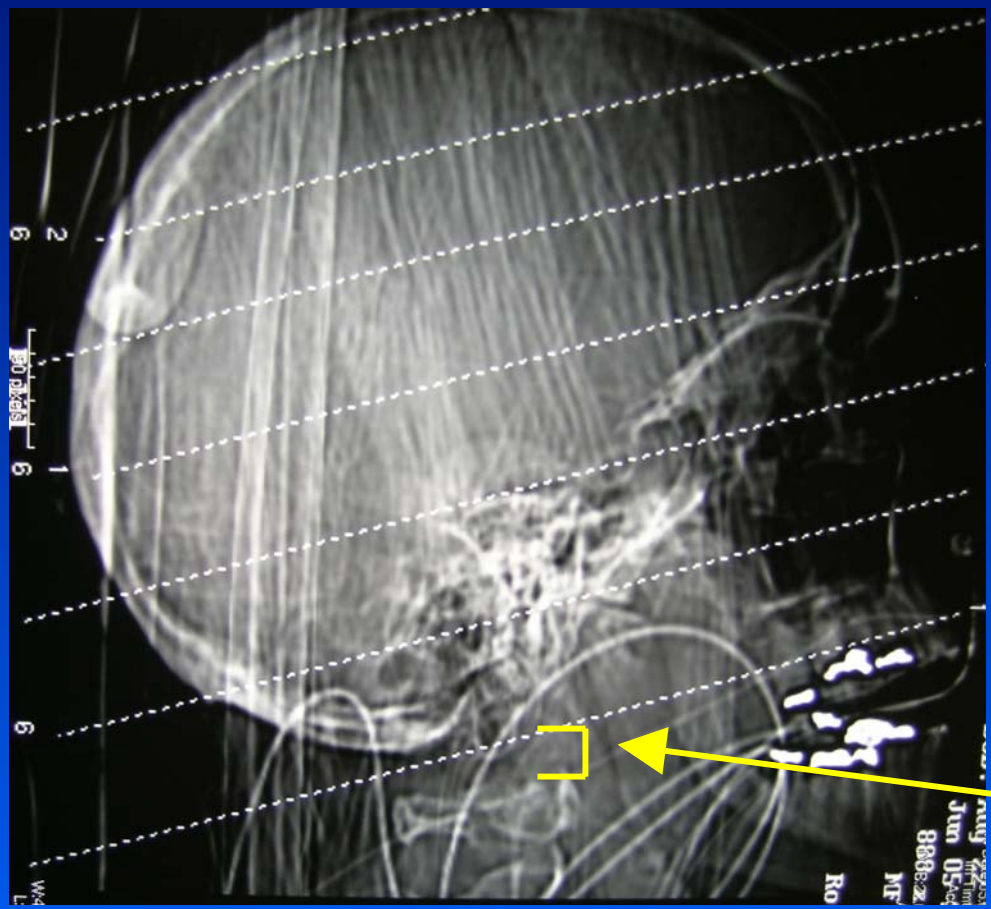
- New body region classification
  - Segments
  - Joints
- Establish load paths
  - Cervical fx from safety belt (frontal)

- Indirect – Belt restraint webbing

- Belt restraint webbing to chest (ribs) to thoracic spine to cervical spine

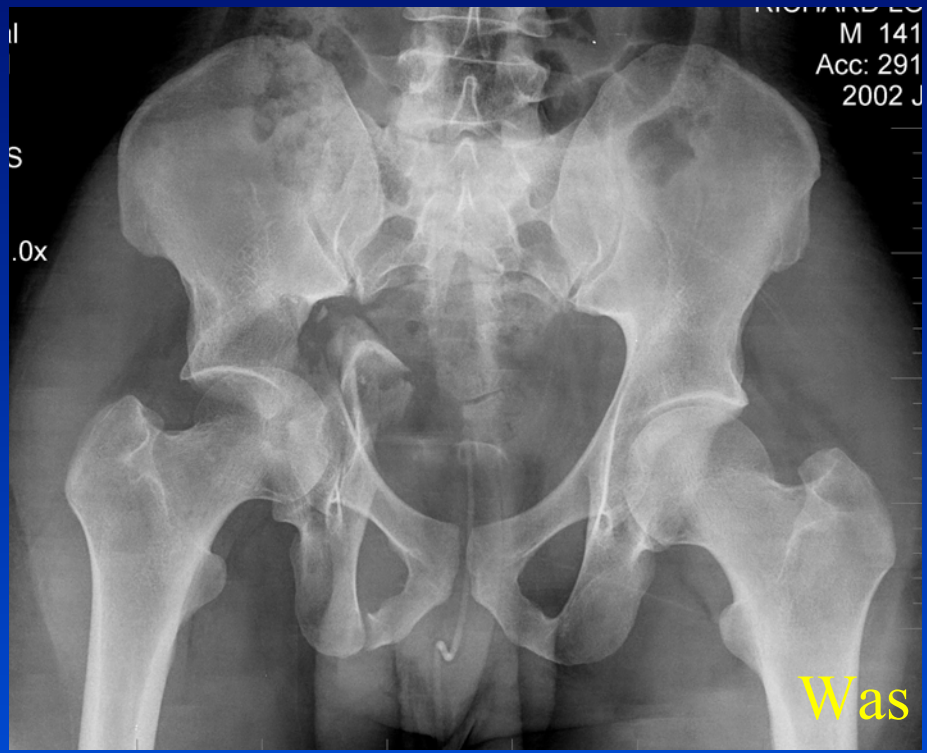
Both methods will be coded in CIREN

Bio Tab



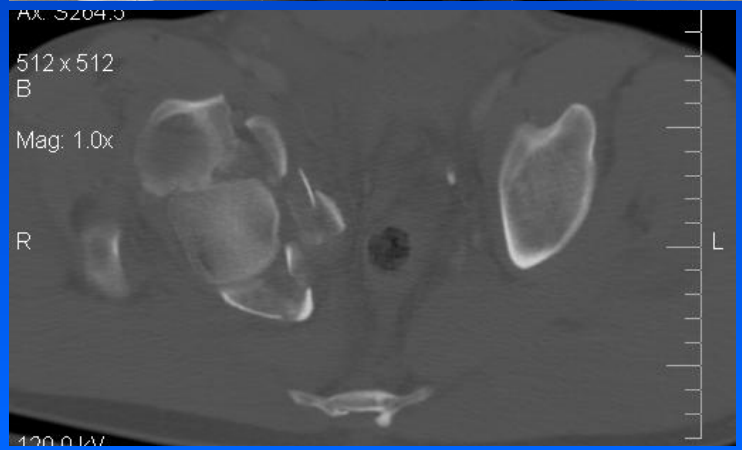
- Injury mechanism
  - General to all BR
    - Compression
    - Shear
    - Puncture
    - Cutting
    - Crushing
    - Heat
    - Chemical
- BR specific – example
  - Cervical Spine
    - Axial compression
    - Axial tension
    - Flexion
    - Extension
    - Lateral bending

Bio Tab Example



- Passenger side door impact
- Rt front passenger
  - Belted avg. adult
- Pelvic fractures
  - Rt acetabulum
  - Rt pubic rami

Was this injury caused by another injury?



NO

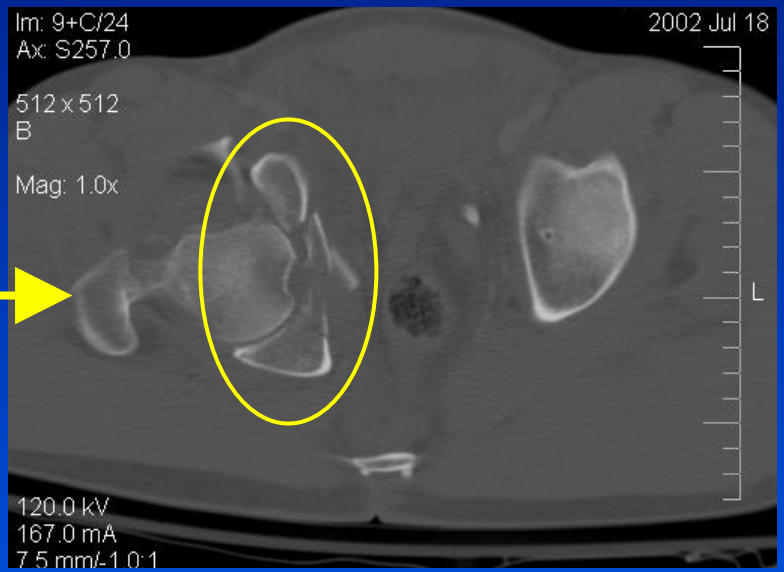
Injury Causation Scenario (ICS) Evidence = Yes

- Kinematics
- Contact evidence
- Injury pattern
- Intrusion

ICS Example

- 100 degree impact
- Occupant moves right as door intrudes
- Occupant contacts arm rest
  - Scuffing and transfers
  - Confidence - Certain

ICS Details

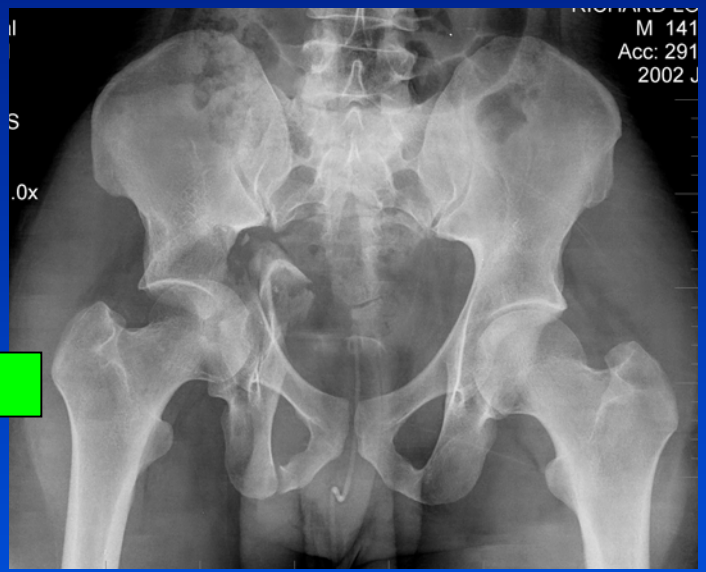


- Source of energy
  - CRASH
- Body region injured
  - HIP JOINT
- Involved Physical Component (IPC)
  - RIGHT SIDE DOOR ARMREST
- Body region contacted by IPC
  - THIGH
- Confidence = Certain

Was the injured BR directly contacted by the IPC?

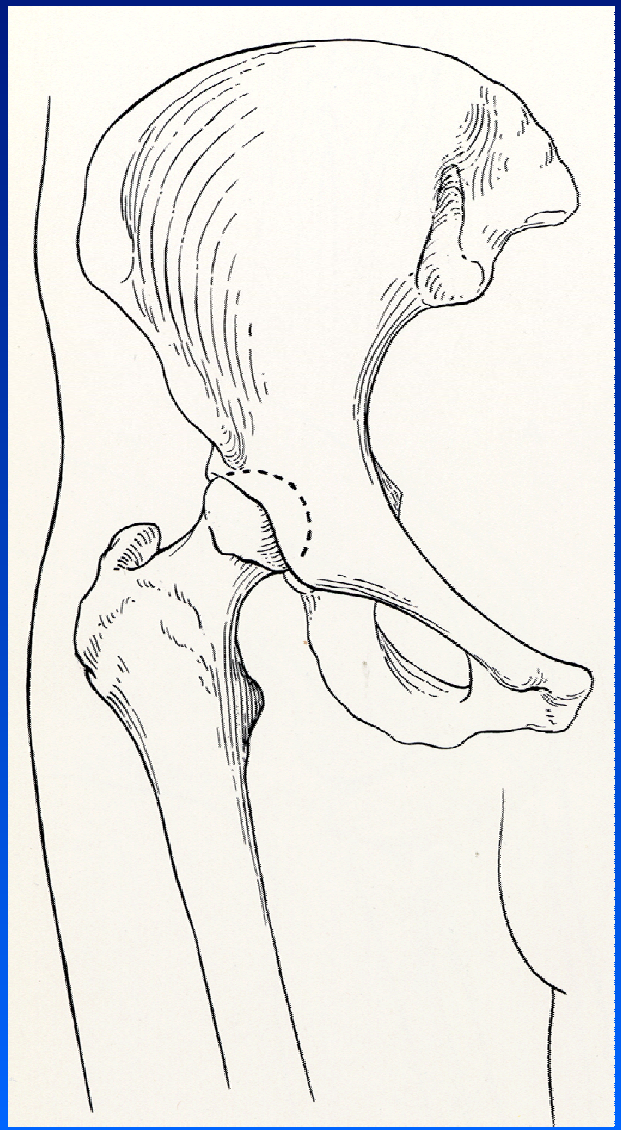
NO – Develop internal load path

Internal Load Path



- Energy path from injury to component
- Mult. body regions involved
- IPC to Thigh to Hip joint
  - IPC = arm rest

Injury Mechanism



- ***COMPRESSION***
- Compression of the femoral head into the acetabular socket
- Confidence = Certain

Bio Tab Data

- 852604.3 Pelvic Fx (Acetabular fx – 808.0)
- Injured body region = Hip joint
- Energy from crash
- Involved physical component – Rt door arm rest
- Intrusion factor
- Energy path – Thigh to Hip joint
- Mechanism = Compression

Example 2

- Frontal crash
- 9 y/o 5’ tall 120 lbs.
- Left rear passenger
- 3 pt. belt
  - Shoulder portion behind
- L3 spinal fx and post. ligament injury
- Multiple other abdominal injuries

Was this injury caused by another injury? - NO

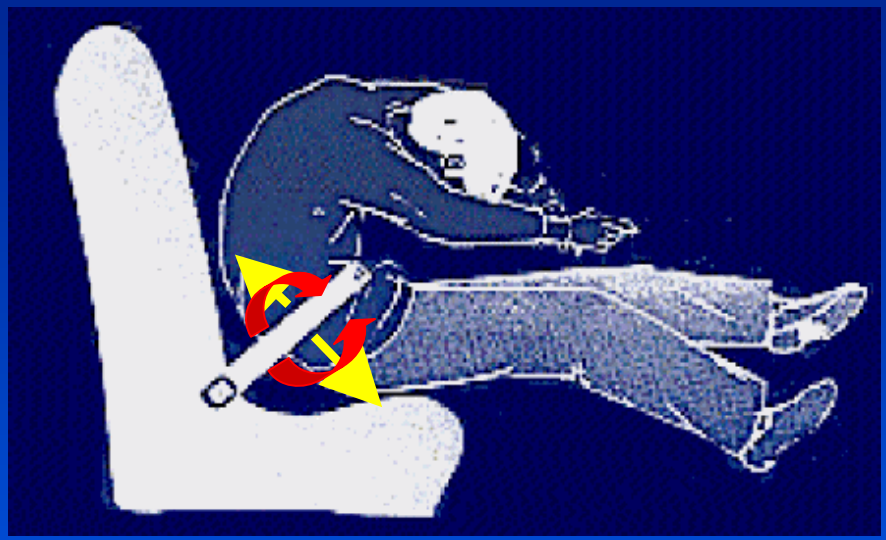
ICS Evidence = YES

- Kinematics
- Contact evidence
- Injury pattern
- Interview data

ICS Example #2

- 340 degree impact
- Occupant moves forward
- Lap belt loaded (alone)
- Occupant “hinges” over lap belt
- Confidence = Certain

ICS Details



- Source of energy
  - CRASH
- Body region injured
  - LUMBAR SPINE
- Involved Physical Component (IPC)
  - BELT RESTRAINT WEBBING
- Body region contacted by IPC
  - ABDOMEN
- Confidence = Certain

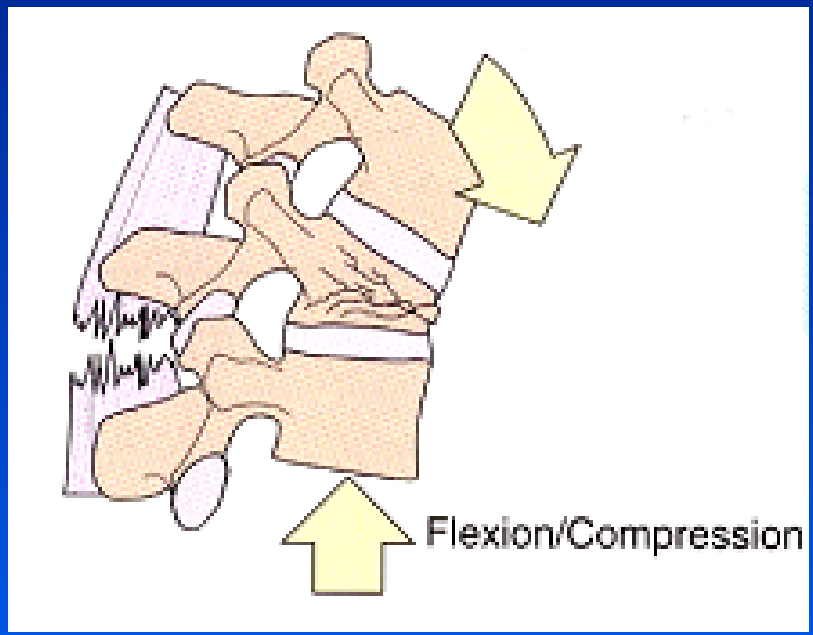
Was the the injured BR directly contacted by the IPC?

NO – Develop internal load path

Internal Load Path

- Energy path from injury to component
- Mult. body regions involved
- IPC to Abdomen to Lumbar spine
  - IPC = Belt restraint webbing

Injury Mechanism



- ***FLEXION COMPRESSION***
- Flexion of the spine over the belt
- Compression on the vertebral body
- Confidence = Probable

Bio Tab Data Example #2

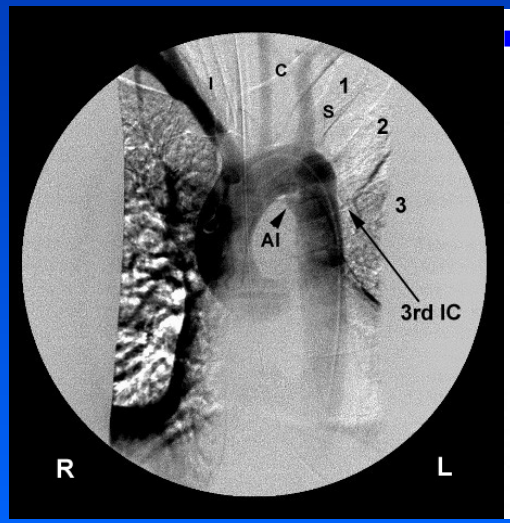
- 650622.3 L4 Facet Fx (Lumbar F/D – 53B1)
- Injured body region = Lumbar spine
- Energy from crash
- Involved component – Belt restraint webbing
- Improper belt use factor
- Energy path – Abdomen to lumbar spine
- Mechanism = Flexion and compression

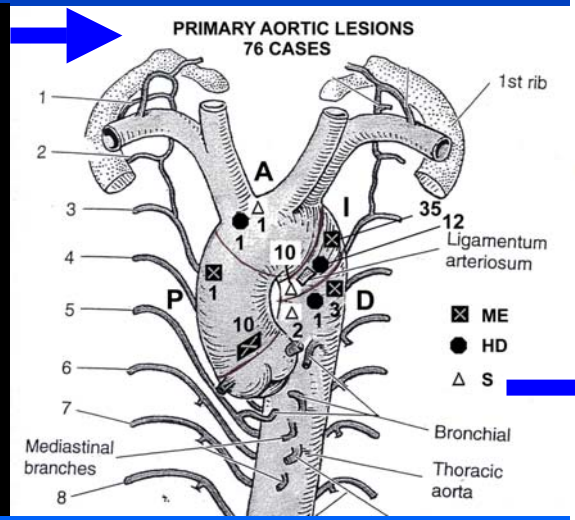
Modeling and Simulation

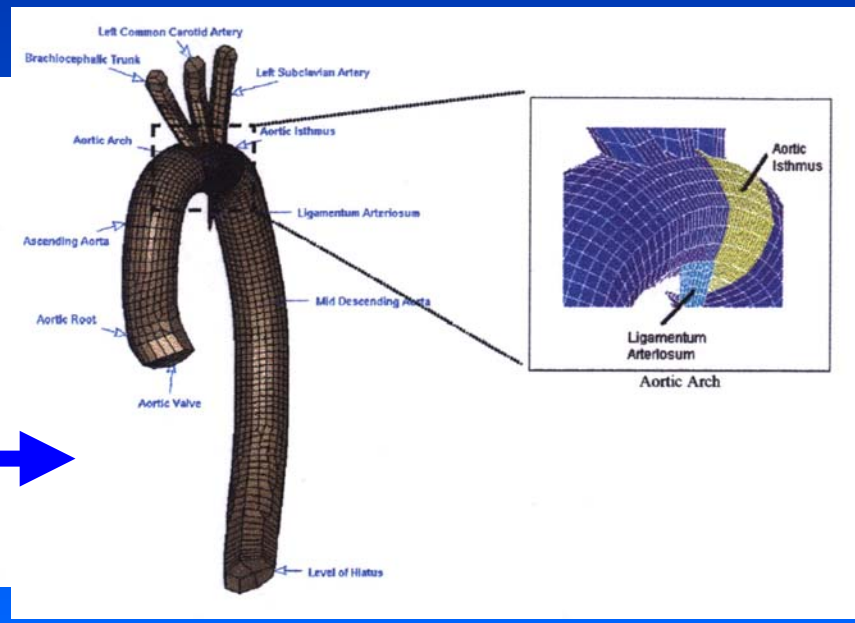
Academia/Industry – Movement towards simulation

- Universal need for improved field data
  - New crash investigation techniques and data
  - Increased EDR data

CIREN's Aortic Model



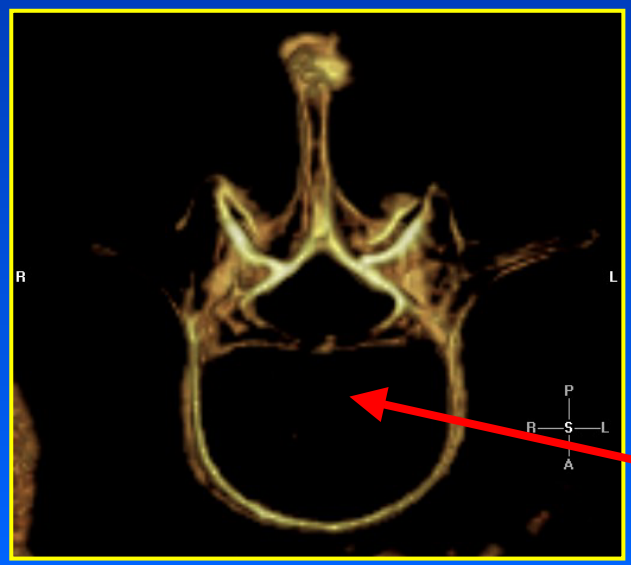




Medical Imaging Technology

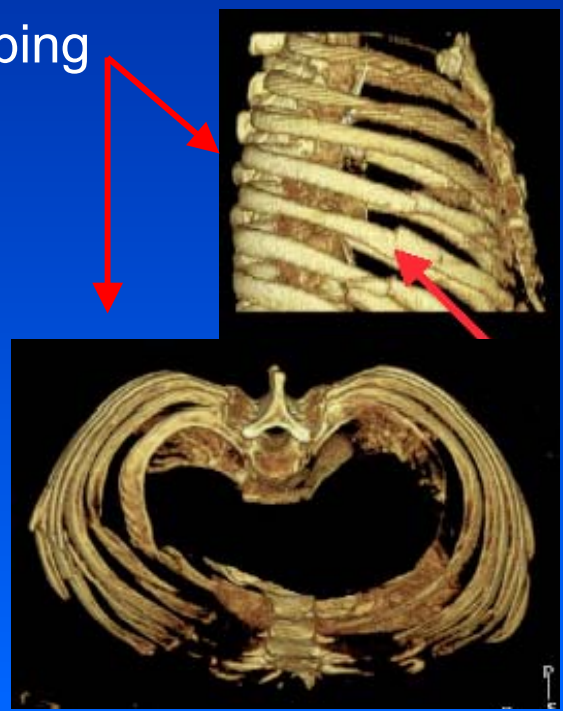
Bone Density

- Improved radiology data capture
- Utilize the DICOM CAT scan images in CIREN
- Applications
  - Elderly tolerance
  - Exact anthropometric measurements
  - 3-D injury mapping



16 y.o. male
L4 vertebrae
243 HU

75 y.o. female
L4 vertebrae
94 HU



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Thank You,

Questions?