

The Vital Role of Medical Examiners and Autopsy Data in Trauma System Development

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Disclosures

- None

Genesis and Evolution of the AIS (Abbreviated Injury Score)

- Need for a standardized system
- Classify type and severity of injury from vehicular crashes
- Consensus derived
- 1969 Multidisciplinary Task Group
 - SAE – Society of Automotive Engineers
 - AMA – American Medical Association
 - AAAM – Association for the Advancement of Automotive Medicine
- 75 descriptions of the most frequent MVC injuries

Association for the Advancement of Automotive Medicine. The Abbreviated Injury Scale – 2005 – Update 2008. Course Training Manual 2013

AIS Concepts and Purpose

- Simple method to rank injury by severity relative to importance to the body
- Standardized terminology
- Usable for multiple causes of injury
- Injury descriptors organized anatomically
- Reflects severity of single injury unaffected by time, sequela or outcome
- Should be more than a threat to life scale

Association for the Advancement of Automotive Medicine. The Abbreviated Injury Scale – 2005 – Update 2008. Course Training Manual 2012

AIS Scaling System

- Anatomically based – clinical training not needed to collect data
 - Not variable as are physiologic measurements (by drugs, tx, age, etc.)
- Ordinal scale: 1 – minor to 5 – critical to 6 – maximum (not survivable)
 - Not a linear relationship
 - AIS 9 = injured but severity unknown
- Nine body regions
- Essentially a severity of injury scale – But death is not part of the scale
- AIS 2005 updated in 2008

Association for the Advancement of Automotive Medicine. The Abbreviated Injury Scale – 2005 – Update 2008. Course Training Manual 2012

Severity Number

- The AIS single digit severity number indicates relative severity in an "average patient" who sustains only that injury
- Average patient
 - 40-45
 - Free of pre-existing conditions
 - Free of treatment complications
 - Receives timely, appropriate care
- Found appropriate to pediatric populations
 - The few exceptions incorporated in 1990 revision as separate codes

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7 Digit Unique Identifier

- Pre-dot code: abcddd
 - a-Body region (nine)
 - b-Type of anatomic structure
 - cc-Specific anatomic structure
 - dd-Level of injury within region and structure
 - oo - NFS
- AIS severity number (1-6, 9)
- 853000.4
 - 8-Lower extremity
 - 5-Skeletal
 - 30-Femur
 - oo-Not further specified
 - 4-Severe

Association for the Advancement of Automotive Medicine. The Abbreviated Injury Scale – 2005 – Update 2008. Course Training Manual 2012.

Injury Severity Score

- Developed by Susan Baker in 1971 to assess severity of multiply injured patients
- Weighted system using highest AIS in three of six body regions
- ISS is sum of the squares of the highest AIS in three regions
 - NISS (new ISS) – three most severe AIS regardless of body region
- ISS uses 6 regions
- Score ranges from 1 – 75 (AIS of 6 anywhere = 75 ; $5^2 + 5^2 + 5^2 = 75$)

Association for the Advancement of Automotive Medicine. The Abbreviated Injury Scale – 2005 – Update 2008. Course Training Manual 2012.

Body Regions

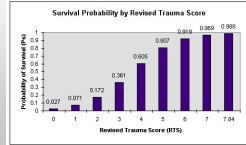
- AIS
 - 1 – Head
 - 2 – Face
 - 3 – Neck
 - 4 – Thorax
 - 5 – Abdomen
 - 6 – Spine
 - 7 – Upper extremity
 - 8 – Lower extremity
 - 9 – Unspecified
- ISS
 - 1 – Head & neck
 - 2 – Face
 - 3 – Chest
 - 4 – Abdomen/pelvis
 - 5 – Extremities/pelvic girdle
 - 6 – External

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Revised Trauma Score

- Revised Trauma Score is a physiological scoring system with demonstrated accuracy in predicting death.
- Consists of Glasgow Coma Scale, Systolic Blood Pressure and Respiratory Rate.
- $RTS = 0.9368 \text{ GCS} + 0.7326 \text{ SBP} + 0.2908 \text{ RR}$

Glasgow Coma Scale (GCS)	Systolic Blood Pressure (SBP)	Respiratory Rate (RR)	Colored Value
13-15	>99	10-29	4
9-12	76-99	>29	3
6-8	50-75	6-9	2
4-5	1-49	1-5	1
3	0	0	0



<http://trauma.org/arch/trauma/rtts.html>

The TRISS Score

- **T**rauma **I**njury **S**everity **S**core gives the probability that an injured person will survive serious trauma based on age, physiologic parameters and the AIS
- This allows Trauma Registrars to predict survivability (Probability of Survival or Ps) and allows the ACS to compare standardized data and judge the effectiveness of treatment across trauma centers

Boyd CR, Tolson MA, Copay WS "Evaluating Trauma Care: The TRISS Method", J Trauma 37:316-318(1994)

Calculation of TRISS

<http://trauma.org/arch/trauma/triss.html>

TRAUMA.ORG

INJURY SEVERITY SCORE CALCULATOR	REVISED TRAUMA SCORE CALCULATOR	TRISS
Abbreviated Injury Scale: Head: 3 Chest: 2 Extremity: 1	Face: 1 Abdomen: 5 External: 1 Coma Score: 9	Systolic BP: 110 Resp. Rate: 20 Age: 50
Calculate	Calculate	Calculate
ISS: 38	RTS: 6.904	Probability of Survival: Blunt: 87.6% Penetrating: 86.4%
	Clear	

<http://trauma.org/archives/core/triss.html>

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<http://trauma.org/archives/core/triss.html>

The image displays four instances of the TRAUMA.ORG injury severity score calculator. Each calculator has the following fields: Abbreviated Injury Scale (Head, Face, Chest, Abdomen, Extremity, External), Revised Trauma Score (Systolic BP, Resp. Rate, Coma Score), Age, ISS, and RTS. The calculators show the following results:

- Calculator 1: ISS 14, RTS 6.904, Probability of Survival: Blunt 87.6%, Penetrating 88.4%
- Calculator 2: ISS 24, RTS 6.204, Probability of Survival: Blunt 65.1%, Penetrating 69.2%
- Calculator 3: ISS 16, RTS 6.904, Probability of Survival: Blunt 80.6%, Penetrating 80.7%
- Calculator 4: ISS 26, RTS 5.429, Probability of Survival: Blunt 33.5%, Penetrating 37.1%

Autopsy and AIS Coding

- According to the AAAM:
 - *Autopsy or medical examiner reports will be more detailed and complete than ED records*
 - Trauma registrars rely on the most reliable source of information (vide supra)
 - Taught to code conservatively; "probable", "possible", "rule-out" not coded.
 - Cannot code without proper verification (autopsy or imaging studies).
 - Faced with contradictory information, use most reliable source (vide supra).
- Code g injury
 - Trauma has occurred but no information as to specific organ or region
 - *Injuries to the head 100000 g
 - Cannot get AIS code

Association for the Advancement of Automotive Medicine. The Abbreviated Injury Scale - 2005 - Update 2008. Course Training Manual 2013

Injury Source Hierarchy

RANKING OF MOST RELIABLE SOURCES OF INJURY INFORMATION

Medical Examiner/Autopsy Reports	Highest
Hospital/Medical Records Autopsy Reports Operative Reports Radiology Reports Nursing or ICU Notes Physician Progress Notes ED Record Discharge Summary Fax Sheet (Include Secondary Sheet)	Level of General Reliability, Completeness or Detail
"Field" Records Ambulance Run Sheets Police Reports Bystander Patient (esp. LOC)	Lowest

Association for the Advancement of Automotive Medicine. The Abbreviated Injury Scale - 2005 - Update 2008. Course Training Manual 2013

SOURCE	ADVANTAGES	DISADVANTAGES
Medical examiner's reports	<ul style="list-style-type: none"> very detailed 	<ul style="list-style-type: none"> rarely available
Autopsy reports	<ul style="list-style-type: none"> complete listing of injuries very detailed if well done 	<ul style="list-style-type: none"> requires extra steps to obtain brain exam may be skipped because time consuming; therefore some injuries may be missed can be sketchy if not well done not available for all deaths not available for all injuries
Operative reports	<ul style="list-style-type: none"> very precise if well done external measures usually described freely typed 	
Radiology reports/imaging studies	<ul style="list-style-type: none"> usually good source of injury detail complete descriptions especially good for fractures 	<ul style="list-style-type: none"> diagnosis possible or sometimes not conclusive (e.g. rib fractures)
Nursing or ICU notes	<ul style="list-style-type: none"> good for description and location of external injuries sometimes contains graphics of external injuries often best source of duration of LOC 	<ul style="list-style-type: none"> sometimes illegible
Physician progress notes	<ul style="list-style-type: none"> precise and useful, but only within specialty 	<ul style="list-style-type: none"> detail sometimes lacking often illegible
ED record	<ul style="list-style-type: none"> good descriptions of external injuries, esp. nurse notes 	<ul style="list-style-type: none"> many non-verified diagnoses
Discharge summary	<ul style="list-style-type: none"> highly high level "overview" of case 	<ul style="list-style-type: none"> variability in completeness of injury details often skips or misdiagnoses injuries depending on who is dictating
Face sheet (discharge summary)	<ul style="list-style-type: none"> contains list of diagnoses contains ICD codes 	<ul style="list-style-type: none"> not complete insufficient detail
"Pain" records	<ul style="list-style-type: none"> contains information about condition at scene, LOC, blood loss 	<ul style="list-style-type: none"> may be incomplete not always available
Police reports	<ul style="list-style-type: none"> may have witnessed injury event 	<ul style="list-style-type: none"> may be unreliable
Bystander	<ul style="list-style-type: none"> may report useful information about injury event or situative factors 	<ul style="list-style-type: none"> may be unreliable

Examples

- No autopsy or incompletely documented autopsy
 - Liver laceration – 541820.2
 - AIS 4
- Well documented autopsy
 - Multiple liver lacerations >3cm deep or "rupture" – 541826.4
 - AIS 16
 - Liver lacerations with disruption of >75% of a lobe or involving retrohepatic cava – 541828.5
 - AIS 35

Examples

- No autopsy or incompletely documented autopsy
 - Multiple rib fractures – 450210.2
 - AIS 4
- Well documented autopsy
 - Bilateral flail chest – 450214.5
 - AIS 25
 - Note – flail chest is three or more ribs fractured in more than one location

Examples

- No autopsy or incompletely documented autopsy
 - Multiple head injuries – 10099.9
 - AIS 4
 - Subdural hematoma – 140650.3
 - AIS 3
 - Cerebellar contusion – 140402.3
 - AIS 3
 - Internal carotid injury – 121099.3
 - AIS 3
- Well documented autopsy
 - Cerebral contusion (extensive, massive or >50cc) – 140648.5
 - AIS 35
 - Subdural hematoma >50cc (25cc if <=10) – 140655.5
 - AIS 35
 - Cerebellar contusion >30cc – 140405.5
 - AIS 35
 - Bilateral internal carotid artery lacerations – 121003.6
 - AIS 36

Examples

- No autopsy or incompletely documented autopsy
 - Subdural hematoma – 140650.3
 - AIS 3
 - Liver laceration – 541820.2
 - AIS 4
 - Multiple rib fractures – 450210.2
 - AIS 4
 - Total AIS = 17
- Well documented autopsy
 - Subdural hematoma >50cc (25cc if <=10) – 140655.5
 - AIS 35
 - Liver lacerations involving retrohepatic cava – 541820.5
 - AIS 35
 - Bilateral flail chest – 450214.5
 - AIS 35
 - Total AIS = 75 (maximum possible)

References

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