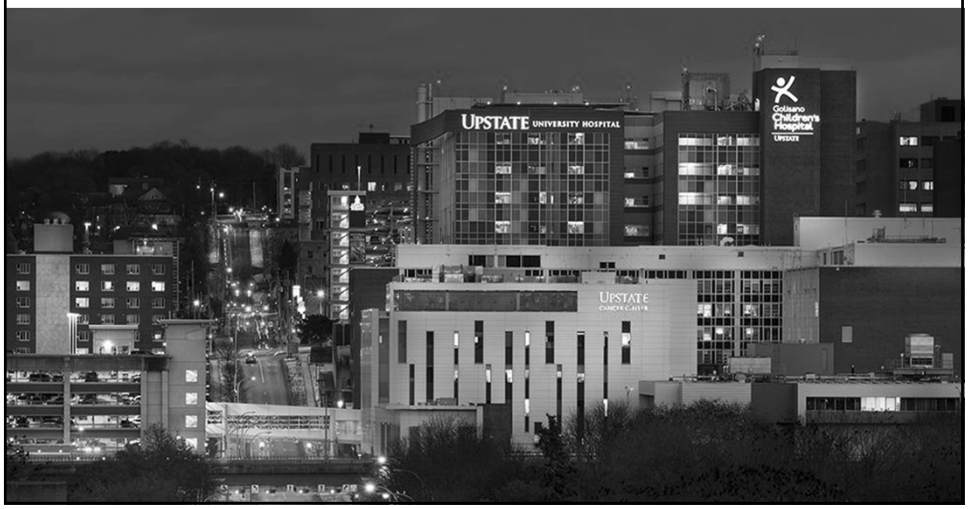
Behind the Mechanism of Injury



1

Objectives

- The participant will be able to compare and contrast the current Trauma Patient Destination Protocol with the American College of Surgeons Committee on Trauma's National Guideline for the Field Triage of Injured Patients
- The participant will be able to describe injury patterns associated with the mechanisms of injury found the Field Triage guidelines

2

Trauma is the leading cause of **death** for individuals up to the age of 45 years

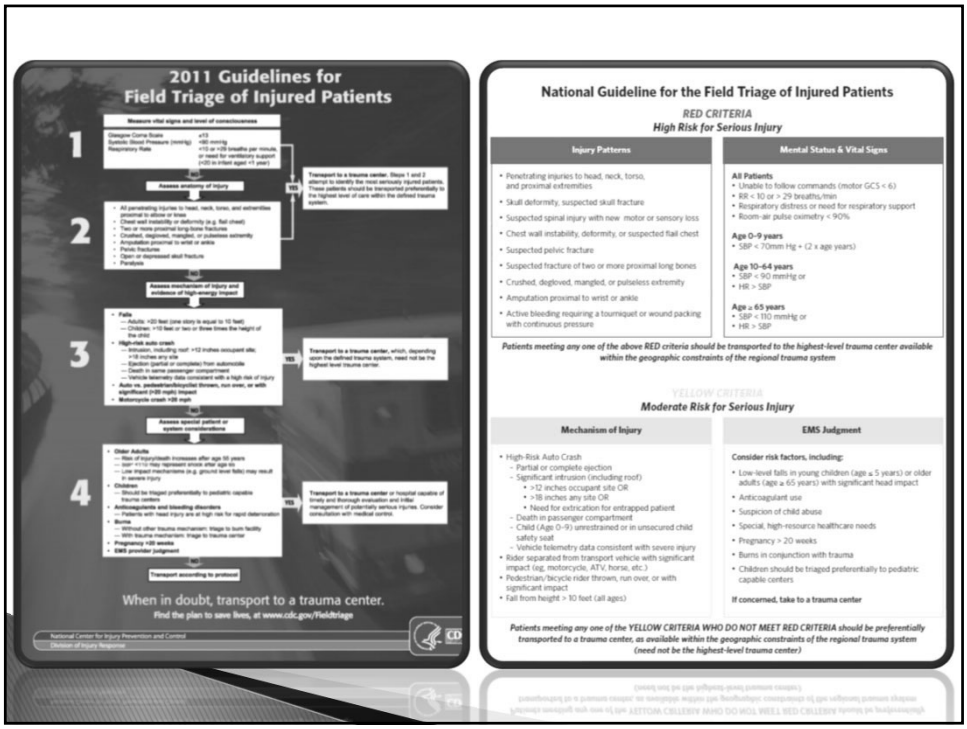
Trauma is the fourth leading cause of **death** overall for all ages.

3

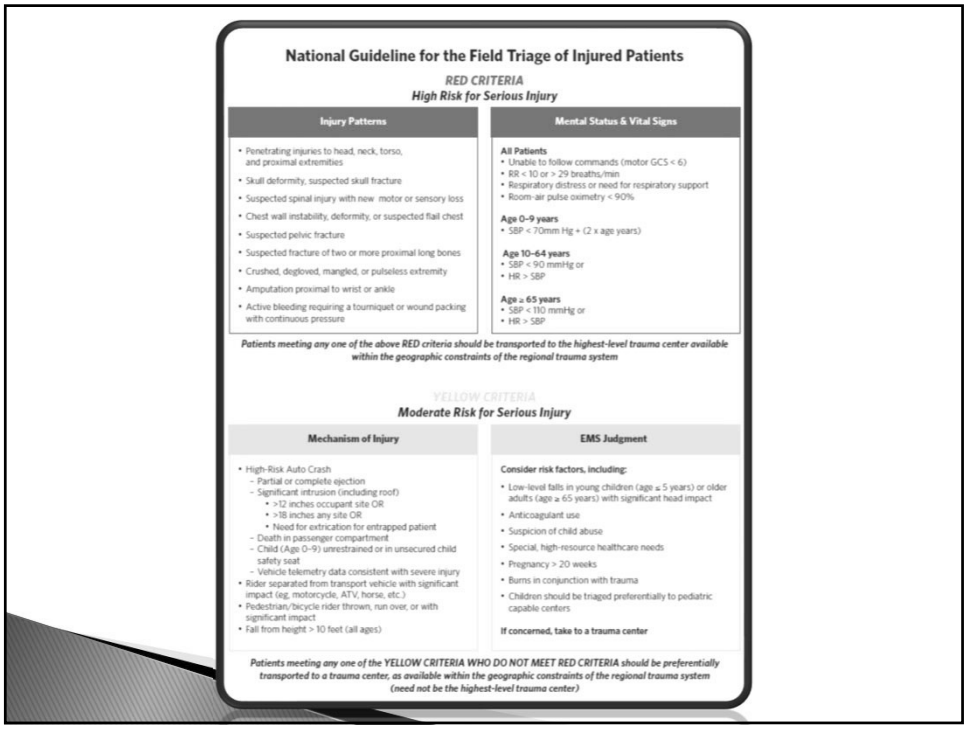
Trauma Patient Destination Protocol

Adult and Pediatric Patients

4


2011 Guidelines for
Field Triage of Injured Patients
When in doubt, transport to a trauma center.
Find the plan to save lives, at www.cdc.gov/fieldtriage
National Guideline for the Field Triage of Injured Patients
RED CRITERIA
High Risk for Serious Injury
Injury Patterns
Mental Status & Vital Signs
Patients meeting any one of the above RED criteria should be transported to the highest-level trauma center available within the geographic constraints of the regional trauma system
YELLOW CRITERIA
Moderate Risk for Serious Injury
Mechanism of Injury
EMS Judgment
Patients meeting any one of the YELLOW CRITERIA WHO DO NOT MEET RED CRITERIA should be preferentially transported to a trauma center, as available within the geographic constraints of the regional trauma system (need not be the highest-level trauma center)

5


National Guideline for the Field Triage of Injured Patients
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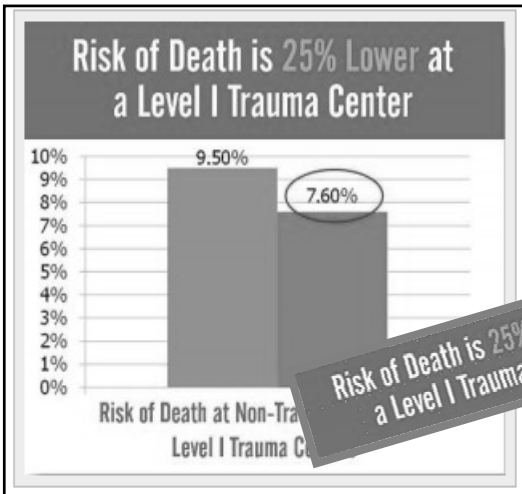
6



A study published in the Jan. 26, 2006 issue of *The New England Journal of Medicine* evaluated the records of patients (ages 18 to 84) with moderate to severe injuries, comparing the mortality outcomes of those t[illegible]ed in Level I trauma [illegible]3 hospitals to those [illegible]-trauma centers at 51 hospitals. After adjustment for differences in the case mix, the National Study on the Costs and Outcomes of Trauma (NSCOT), showed that overall risk of death was 25 percent lower when care was provided at a Level I trauma center than when it was provided at a non-trauma center. Besides demonstrating improved survivability in Level I trauma centers, the study also supports the case for continued efforts at regionalized trauma systems.

7

Impact of Trauma Center Designation on Outcomes: Is There a Difference Between Level I and Level II Trauma Centers?

Laurent G. Glance, MD, Turner M. Osler, MD, FACS, Dana B. Mukamel, PhD, Andrew W. Dick, PhD

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Abstract | Full Text | Images | References

Background

Within organized trauma systems, both Level I and Level II trauma centers are expected to have the resources to treat patients with major multisystem trauma. The evidence supporting separate designations for Level I and Level II trauma centers is inconclusive. The objective of this study was to compare mortality and complications for injured patients admitted to Level I and Level II trauma centers.

Study Design

Using data from the Pennsylvania Trauma Outcomes Study registry, we performed a retrospective observational study of 208,866 patients admitted to 28 Level I and Level II trauma centers between 2000 and 2009. Regression modeling was used to estimate the association between patient outcomes and trauma center designation, after controlling for injury severity, mechanism of injury, transfer status, and physiology.

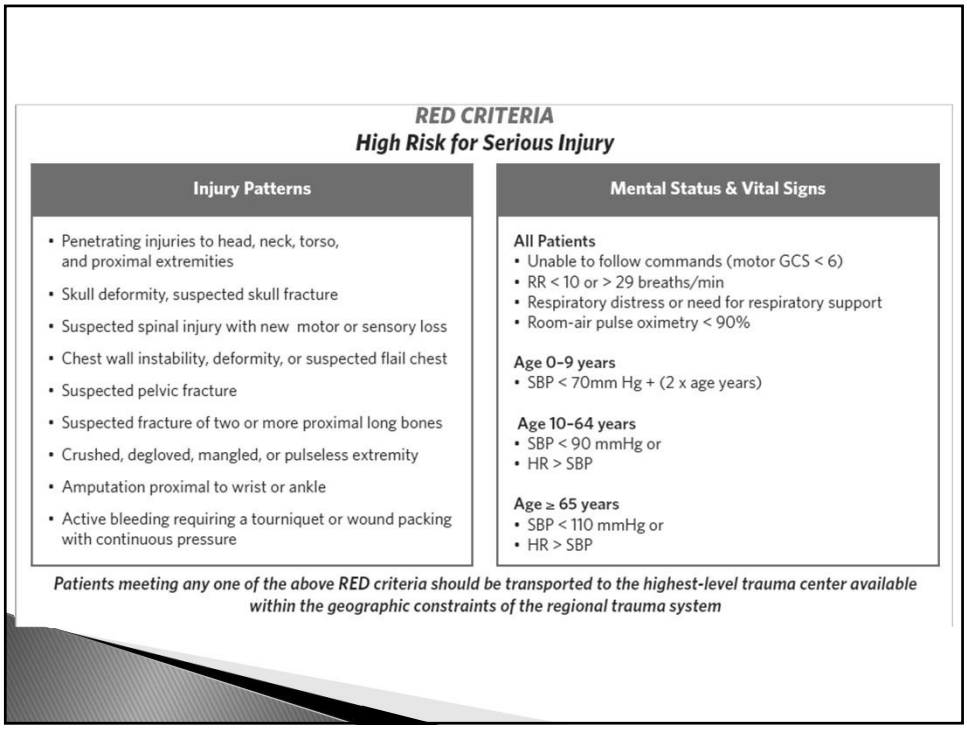
Results

Patients admitted to Level I trauma centers had a 15% lower odds of mortality (adjusted odds ratio [adj OR] 0.85; 95% CI 0.72 to 0.99) and a 36% increased odds of complications (adj OR 1.37, 95% CI 1.04 to 1.79). The survival benefit associated with admission to Level I centers was strongest in patients with very severe injuries (Injury Severity Score [ISS] ≥ 25; adj OR 0.78; 95% CI 0.64 to 0.95). Less severely injured patients with an ISS < 9 (adj OR 0.91; 95% CI 0.64 to 1.30) and with an ISS between 9 and 15 (adj OR 0.98; 95% CI 0.81 to 1.18) had similar risks of mortality in Level I and Level II trauma centers.

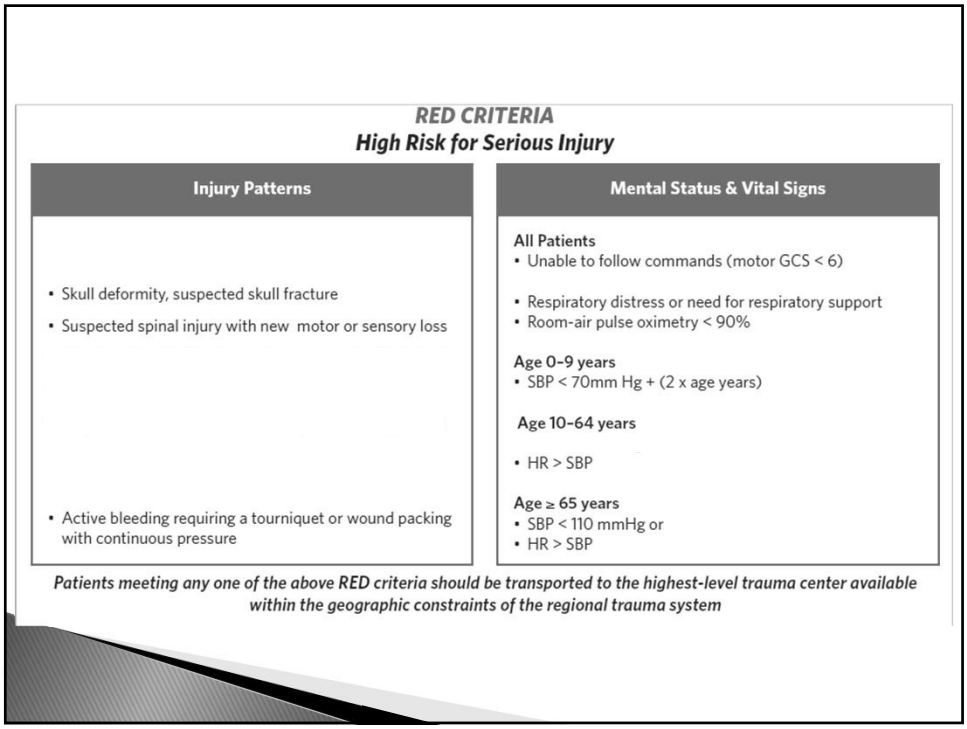
Conclusions

Severely injured patients admitted to Level I trauma centers have a lower risk of mortality compared with patients admitted to Level II centers. These findings support the continuation of a 2-tiered designation system for trauma.

8


RED CRITERIA
High Risk for Serious Injury
Injury Patterns
• Penetrating injuries to head, neck, torso, and proximal extremities
• Skull deformity, suspected skull fracture
• Suspected spinal injury with new motor or sensory loss
• Chest wall instability, deformity, or suspected flail chest
• Suspected pelvic fracture
• Suspected fracture of two or more proximal long bones
• Crushed, degloved, mangled, or pulseless extremity
• Amputation proximal to wrist or ankle
• Active bleeding requiring a tourniquet or wound packing with continuous pressure
Mental Status & Vital Signs
All Patients
• Unable to follow commands (motor GCS < 6)
• RR < 10 or > 29 breaths/min
• Respiratory distress or need for respiratory support
• Room-air pulse oximetry < 90%
Age 0–9 years
• SBP < 70mm Hg + (2 x age years)
Age 10–64 years
• SBP < 90 mmHg or
• HR > SBP
Age ≥ 65 years
• SBP < 110 mmHg or
• HR > SBP
Patients meeting any one of the above RED criteria should be transported to the highest-level trauma center available within the geographic constraints of the regional trauma system

9


RED CRITERIA
High Risk for Serious Injury
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• Skull deformity, suspected skull fracture
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• Active bleeding requiring a tourniquet or wound packing with continuous pressure
Mental Status & Vital Signs
All Patients
• Unable to follow commands (motor GCS < 6)
• Respiratory distress or need for respiratory support
• Room-air pulse oximetry < 90%
Age 0–9 years
• SBP < 70mm Hg + (2 x age years)
Age 10–64 years
• HR > SBP
Age ≥ 65 years
• SBP < 110 mmHg or
• HR > SBP
Patients meeting any one of the above RED criteria should be transported to the highest-level trauma center available within the geographic constraints of the regional trauma system

10

Penetrating Trauma

Head, neck, torso and proximal extremities

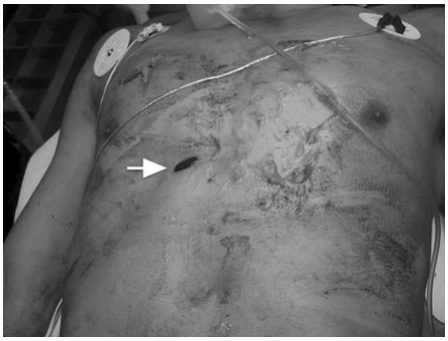
11

Case Scenario

- Your patient mistakenly brought a knife to a gun fight
- There are two wounds present, one gun shot and one stab wound
- The wounds have the exact same location, diameter, depth of penetration and trajectory?
- Which wound has the higher risk?

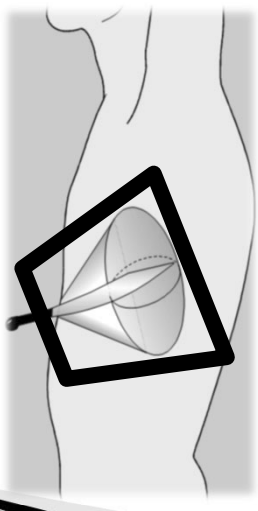
12

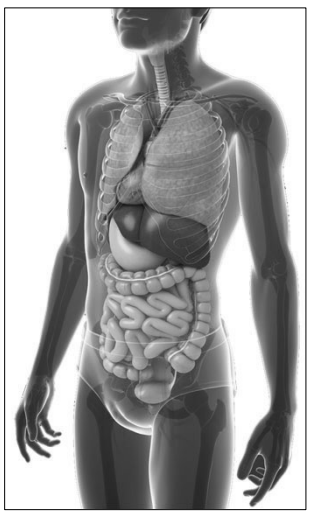
Low Velocity



13

Cone of Damage

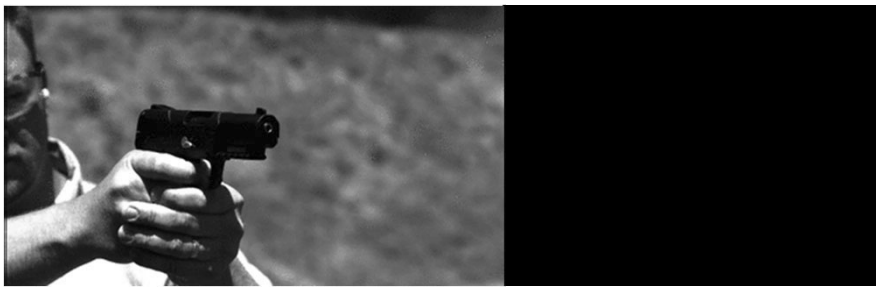




14

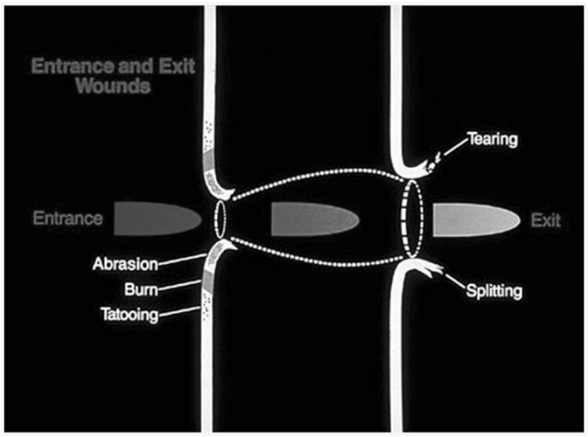
Medium to High Velocity

15



16

Gunshot Wound



17

Tumble

18

Shock Index

- Equals Heart Rate / Systolic Blood Pressure
- Has been studied in patients at risk for shock or experiencing shock from a variety of causes (including trauma and hemorrhage)
- Heart Rate and Systolic Blood Pressure have traditionally been used to characterize shock
  - Problem: Often appear normal in compensated shock
  - Can be confounded by factors such as medications (i.e. antihypertensives, beta-agonists)
- Shock Index >1.0 predicts increased risk of mortality and other markers of morbidity such as need for massive transfusion and ICU admission

Koch E, Lovett S, Nghiem T, Riggs RA, Rech MA. Shock index in the emergency department: utility and limitations. Open Access Emerg Med. 2019 Aug 14;11:179-199.

19

Shock Index = HR/SBP

- Patient has BP 120/80 with a HR of 80
  - 80/120 = 0.6
- Patient has BP 90/60 with HR of 110
  - 110/90 = 1.2

20

Geriatric BP < 110 mm Hg

- Predicts shock equally well as systolic BP of less than 90 mm Hg
- Risk of mortality is similar when compared to systolic BP < 90 mm Hg in non-geriatric patients
- Significantly reduces under-triage rates in geriatric patients
- For these reasons, has been moved to high risk category

Eurzq#ME#Thvwulqj#P O#Iruv|wkh#JP /#nw#bd#
V|vwrdf#eorrg#suhvvxuh#fulwhuld#q#wkh#Qdwrqdd#
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443#v#wkh#qhz #k31#Wkh#Mrxuqdd#ri#Wudxp d#lqg#
Dfxwh#Fduh#Vxujhu|1#5348#The >;+5,=685068<1

21

YELLOW CRITERIA

Moderate Risk for Serious Injury

Mechanism of Injury	EMS Judgment
• High-Risk Auto Crash – Partial or complete ejection – Significant intrusion (including roof) • >12 inches occupant site OR • >18 inches any site OR • Need for extrication for entrapped patient – Death in passenger compartment – Child (Age 0–9) unrestrained or in unsecured child safety seat – Vehicle telemetry data consistent with severe injury • Rider separated from transport vehicle with significant impact (eg, motorcycle, ATV, horse, etc.) • Pedestrian/bicycle rider thrown, run over, or with significant impact • Fall from height > 10 feet (all ages)	**Consider risk factors, including:** • Low-level falls in young children (age ≤ 5 years) or older adults (age ≥ 65 years) with significant head impact • Anticoagulant use • Suspicion of child abuse • Special, high-resource healthcare needs • Pregnancy > 20 weeks • Burns in conjunction with trauma • Children should be triaged preferentially to pediatric capable centers **If concerned, take to a trauma center**

Patients meeting any one of the YELLOW CRITERIA WHO DO NOT MEET RED CRITERIA should be preferentially transported to a trauma center, as available within the geographic constraints of the regional trauma system (need not be the highest-level trauma center)

22

YELLOW CRITERIA
Moderate Risk for Serious Injury

Mechanism of Injury	EMS Judgment
• High-Risk Auto Crash • Need for extrication for entrapped patient – Child (Age 0–9) unrestrained or in unsecured child safety seat • Rider separated from transport vehicle with significant impact (eg, motorcycle, ATV, horse, etc.) • Pedestrian/bicycle rider thrown, run over, or with significant impact • Fall from height > 10 feet (all ages)	**Consider risk factors, including:** • Low-level falls in young children (age ≤ 5 years) or older adults (age ≥ 65 years) with significant head impact • Suspicion of child abuse • Special, high-resource healthcare needs

Patients meeting any one of the YELLOW CRITERIA WHO DO NOT MEET RED CRITERIA should be preferentially transported to a trauma center, as available within the geographic constraints of the regional trauma system (need not be the highest-level trauma center)

23

TRAUMA REACH 2023
GIVEAWAY REQUEST FORM

https://www.surveymonkey.com/r/TREACH2023_GIVEAWAY

24

High-Risk Auto Crash

Significant intrusion or need for extrication

25

Frontal Impact

26

Up and Over Pathway

- Head
- Spine
- Chest
  - Fractures
  - Pneumothorax
  - Hemothorax
  - Contusions
  - Great Vessel Injury
- Abdominal organs
  - Solid, hollow, diaphragm
- Fractured Pelvis

27

Down and Under Pathway

- Posterior knee and hip dislocations
- Pelvic and acetabular fractures
- Femur fractures
- Lower extremity fractures

28

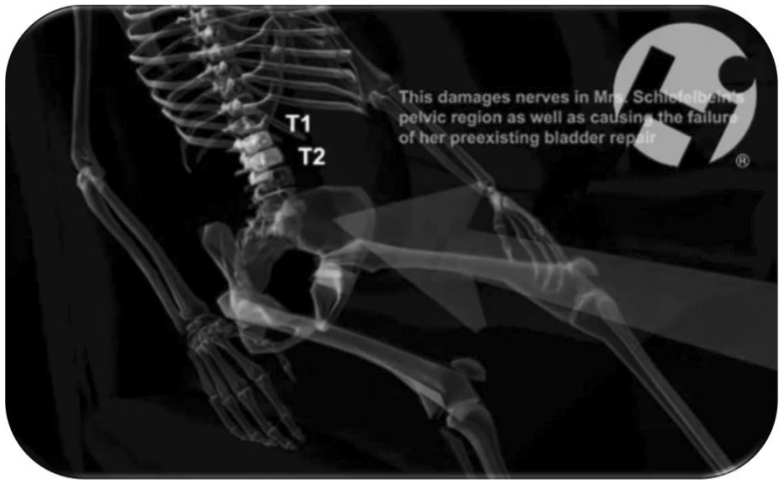
Lateral Impact

29

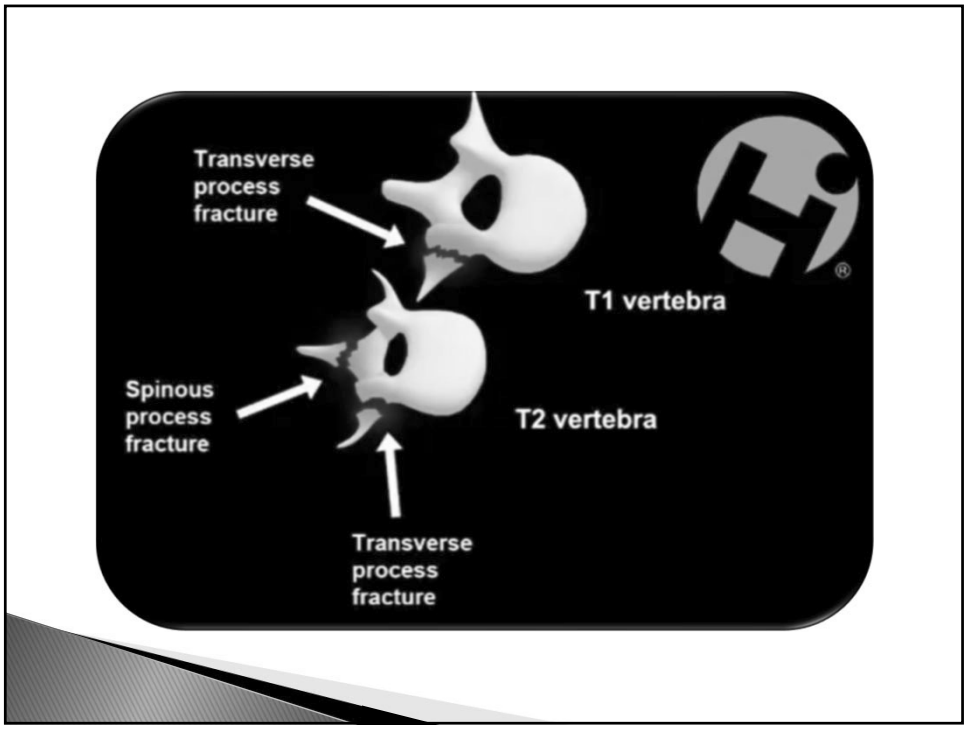
30

Rear Impact

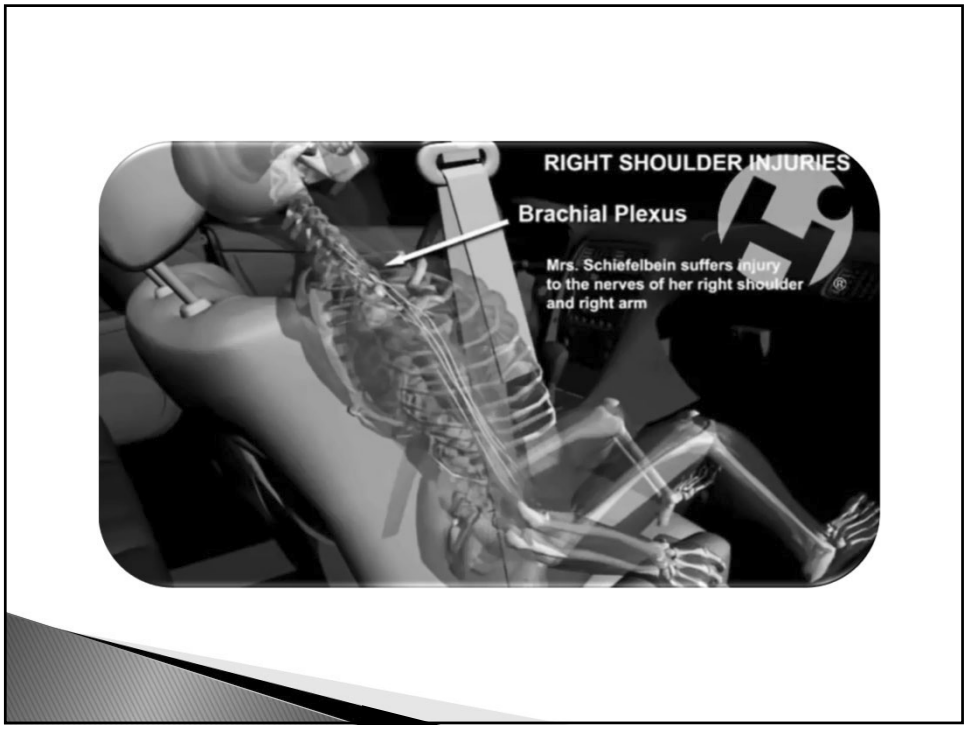
31



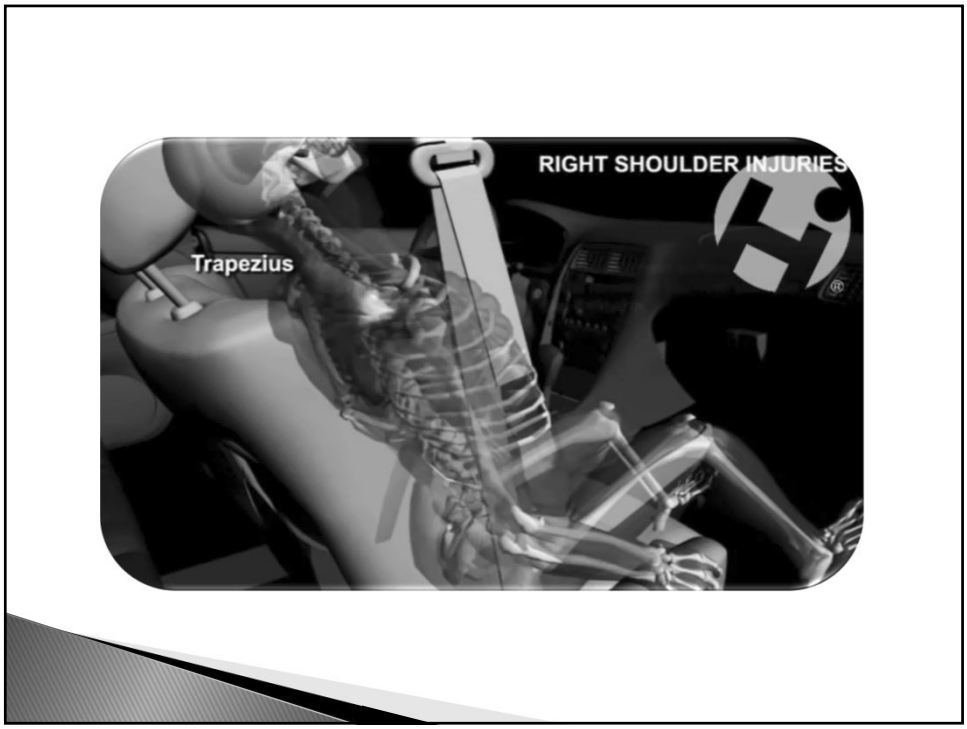
32


Transverse process fracture
T1 vertebra
Spinous process fracture
T2 vertebra
Transverse process fracture

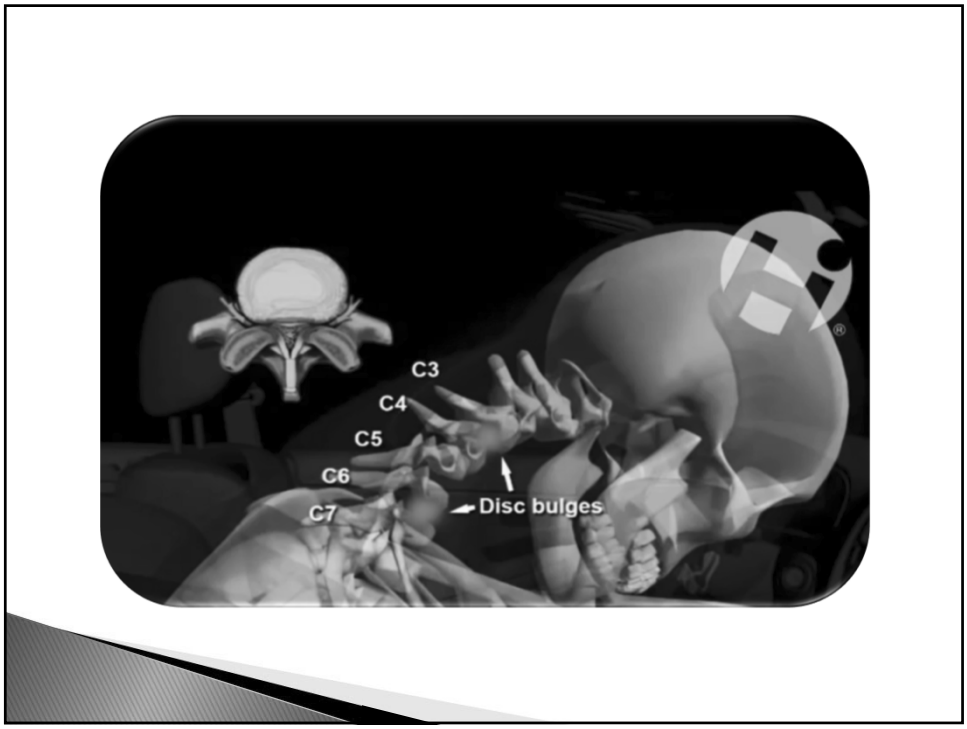
33


RIGHT SHOULDER INJURIES
Brachial Plexus
Mrs. Schiefelbein suffers injury to the nerves of her right shoulder and right arm

34


RIGHT SHOULDER INJURIES
Trapezius

35


C3
C4
C5
C6
C7
Disc bulges

36

Death in Same Vehicle compartment

37

Predictor for Injury Severity

Objective: To determine if death in same compartment is useful as a predictor for injury severity and mortality.

Methods: A retrospective cross-sectional study was conducted of 525 high-risk automobile accident victims. Data collected from Natividad Medical Center's trauma registry were used to analyze reports of adult patients from July 1 2014 to July 1 2017. 15 patients were victims of high-risk accidents with a death in the same compartment. These patients were compared with the other 510 patients.

Results: Out of 15 patients who had death in same compartment, 2 (13%) were identified to have ISS>15 and 1 (6.7%) expired. Odds of severe injury (ISS>15) were not significantly different between groups [OR 0.73 95% CI 0.16-3.3]. Odds of death between the two groups were not significantly different [OR 2.0 95% CI 0.25-17]. Mean ISS between the two groups was not significant [9.1 ± 6.3 vs 8.3 ± 0.7 P=0.8].

Conclusion:

- Mechanistic factors alone have been shown to be useful as predictors for mortality and risk for suffering major trauma
- Study suggests that patients with a death in same compartment are at an equal risk as victims of other high-risk accidents (major trauma and death)

Citation: McCague A, Shah K, Serio F, Fujii Q (2020) "Death in the Same Compartment" as a Predictor for Injury Severity. Trauma Acute Care Vol.5 No.1:79. DOI: 10.36648/2476-2105.5.1.79

38

Child Unrestrained or Unsecured Child Safety Seat

Age 0-9 years

39

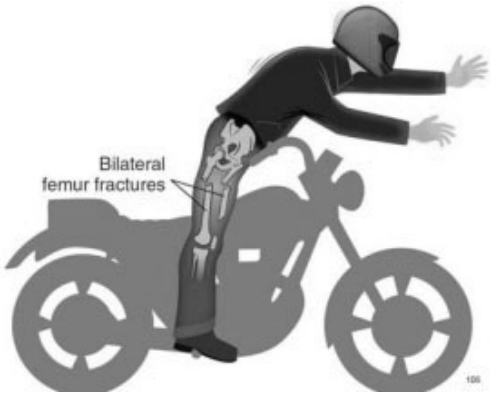
Rider Separated from Transport Vehicle

With significant impact
(motorcycle, ATV, horse, etc.)

40

Frontal Impact with Ejection

41



42

Lateral Impact

43

Pedestrian/Bicycle Rider

Thrown, run over, or with significant impact

44

Adult vs. Child

45

Falls >10 feet (all ages)

46

Autopsy from a 12-foot fall

47

Low-Level Falls

Young Children ($\leq$ 5 years)
Older Adults (age $\geq$65 years) with Significant Head Impact

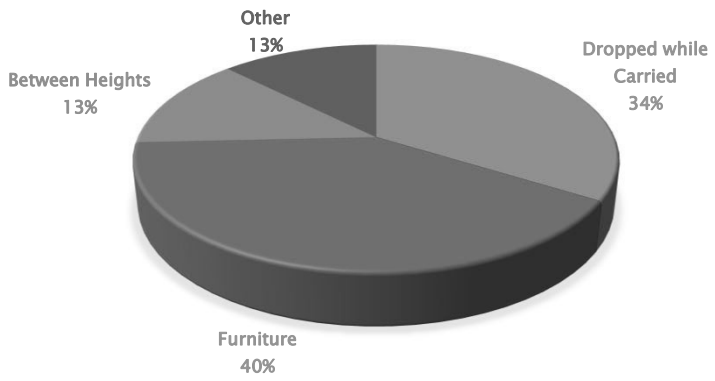
48

Infant

<1 YEAR

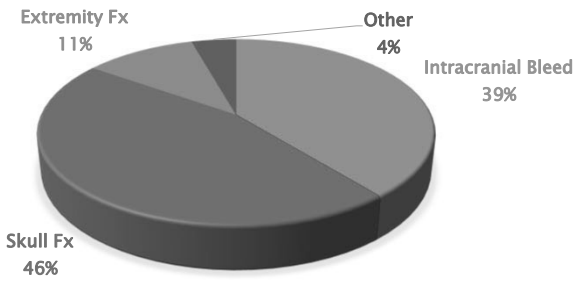
49

Mechanism

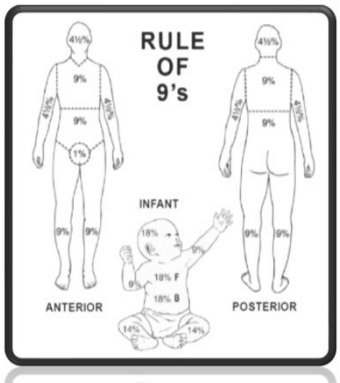


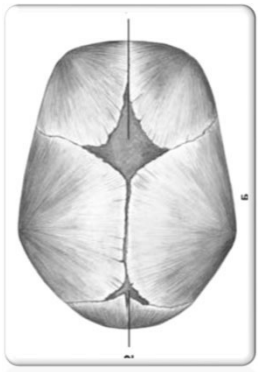
50

Falls while being carried



51





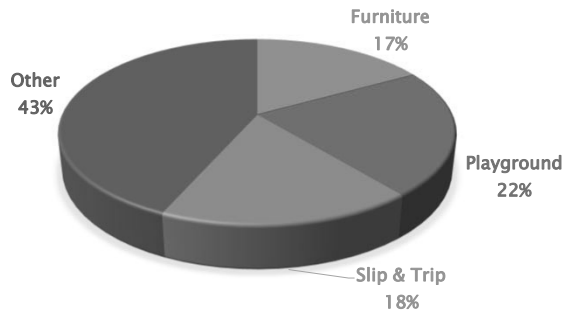
52

Children

1-11 Years

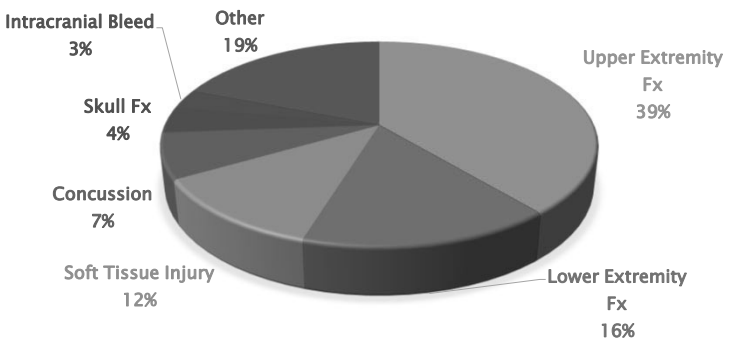
53

Mechanism



54

Slip & Trip



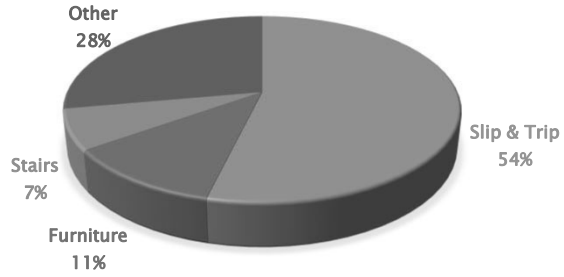
55

OLDER ADULTs

65+ Years

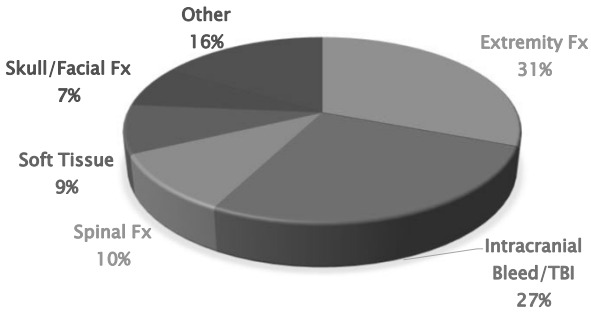
56

Mechanism



57

Slip & Trip



58

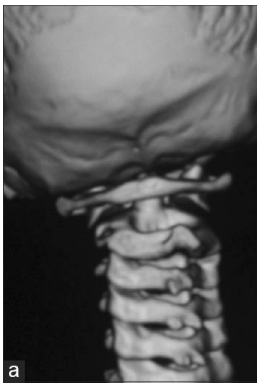
Geriatric Falls and Reflexes

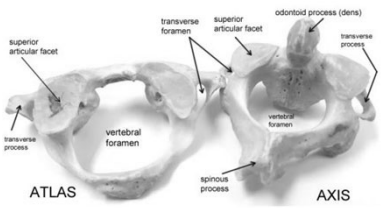
Normal Reflexes

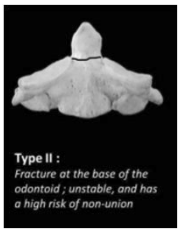
Delayed reflexes

59

DENS ii fx



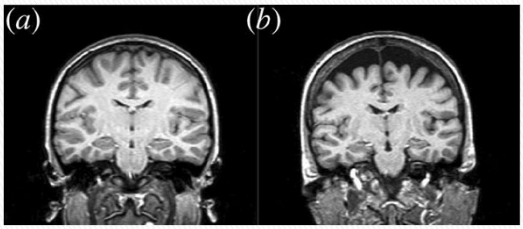


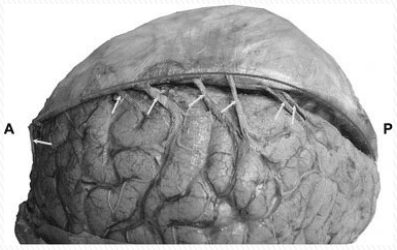


60

Subdural hematoma

- Blood vessels stretch and weaken as the elderly brain atrophies
- Shearing of vessels creates subdural hematoma





61

Children

Preferentially triaged to pediatric capable centers

62

Pediatric Trauma Center Effect on Mortality

(Age $\leq$14)

63

Pediatric Only Trauma Center

64

Dual Trauma Center (part-time peds)

Death rate is
2-3 times higher

65

Adult Trauma Center

Death rate is *6 times higher*

66

Commissioner of Health to Hospital CEO's

Pediatric trauma patients transported to an Adult Trauma Center or a non-Trauma Center must be transferred to a Level I or II Pediatric Trauma Center if they still meet CDC field trauma triage guidelines at the time of arrival at the Adult Trauma Center or non-Trauma Center.

67

"The human body seems indestructible when we are young. However, it is incredibly fragile and must be care for if it is to serve us for a lifetime. during later years."

— James C. Dobson, Life on the Edge: The Next Generation's Guide to a Meaningful Future

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