

Crash Injury Data for Automotive Engineers

Lessons from Real Life

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Motor Vehicle Crashes

- 1,000,000 deaths per year worldwide
- No. 2 global health problem by the year 2020 – W.H.O.

Crashes in the USA

40,000 killed

(115/day, 1/13 minutes)

3,000,000 injured

Crash Injury for Engineers:

Femur load

HIC

TTI



Real life!

It can't be replicated by dummies and
standardized tests.









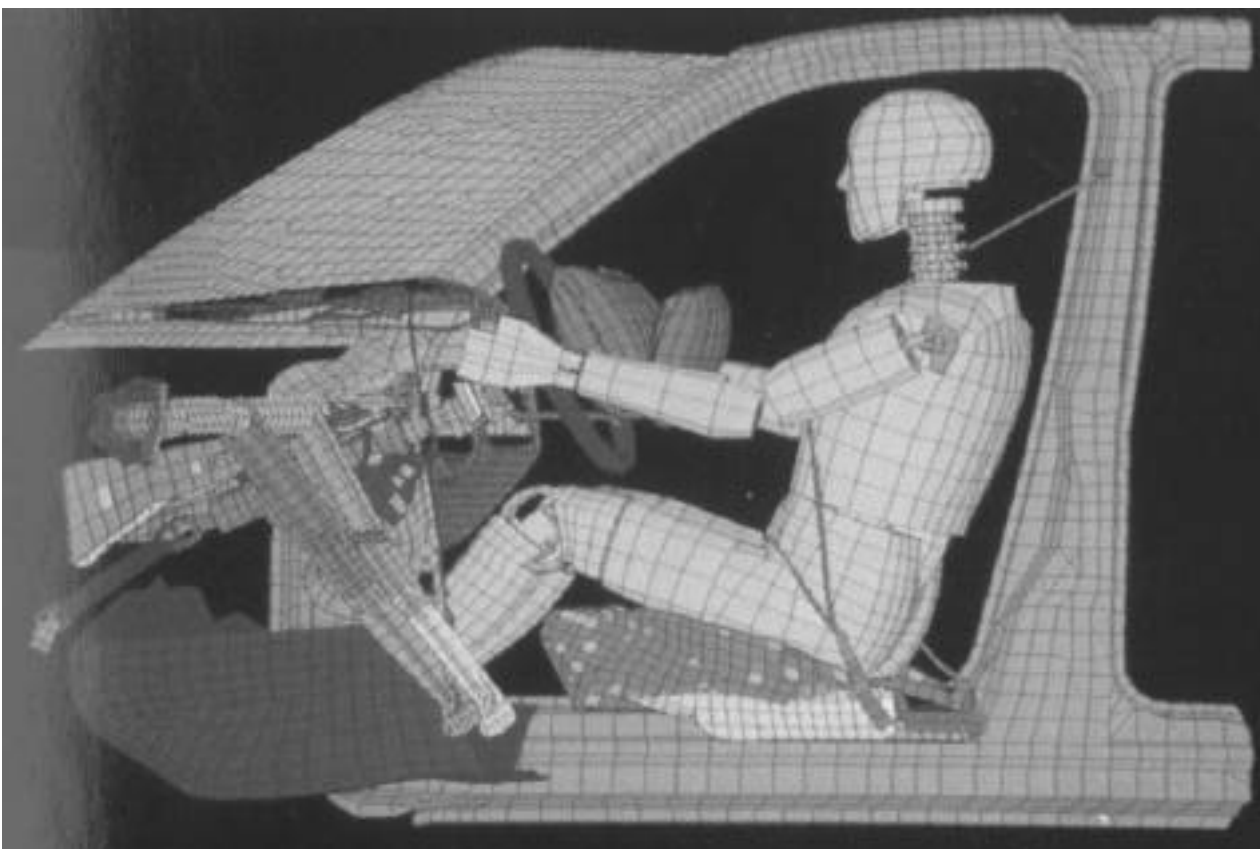
Automotive Safety

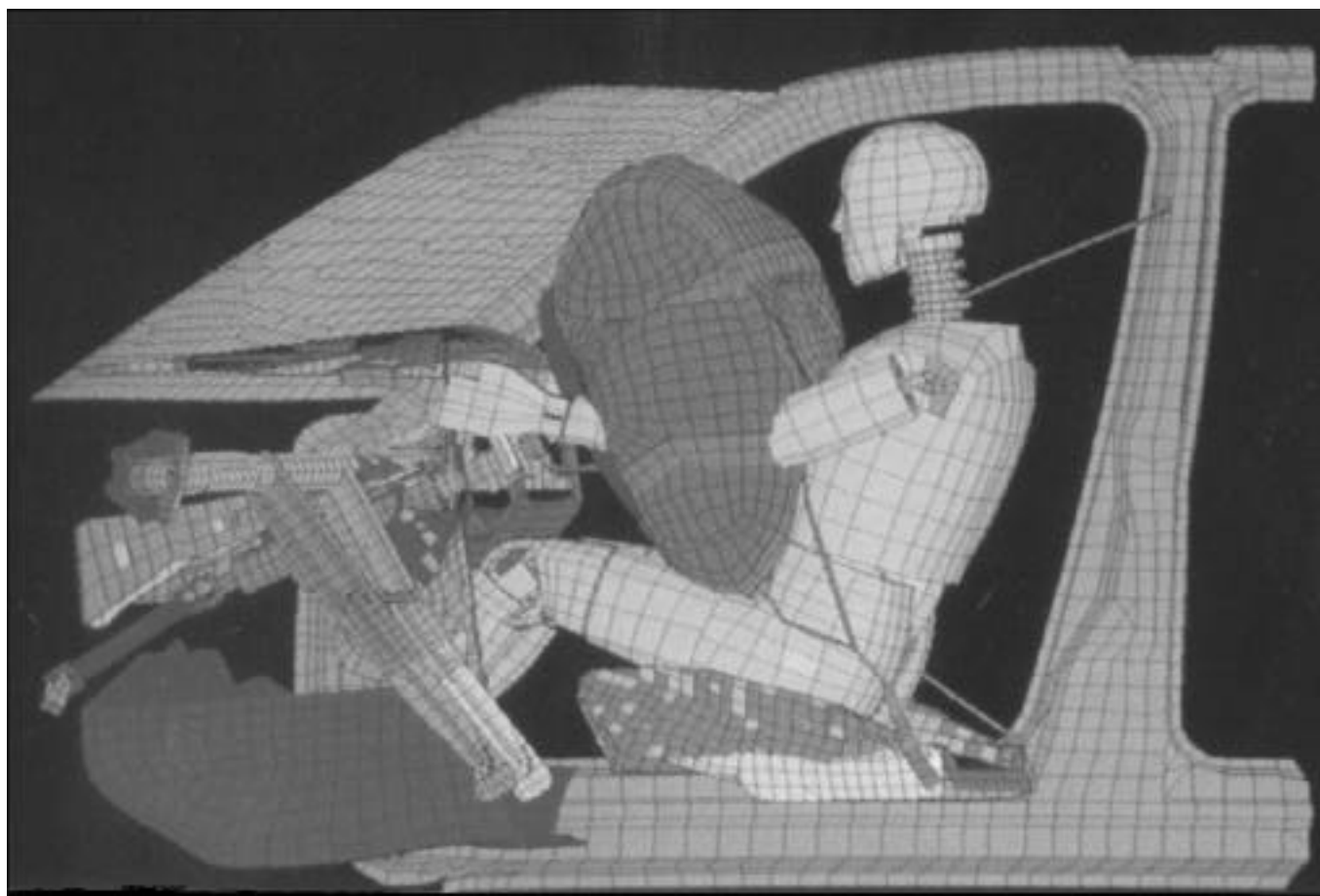
- It's not about numbers, forces, percentages.
- It's about people. Human loss and suffering.

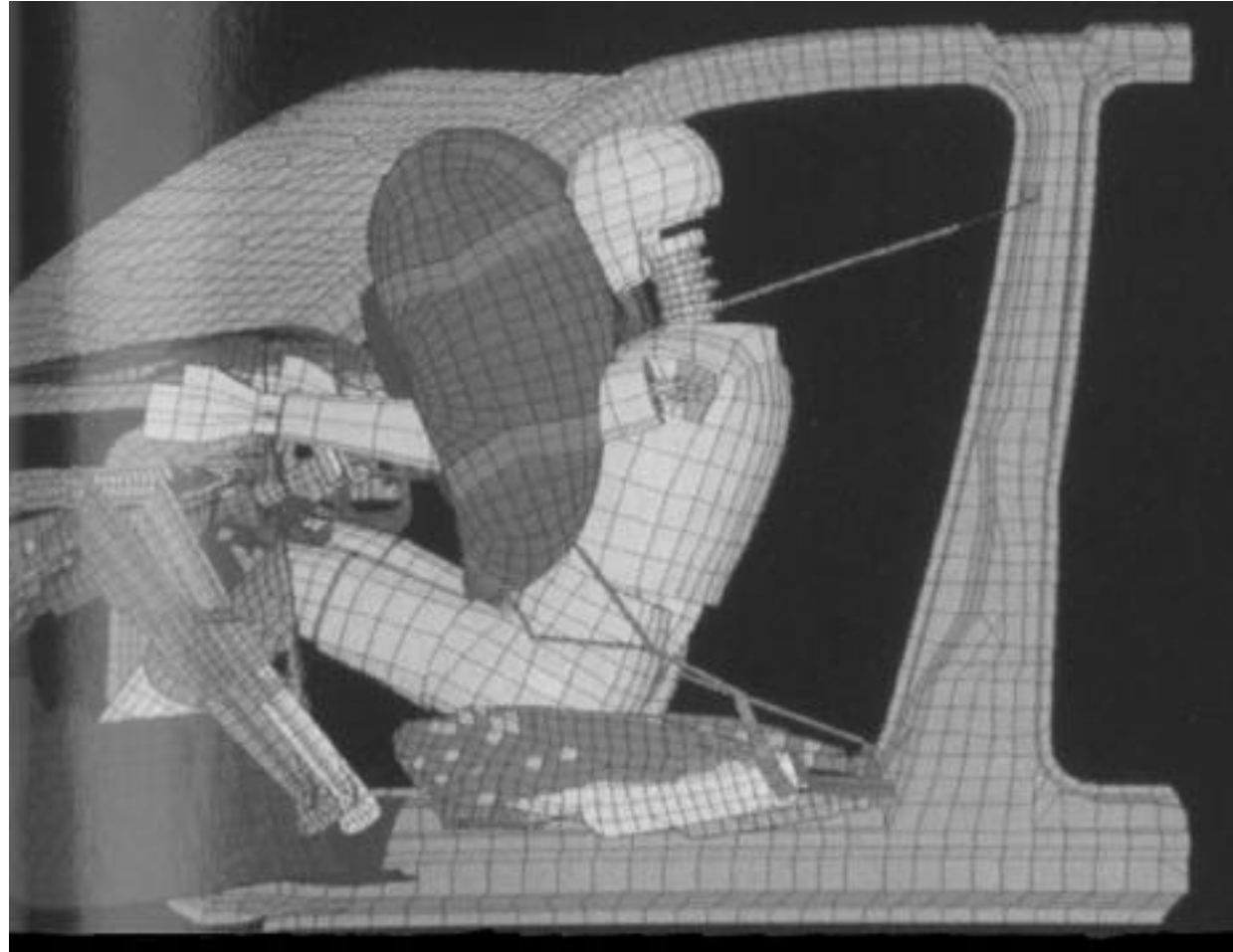


People don't sit still and behave
logically.

Real life crash conditions may not resemble
those in the crash laboratory.







Case 1



- **Case Vehicle: 1995 Ford Taurus**
- **Object Struck: Tree**
- **Impact Type: Offset Frontal (34% VOL)**
- **PDOF: 0**
- **CDC: 12FDEW3**
- **Direct Damage: 46 cm**
- **Max Crush: 81 cm**

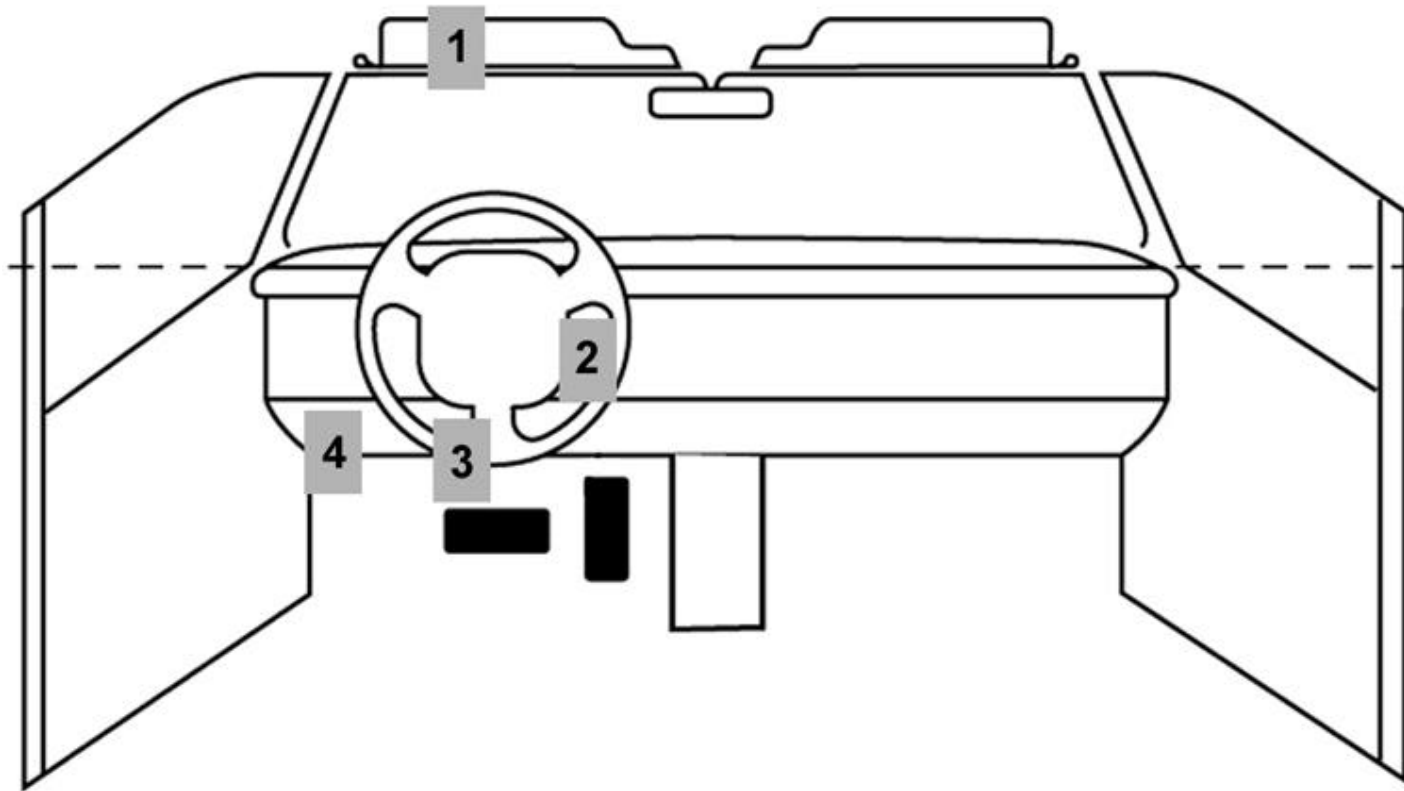






Case Vehicle: 1995 Ford Taurus

Object Struck: Tree



1 = Scuff mark and vanity mirror broken

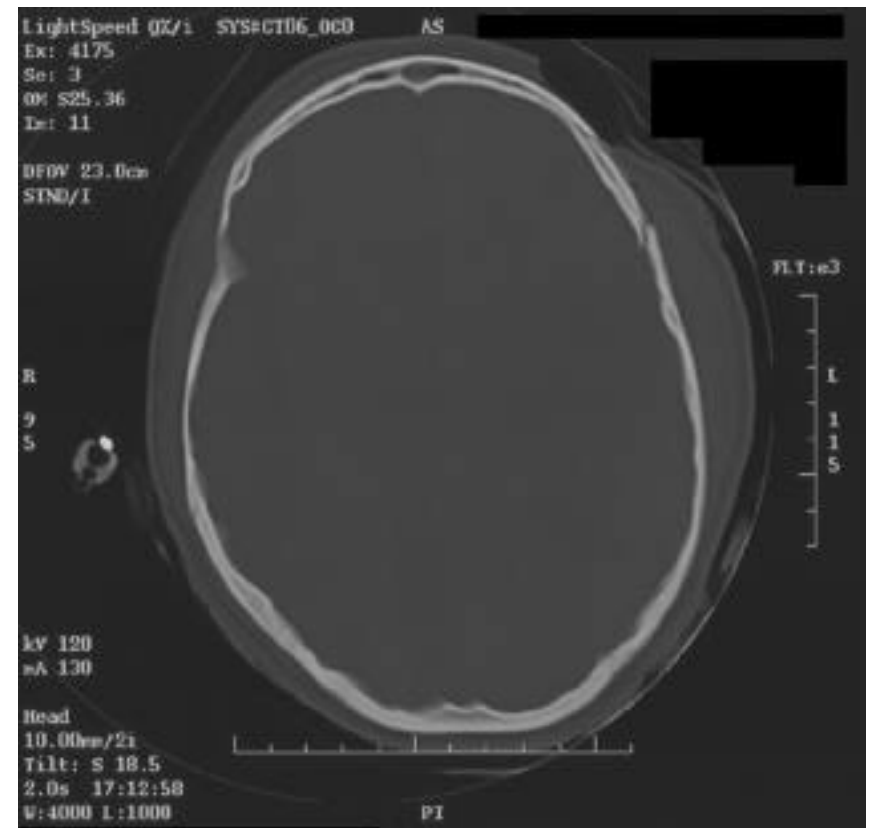
2 = Scuff mark, key top broken and blood deposit

3 = Visible dent

4 = Visible dent

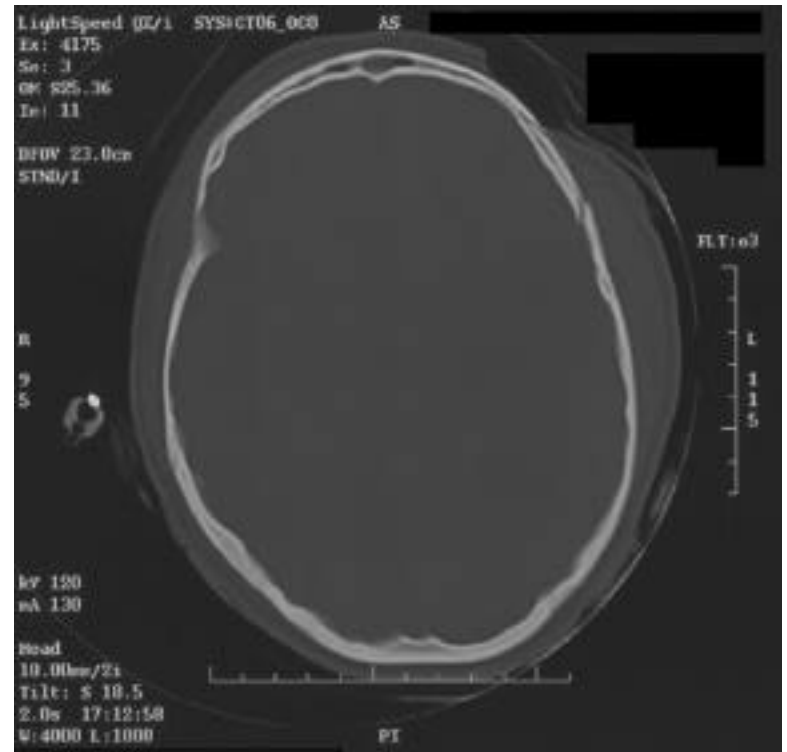


Left forehead laceration
Left frontal bone fracture
Soft tissue swelling















The population is comprised of a diverse collection of individuals.

There are few 50th percentile males.

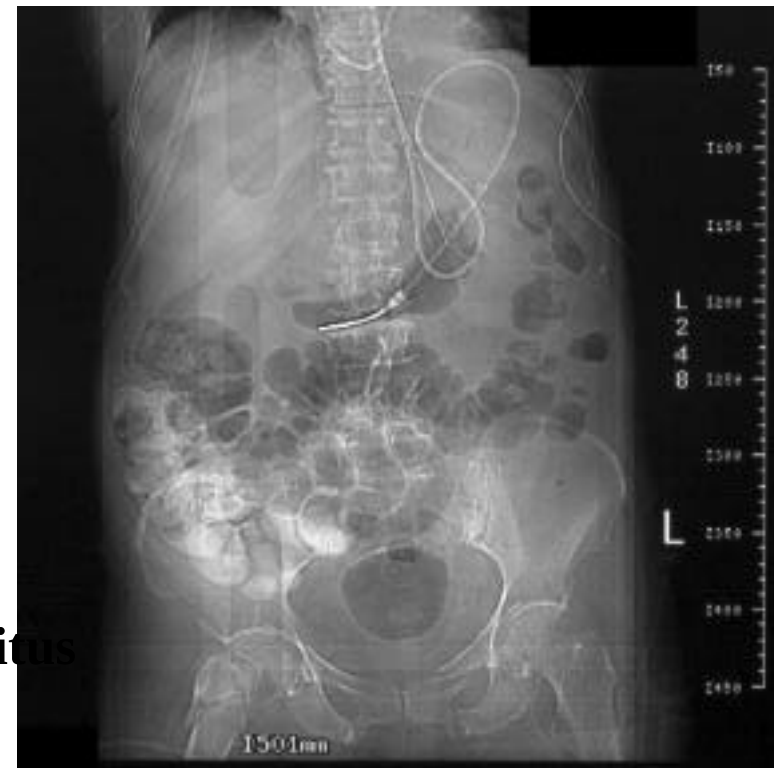
A

- Female, 165 cm, 77 kg
- Age = 27 years



B

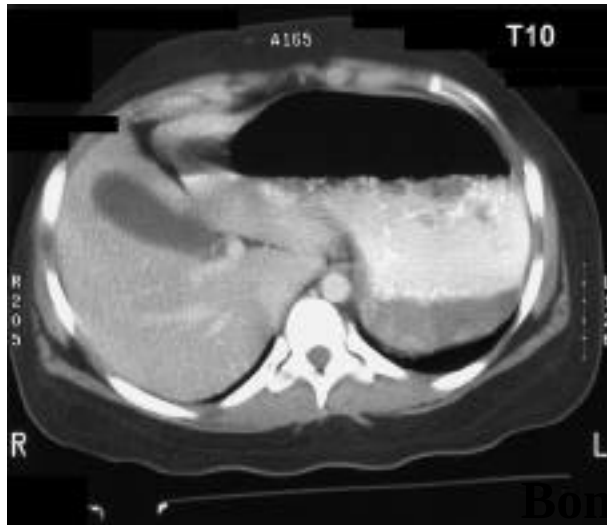
- Female, 165 cm, 78 kg
- Age = 78 years



Body Habitus

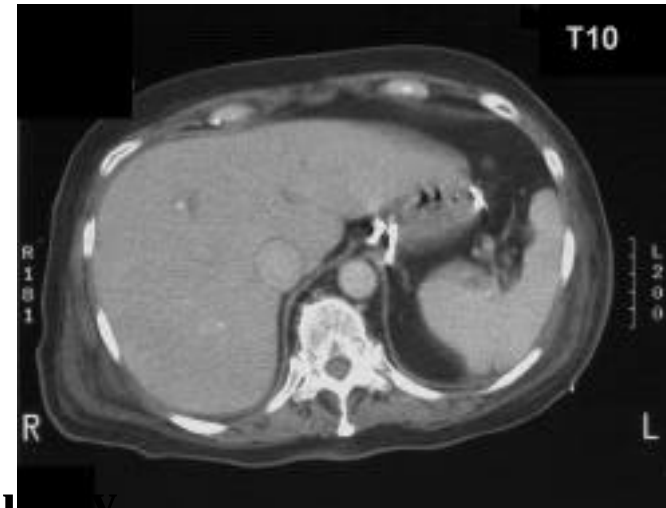
A

- Female, 165 cm, 77 kg
- Age = 27 years



B

- Female, 165 cm, 78 kg
- Age = 78 years



Bone density/quantity

C

- Female, 168 cm, 50 kg
- Age = 18 years



D

- Female, 165 cm, 49 kg
- Age = 72 years



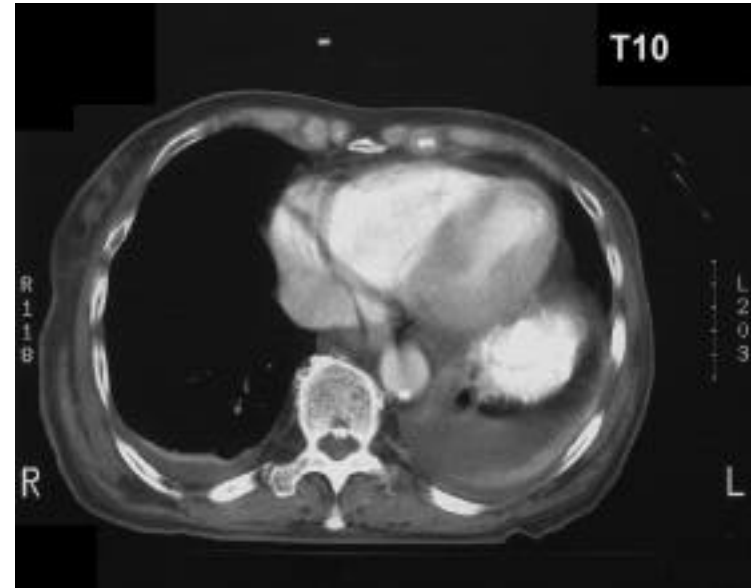
C

- Female, 168 cm, 50 kg
- Age = 18 years



D

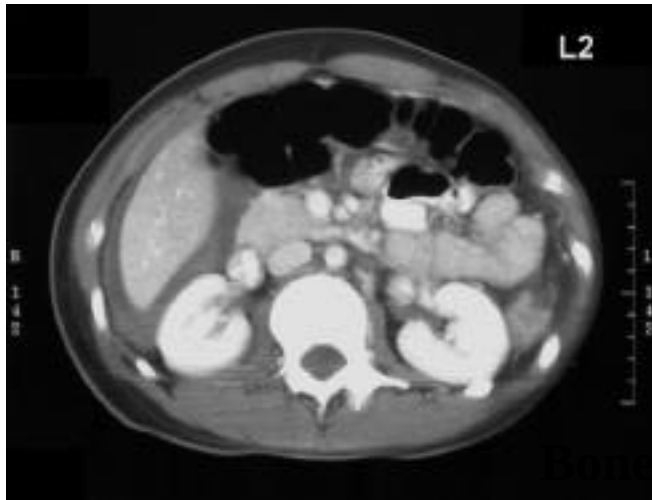
- Female, 165 cm, 49 kg
- Age = 72 years



Bone Density/Quality
Muscle Mass/Quality

C

- Female, 168 cm, 50 kg
- Age = 18 years



D

- Female, 165 cm, 49 kg
- Age = 72 years



Bone Density/Quantity
Muscle Mass/Quantity

E

- Male, 183 cm, 86 kg
- Age = 38 years



F

- Male, 183 cm, 80 kg
- Age = 79 years



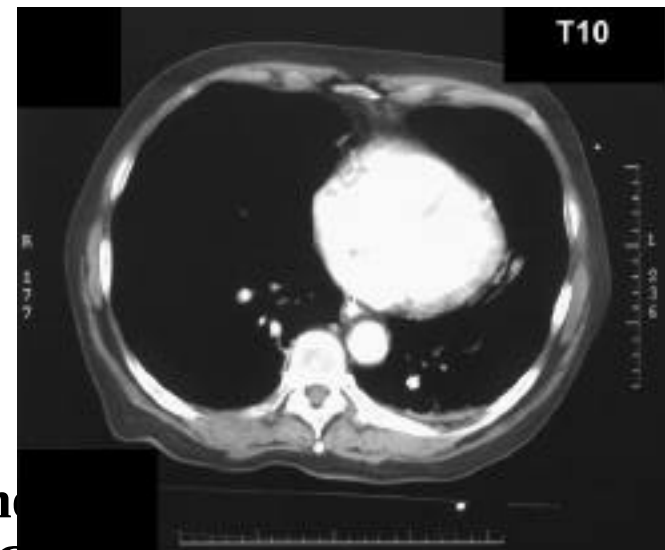
7A

- Male, 183 cm, 86 kg
- Age = 38 years



7B

- Male, 183 cm, 80 kg
- Age = 79 years



Bone Geom
le Mass/Quality

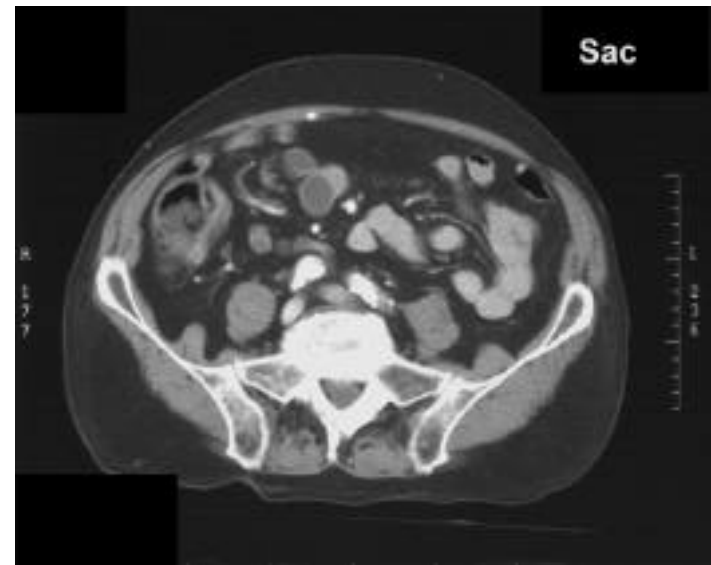
7A

- Male, 183 cm, 86 kg
- Age = 38 years



7B

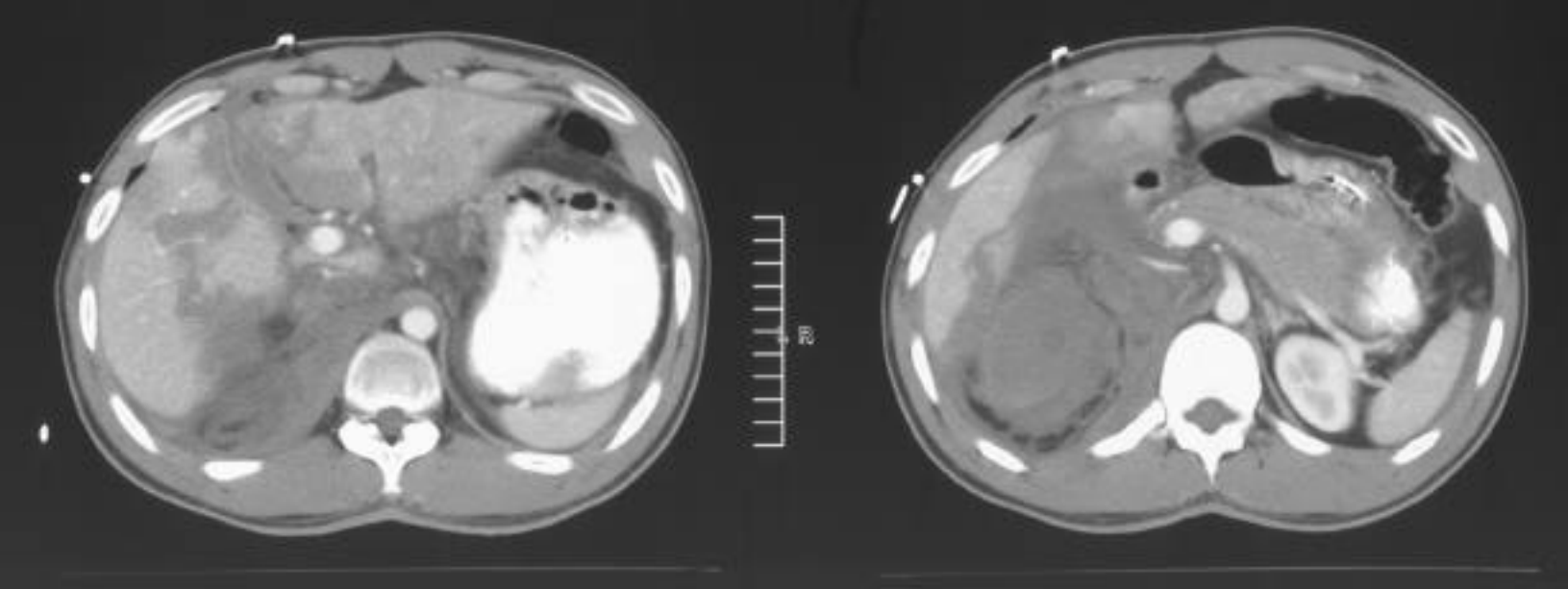
- Male, 183 cm, 80 kg
- Age = 79 years



Bone Density
Muscle Mass/Quality
Fat Mass/Distribution











H

- Male, 38, 178 cm
- Weight = 73 kg



G

- Male, 35, 180 cm
- Weight = 114 kg



Fat Mass/Distribution



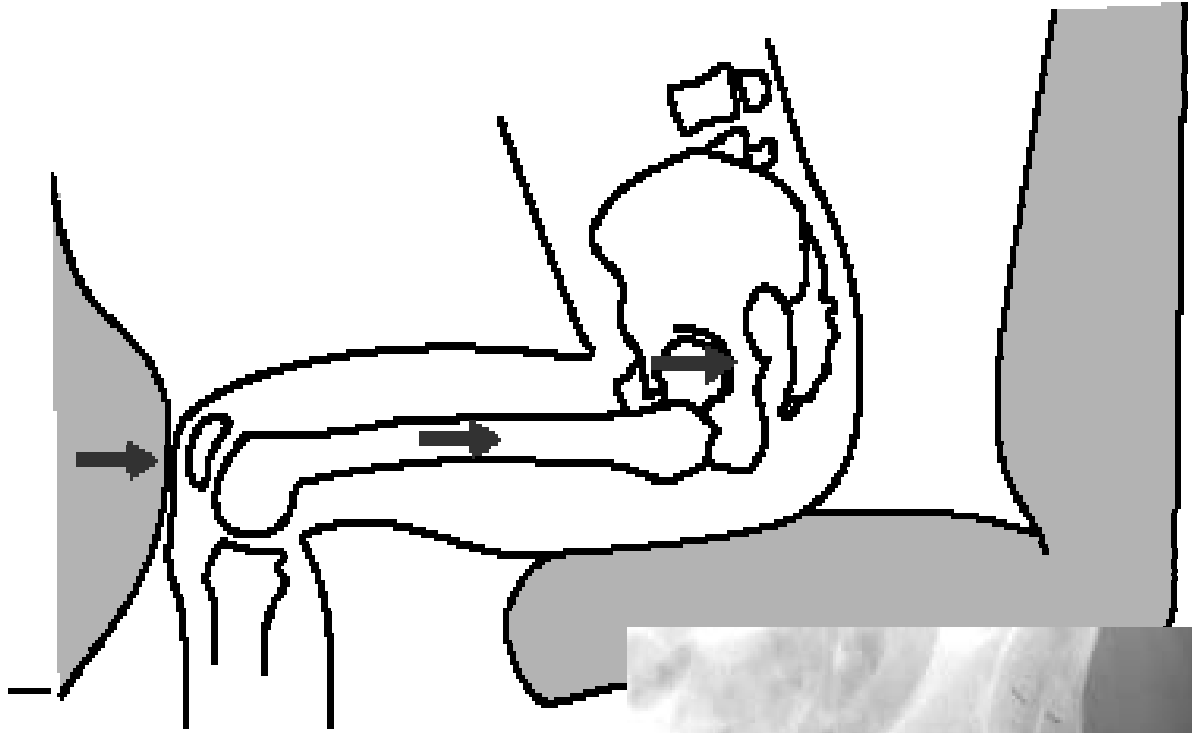
Safety systems effectiveness would be improved if they were tuned for the occupant, like skis for skiers and drugs for patients.

Lesson from medicine: Treat the patient, not the disease.

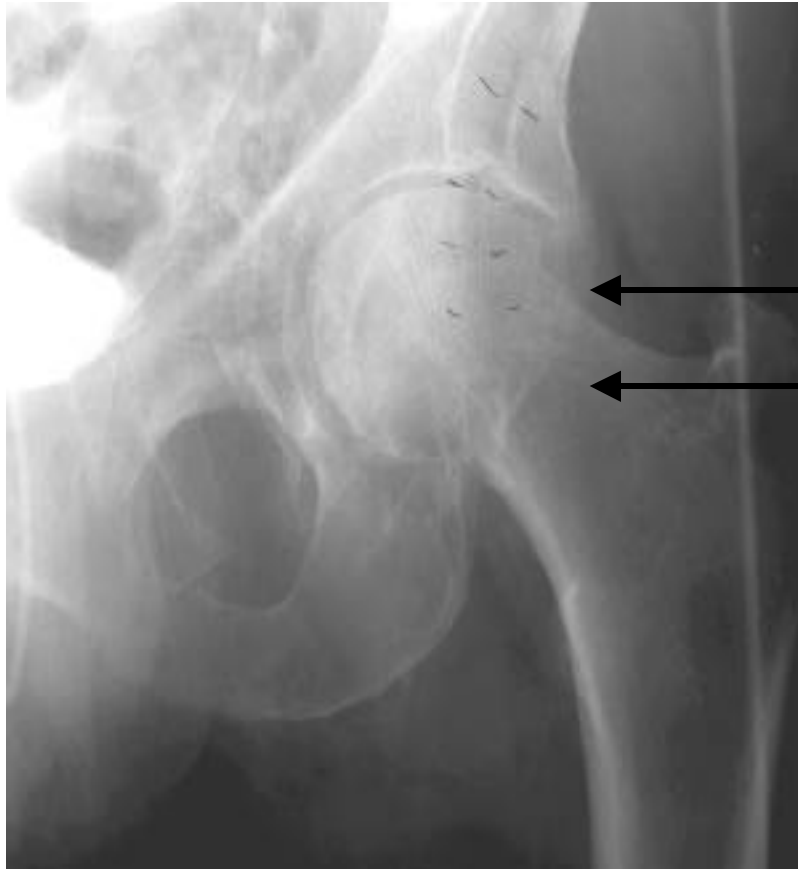
Treatment and prevention must be customized: surgery, chemotherapy, narcotics, antibiotics.

More lessons from medicine

- One can't cure or prevent every disease.
- Problems and solutions need to be prioritized.
- Each intervention has a different risk/benefit ratio.
- Short and long-term outcome of each intervention must be assessed.

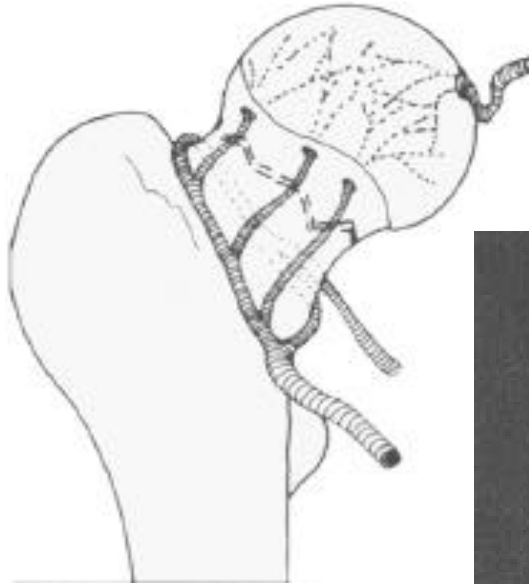






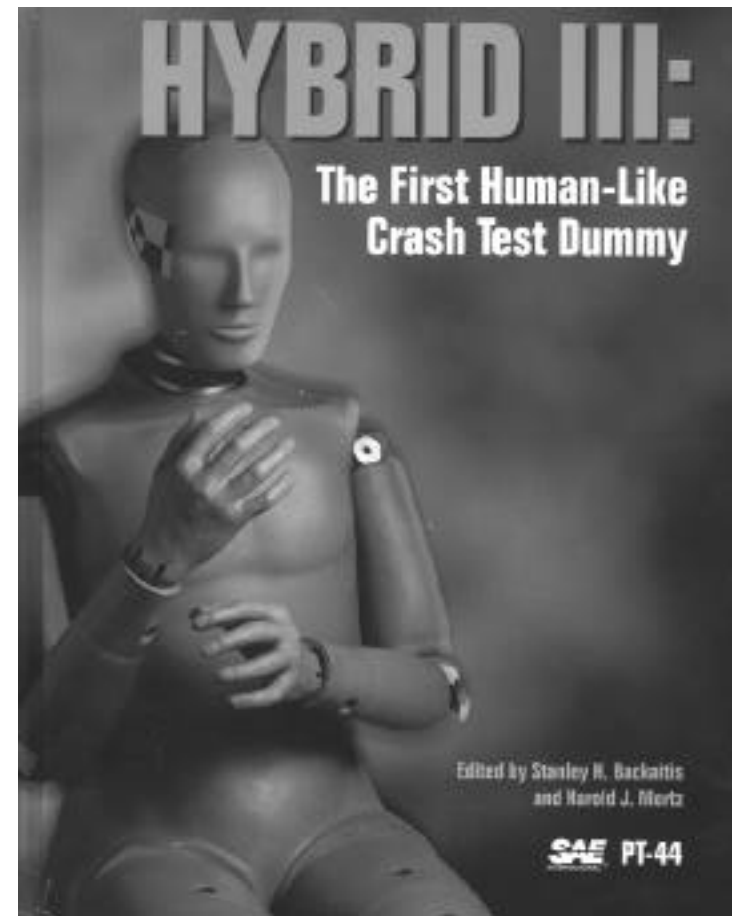






Automotive Safety

- Vehicles are safer than they have ever been.
- Laboratory testing has led to great improvements in safety.



Laboratory findings must be
validated with real life observations.

CIREN

- Thousands of data elements
- Detailed injury analysis
 - Severity
 - Source
 - Mechanism of injury.
- Medical specialists, automotive engineers, bioengineers, crash investigators...



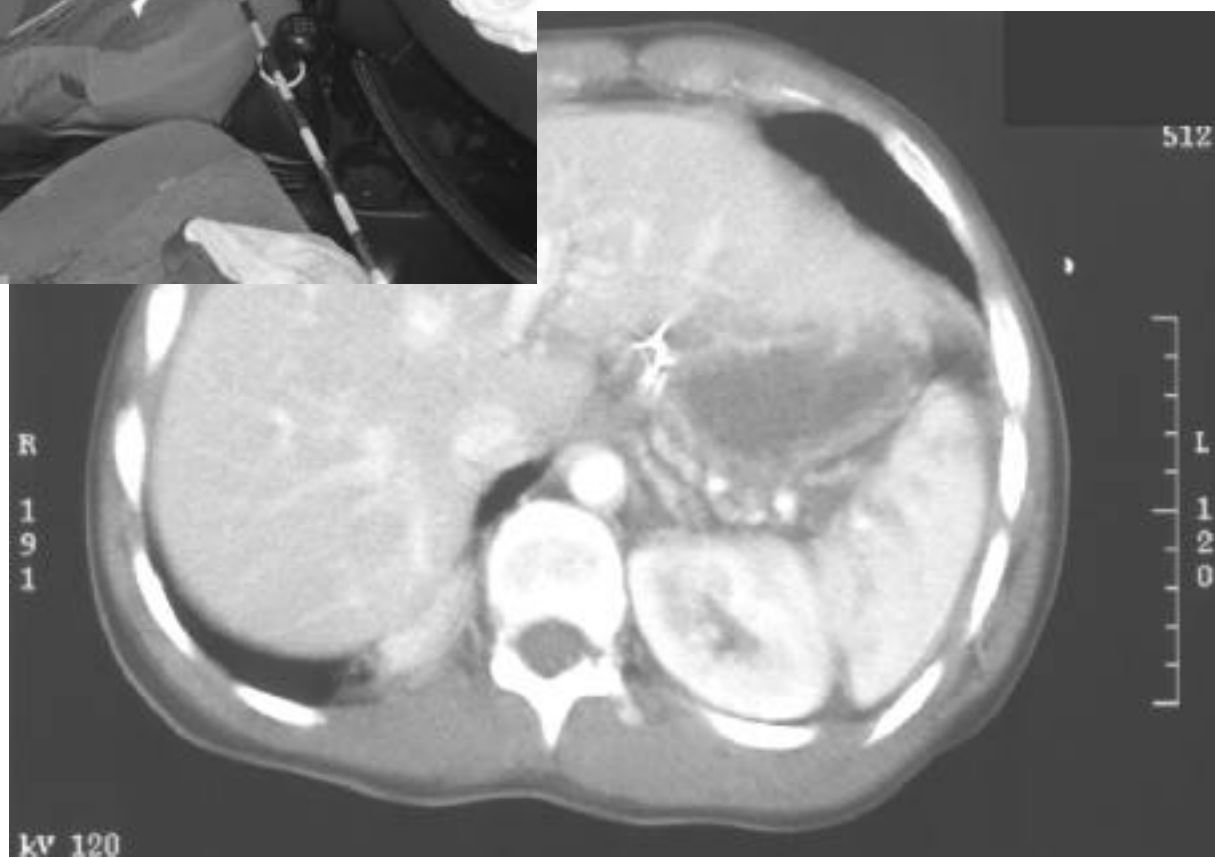




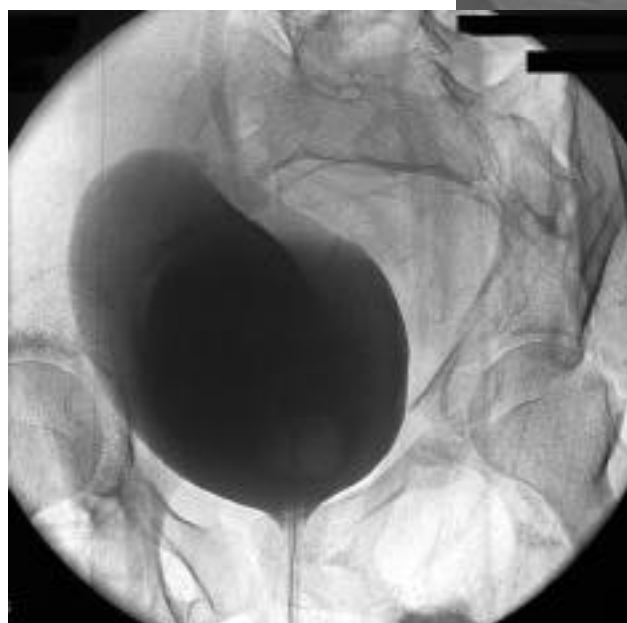














It's difficult to solve a problem without understanding its mechanism.

Typhoid

Polio

Smallpox





There is nothing permanent except change.

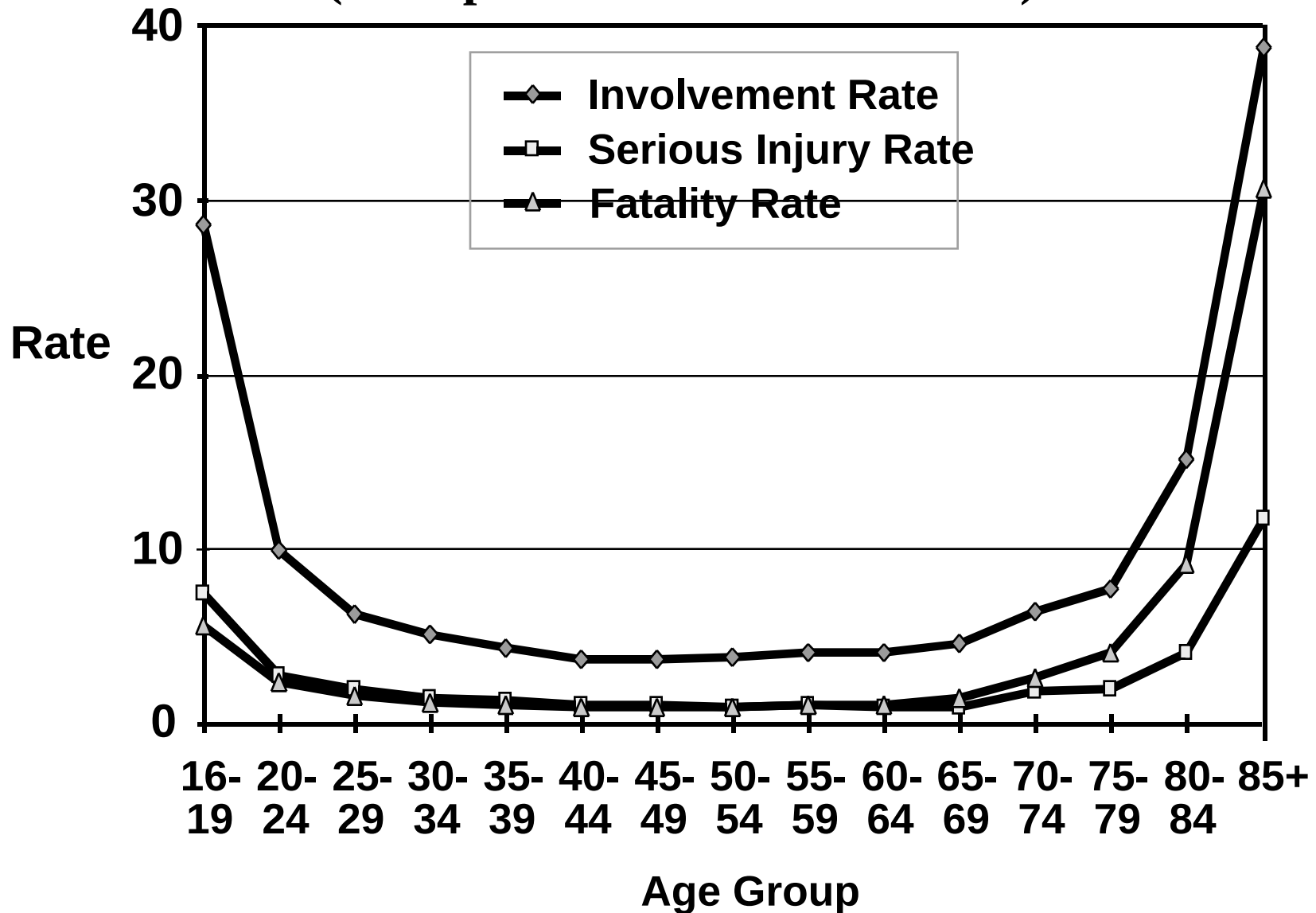
Heraclitus

“The only steady state is death.”

Increase in the Number and Percentage of Older People



Involveent, Injury, and Fatality Rates (rates per vehicle miles of travel)



Vehicle fleet changes as truck sales increase



Vehicle Incompatibility:
Mass, Stiffness, Geometry



In a changing world

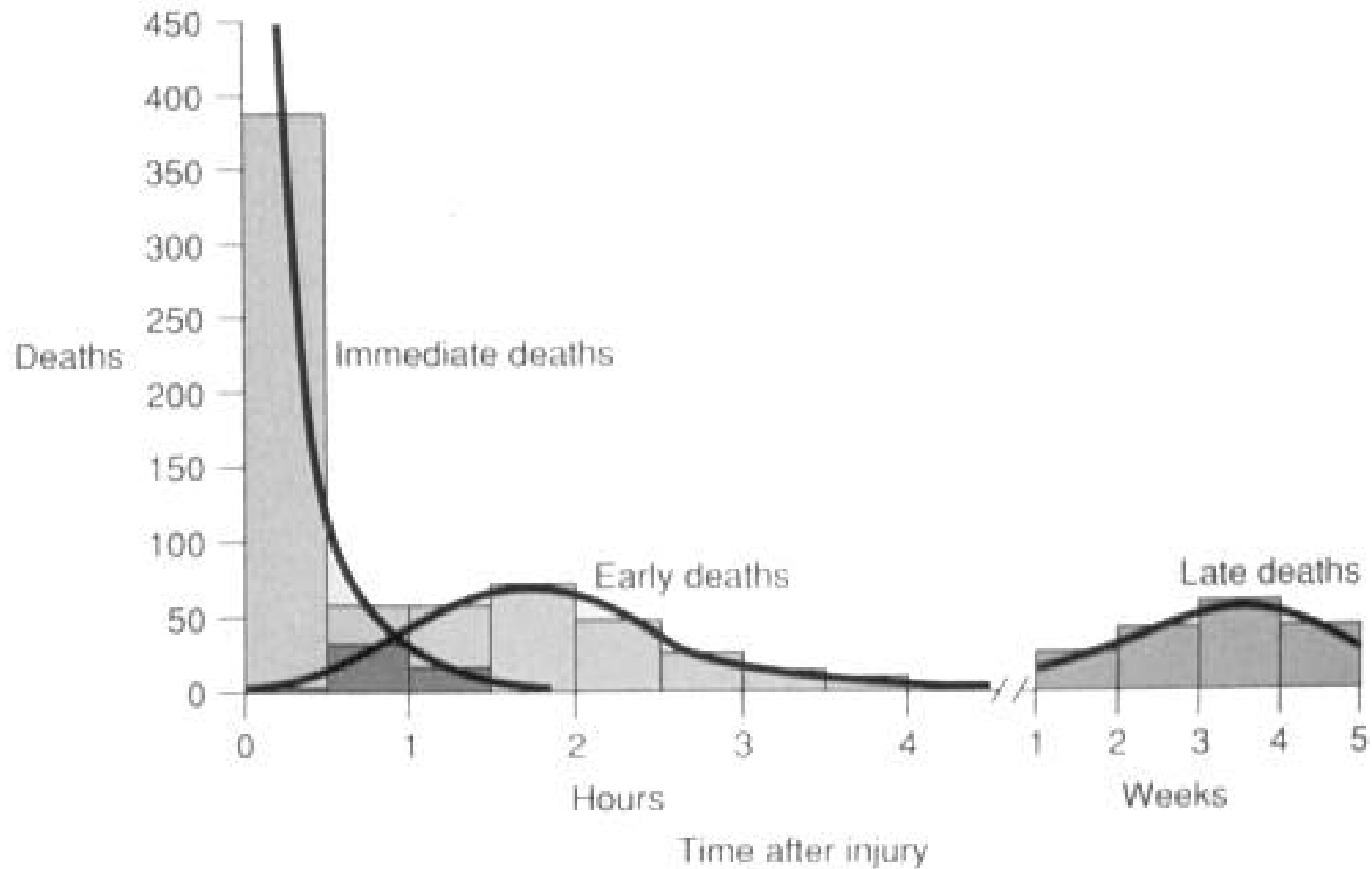
- Real-life human data is irreplaceable.
- Reality checks are absolutely essential since all assumptions/approximations are suspect.
- *Golden opportunity at present with the recent introduction of innovative safety systems.*

Time is of the essence!

To save injured people.
To make cars safer.



Trauma Deaths



When time is of the essence,
Communication is critical.



OnStar
On Board



Trauma Deaths

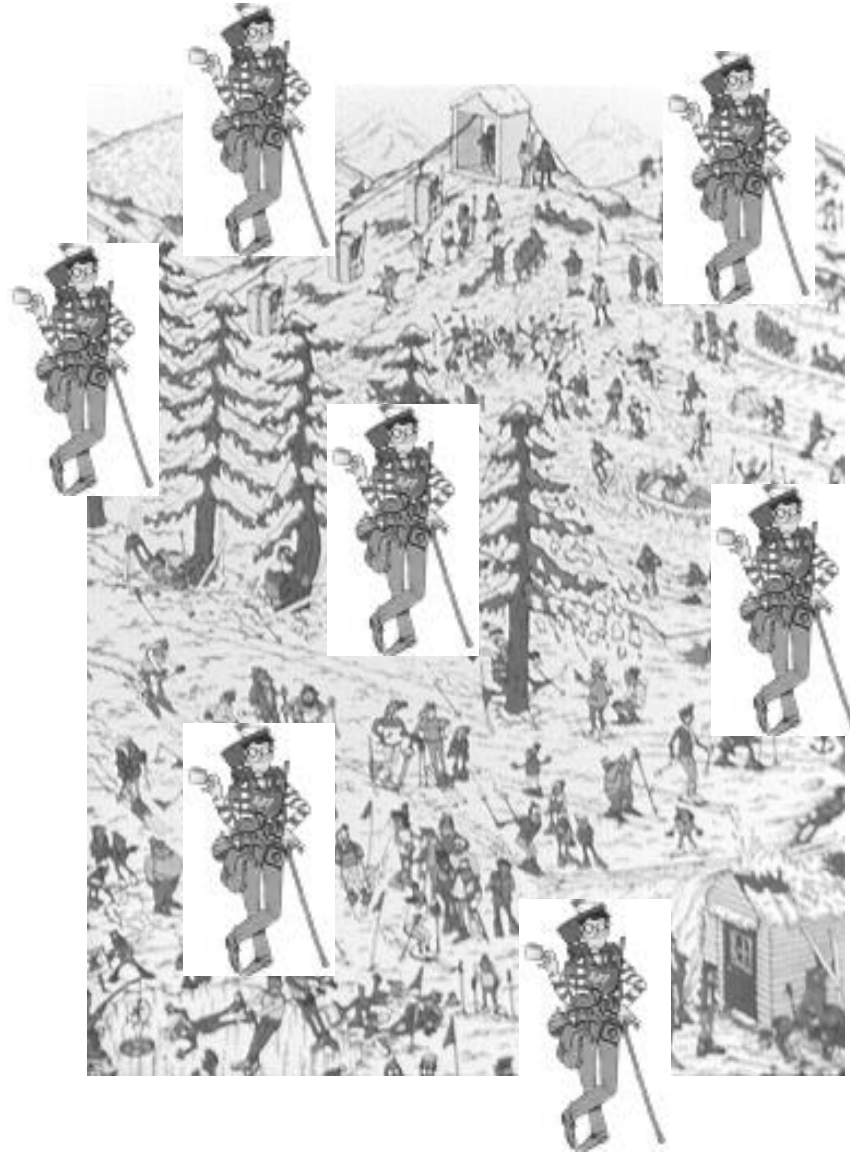
- There are many ways to die:

Airway - face, neck

Breathing - lung, chest wall

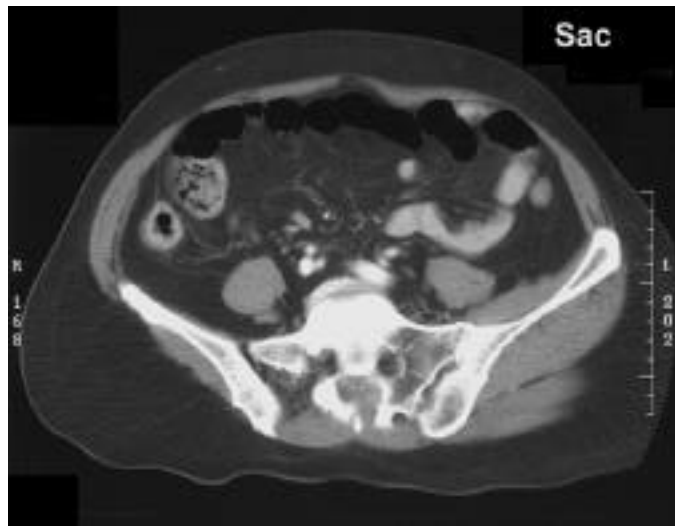
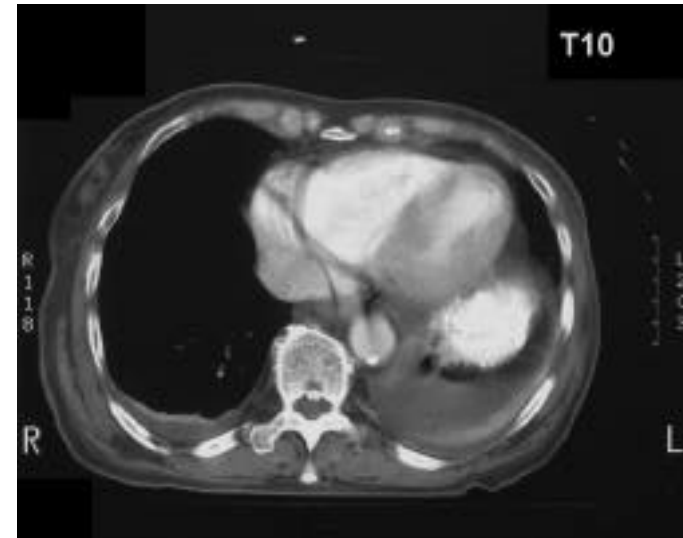
Circulation - heart, blood vessels, organs

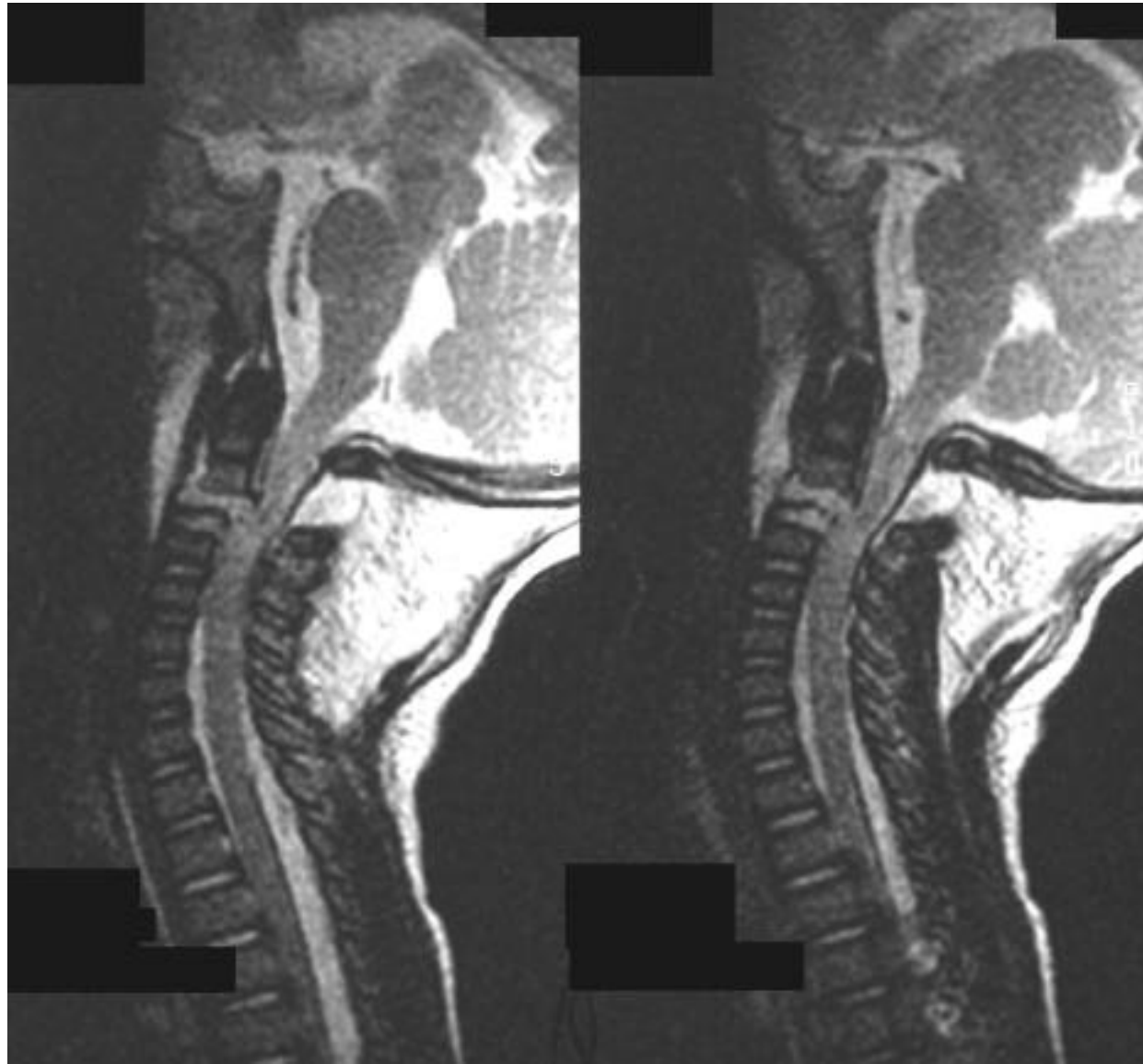


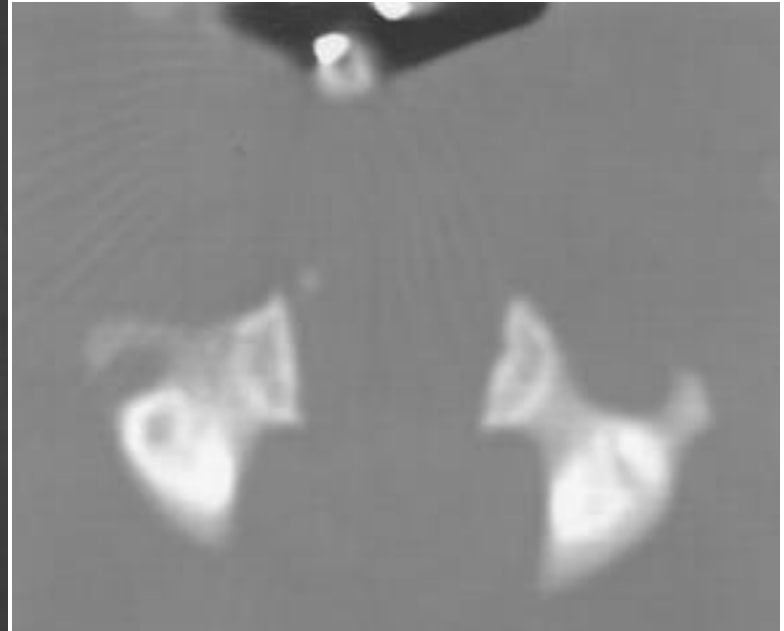
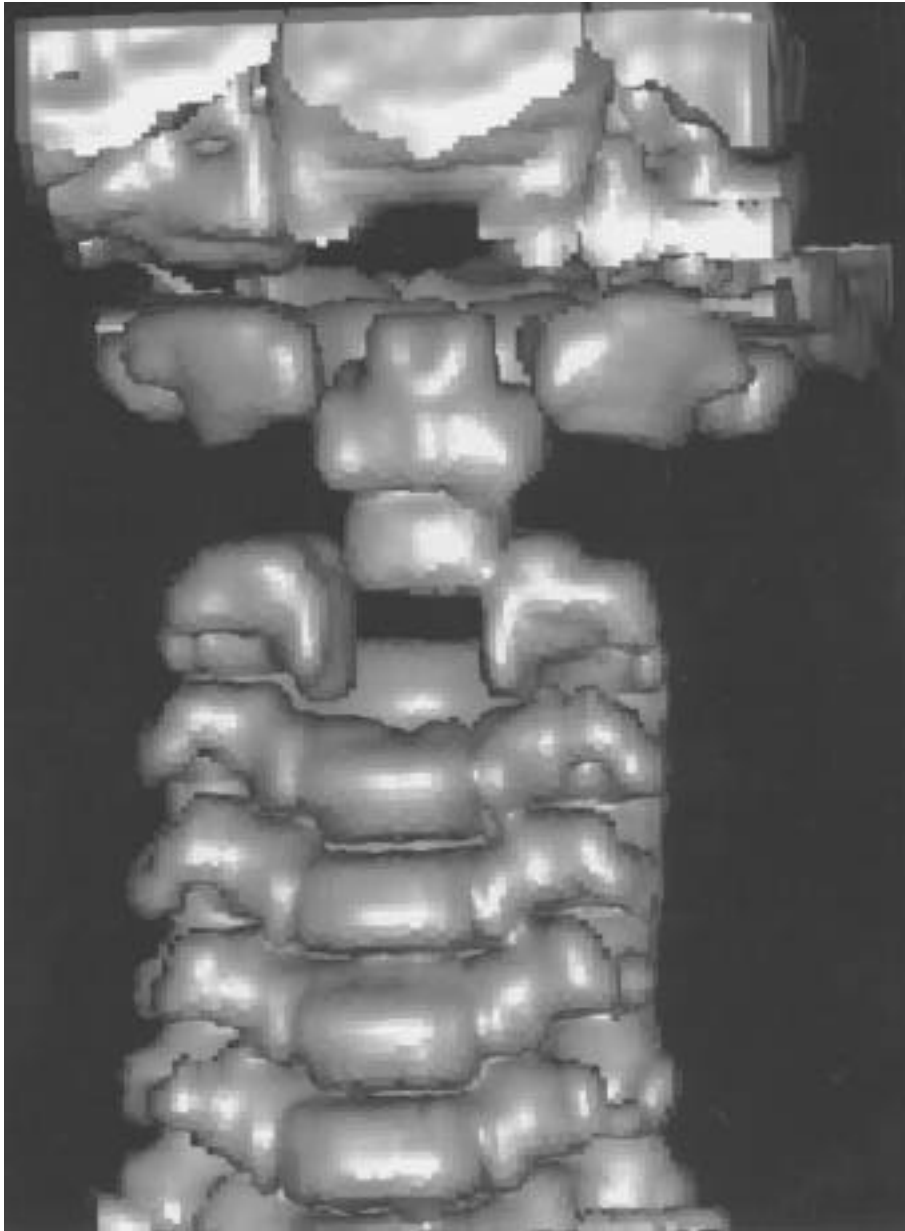














Golden Hour

Notification

Extrication & Transport

Resuscitation

Diagnostic Evaluation

Treatment

Record of the occupant's body's response to the crash.

Anatomic detail, three dimensional.

CIREN subjects are real-life crash dummies.

CIREN

- Engineers, physicians, crash investigators, regulators.....
- Thousands of data elements
- Detailed injury analysis
 - Severity
 - Source
 - Mechanism of injury

CIREN



Not only data....but mutual
understanding and communication...
People working together to save people.

CIREN Network

