PLEASE CLICK ON THE FOLLOWING LINK TO WATCH THE LECTURE ONLINE:-

https://www.youtube.com/watch?v=xjXs5MkDGDE&list=PLuBRb5B7fa_d_ITkxtB-KQYUusx0C1s_x&index=4

How to approach trauma patients

Mahmoud Etaiwi
Orthopedic and trauma surgeon

Objectives

- Appropriately evaluate trauma patient.
- Apply ATLS protocol.
- Identify types of shock and fluid resuscitation.
- Know different types of trauma scoring systems and apply it.

Scenario 1

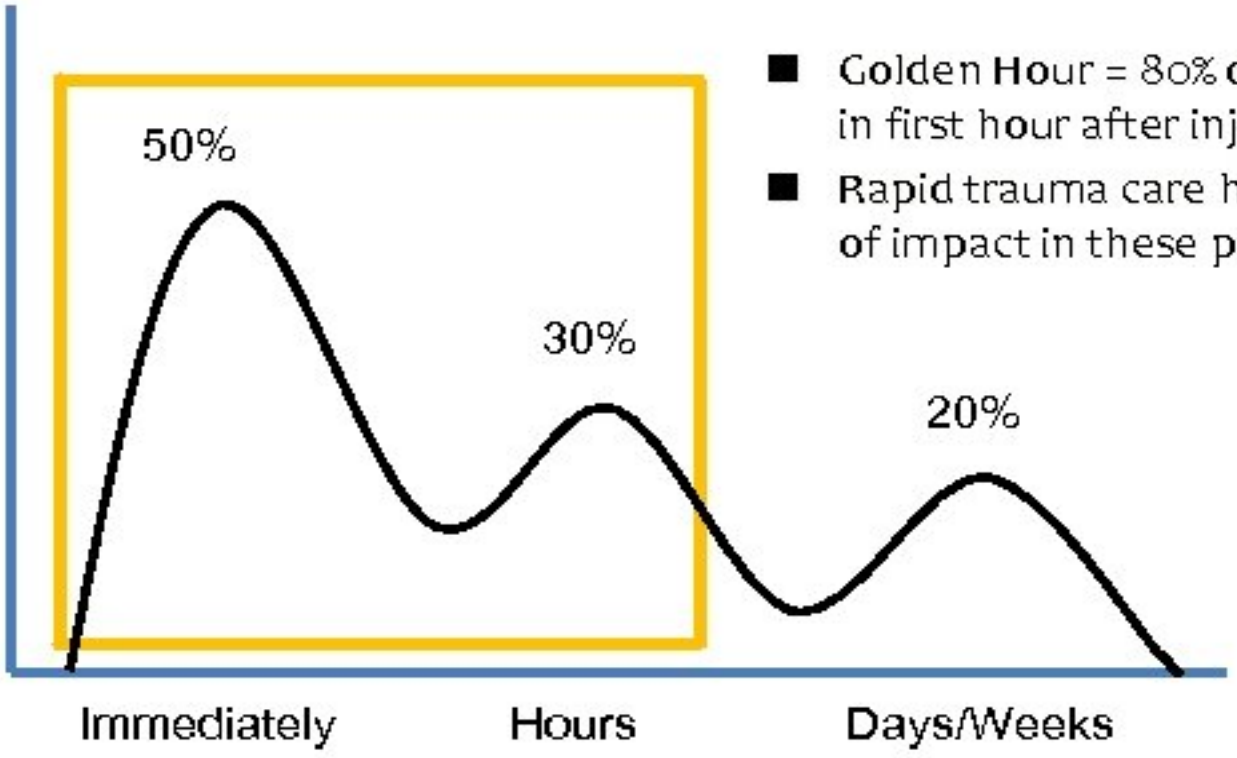
- 24 year old male pt presented to your ER after being involved in MVA as driver(roll over) .
  brought in to ER via ambulance.
- Complain of pelvic pain
- Patient is conscious, anxious.
- Bp 90/60
- HR 110 BPM
- RR 14
- O2 sat 99
- How would you approach this patient?

Why trauma is an important issue

- It is the leading cause of death in population <50 years.
- Very high coast on health care system.
- Necessary to put guide line to decrease morbidity, mortality.
- Not a one man show (team work).

Epidemiology

Trimodal Distribution of Trauma Deaths



- Golden Hour = 80% of trauma deaths in first hour after injury
- Rapid trauma care has greatest level of impact in these patients

- Three peak times of death after trauma:
- 50% within the first minutes of sustaining the injury caused by massive blood loss or neurologic injury
- 30% within the first few hours most commonly from shock, hypoxia, or neurologic injury
- 20% within days to weeks following injury multi system organ failure and infection are leading causes

Initial assessment of trauma patients

- Many programs are were issued:
- Definitive Surgical Trauma Care (DSTC)
- Early Management of Severe Trauma (EMST)
- European Trauma Course (ETC)
- Advanced Trauma Life Support (ATLS)

Why to use trauma protocol

- Search for the most life-threatening and time-limiting injuries. (Golden hour)
- It is performed in a systematic fashion that combines rapid diagnosis with immediate interventions to ensure additional time is available to perform definitive diagnostic studies and to provide further lifesaving procedural interventions.

- The *vertical trauma resuscitation* is one in which a single clinician along with a limited number of additional allied health care personnel functions in isolation.
- The *horizontal trauma resuscitation* is one in which multiple priorities are managed in parallel by multiple clinicians, most effectively led by a designated team leader.

ATLS

- ***Primary survey:***
- Deal with immediate life-threatening injury
- Quick head to toe examination
- ABCDE
- Don’t start with detailed History taking

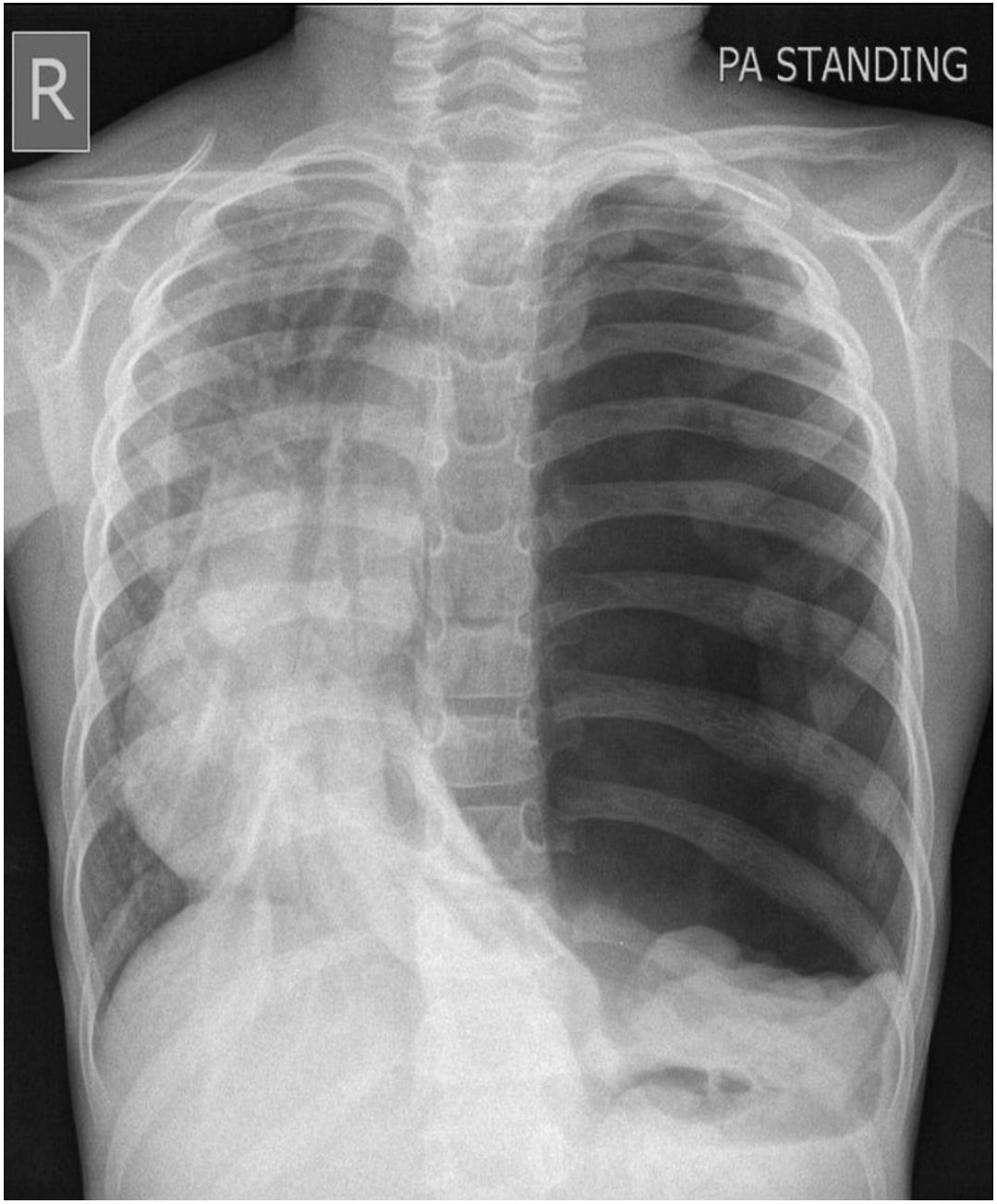
- James Styner, an orthopedic surgeon, in cooperation with the University of Nebraska in 1978

Airway

- Most critical step in assessment, Without oxygenation, clinical deterioration will rapidly ensue, making all other lifesaving efforts futile.
- Chin lift, jaw thrust.
- Nasal canula or mask.
- Orotracheal, nasotracheal intubation.(cervical spine should be immobilized until it is determined that no bony or ligamentous injuries have occurred)
- cricothyroidotomy or tracheostomy.

Breathing

- The assessment of breathing relies on the clinical exam.
- Signs and clinical situations are highly suggestive of a process that will limit the patient's ability to adequately breathe and ventilate and may mandate intubation, tachypnea, expanding neck hematomas, stridor, hoarseness, tracheal deviation, multiple rib fractures, severe burn eschars, and altered mental status.


R
PA STANDING

- Needle decompression is a temporary intervention with no time wasted to be performed for tension pneumothorax, hemothorax. (chest tube is mandatory)
- A patient with tension physiology, will deteriorate due to diminished preload and subsequent decreased cardiac output, rapidly resulting in cardiac arrest.

Circulation

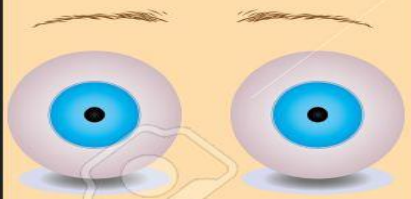
- Shock is a state of inadequate end-organ perfusion, leading to cellular dysfunction and injury.
- Hemorrhage is the most common cause of shock after trauma.
- Goals of treatment are control of hemorrhage and restoration of effective circulating volume

- Asses pulse and blood pressure. (BP can be guided from the area which you took the pulse from eg. 60mmHg carotid)
- Skin color and temperature.
- Don’t wait for BP drop to label a patient with hypovolemic shock
- Two large bore (14- or 16-gauge) intravenous peripheral lines are initially placed for rapid infusion of fluid.
- Crystalloid or colloid. (RL or NS). (warm)

- Search for source of bleeding it can be external or internal.
- FAST “focused assessment with sonography for trauma” , pericardial and peritoneal cavities.
- A bedside chest x-ray, pelvic x-ray.
- In patients with pelvic trauma with hypotension Pelvic binder, sheet, or C-clamp is employed to potentially reduce the volume of the pelvis and tamponade bleeding.

- In vertical shear (VS) injuries, skeletal traction should be placed immediately.
- The easiest method to control of external hemorrhage is application of direct pressure.
- Tourniquets have been used in the prehospital setting, and can be lifesaving, but once in the trauma center these may be removed at the appropriate time for examination of the local area and direct control.

Disability
Glasgow Coma Scale

Behaviour	Response
 Eye Opening Response	4. Spontaneously 3. To speech 2. To pain 1. No response
 Verbal Response	5. Oriented to time, person and place 4. Confused 3. Inappropriate words 2. Incomprehensible sounds 1. No response
 Motor Response	6. Obeys command 5. Moves to localised pain 4. Flex to withdraw from pain 3. Abnormal flexion 2. Abnormal extension 1. No response

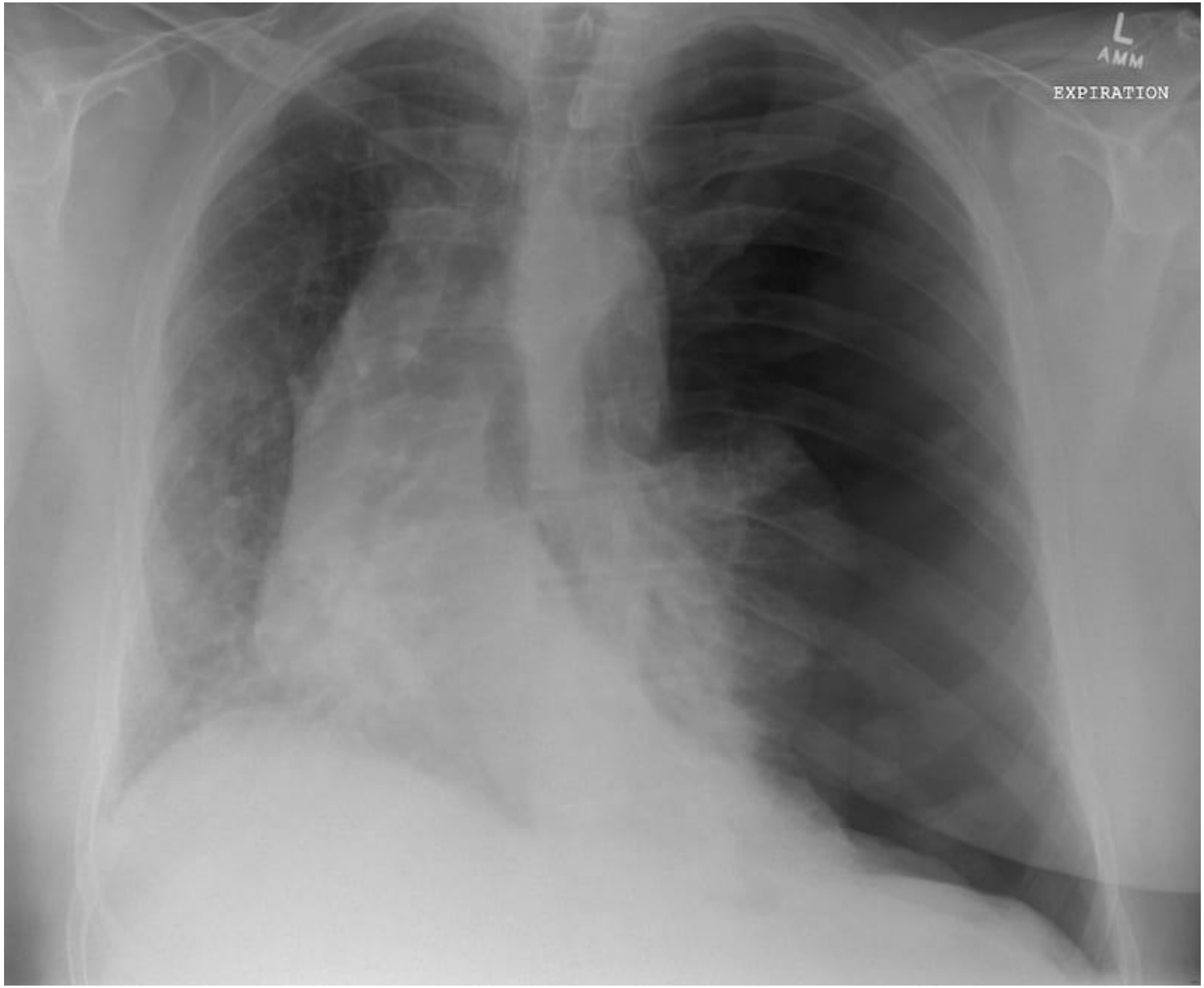
Total Score

Best score - 15
Comatosed - ⩽8
Unresponsive - 3

- The GCS is employed to determine severity of potential traumatic brain injury with the motor component as the most sensitive for predicting outcomes.
- GCS of 13 or higher = mild
- GCS of 9-12 = moderate
- GCS 8 or less = severe

Exposure

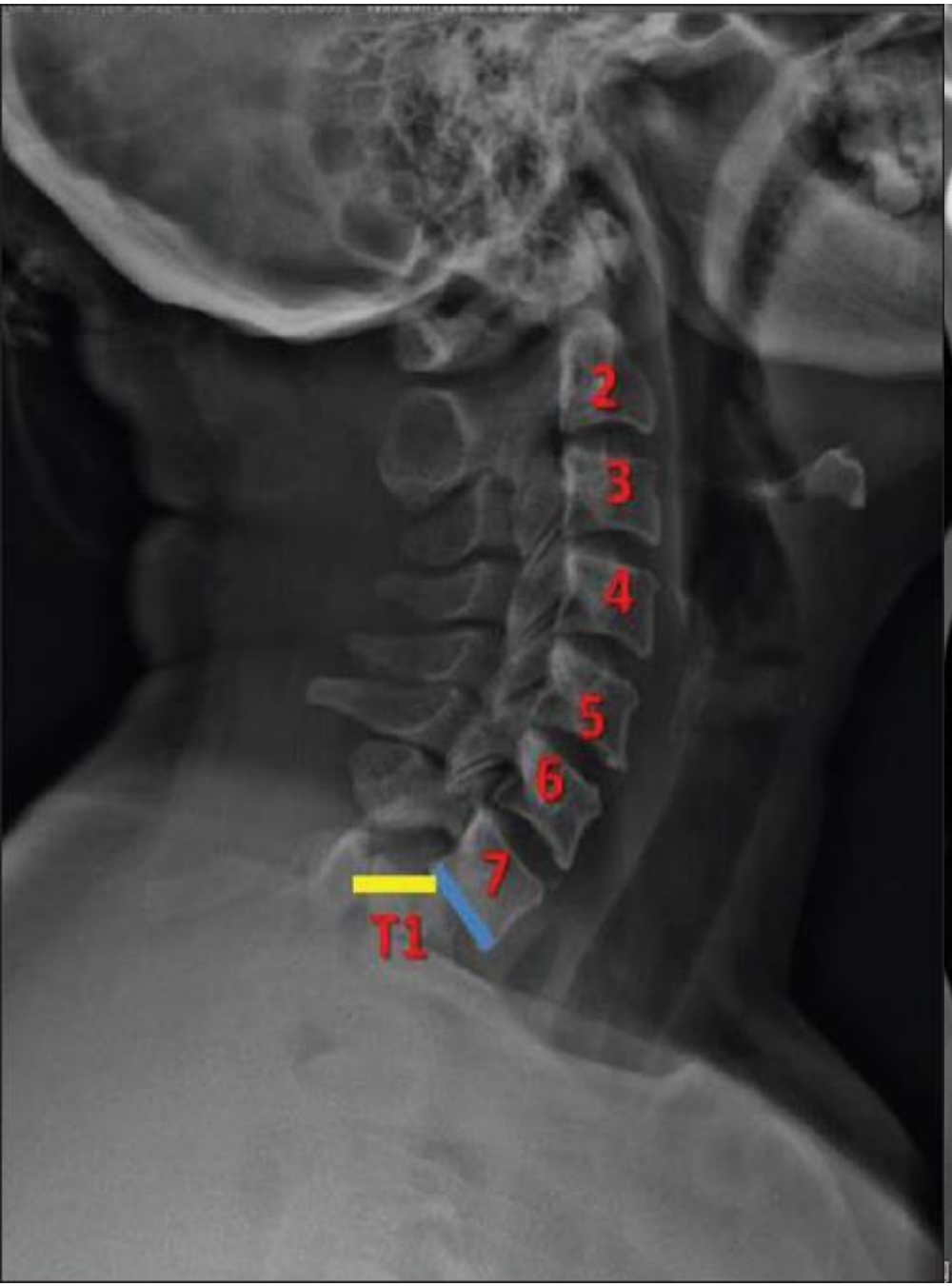
- Expose every inch of the patient.
- Prehospital splints and cervical collars are briefly removed for examination and then reapplied.
- Don’t forget to examine the posterior aspect (back)in a safe manner (log roll).
- Be fast and precise (prevent hypothermia)

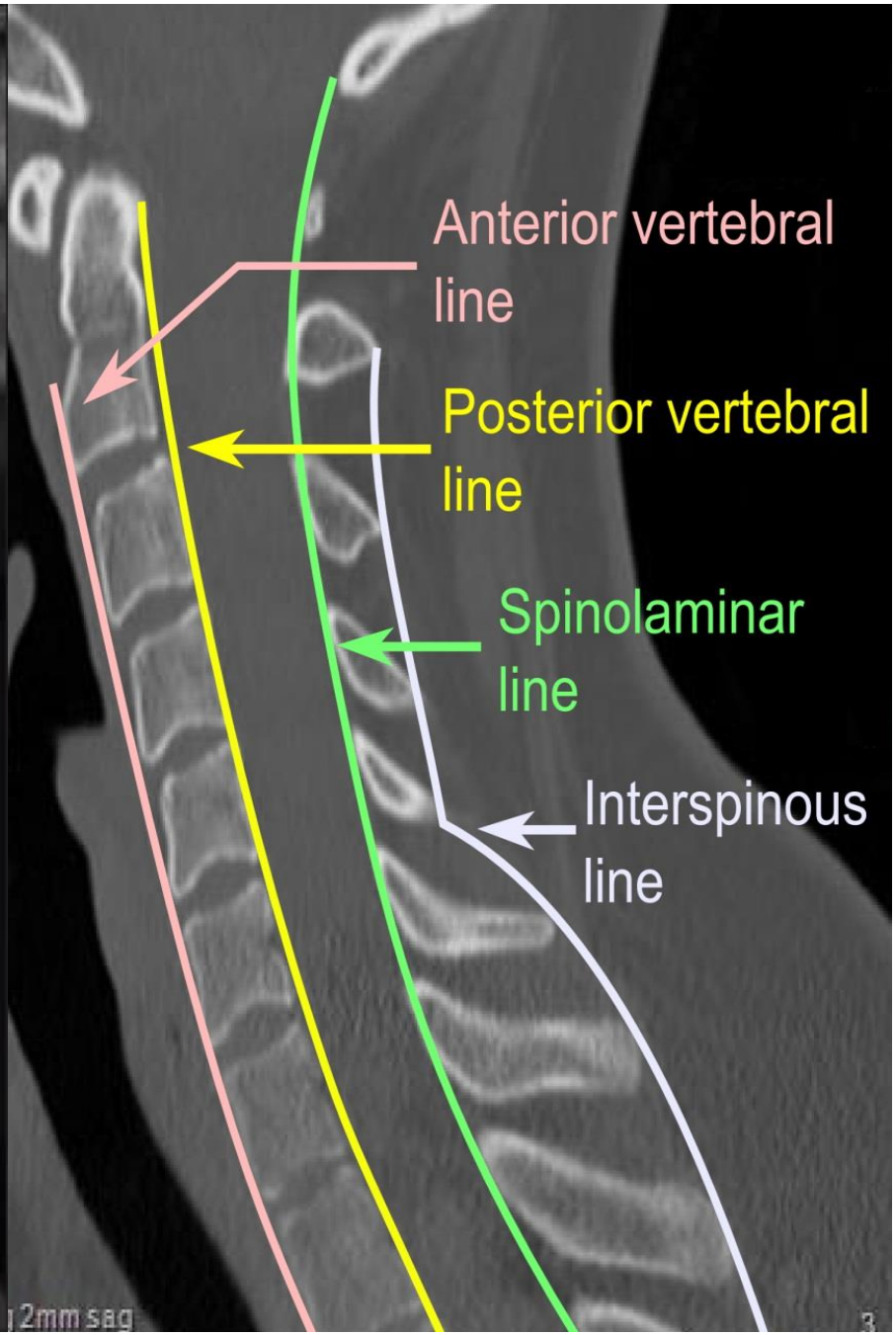

L
AMM
EXPIRATION


SUPINE
HD
EM:RAP

- Not commonly used

Nowadays due to the more Sensitivity of CT scan in identifying cervical injuries


2
3
4
5
6
7
T1


Anterior vertebral line
Posterior vertebral line
Spinolaminar line
Interspinous line
2mm sag

Secondary survey

- AMPLE (*a*llergies, *m*edications, *p*ast illnesses, *l*ast meal, *e*vents/*e*nvironment related to injury).
- Thorough physical examination (head to toe).
- Look for additional injuries.
- Dig more in the mechanism of injury.

Tertiary survey

- Repeat head-to-toe evaluation.
- Missed injuries, particularly musculoskeletal, are common in multiply injured patients.
- Patients with traumatic brain injury requiring emergent surgical procedures are at the highest risk for missed injuries.

Your role as orthopedic surgeon

- Be effective with good communication skills member in trauma cases.
- Save life then limb.
- In secondary survey reduce facture and dislocation(before imaging if possible) as soon as possible which may help in physiological stabilization.
- Damage-control orthopedic surgery

Shock

- Shock is a state of inadequate end-organ perfusion leading to cellular dysfunction and injury.
- In trauma patient type of shock is hypovolemic shock until proven otherwise.
- During the physical exam, attention should be given to evaluate HR, pulse character, RR, skin temperature, and pulse pressure

Hypovolemic shock

Parameter	Class I	Class II	Class III	Class IV
Blood loss (ml)	<750	750-1500	1500-2000	>2000
Blood loss (%)	<15	15-30	30-40	>40
Pulse rate (beats/min)	<100	100-120	>120	>140
BP	Normal	Decreased	Decreased	Decreased
Respiratory rate	14-20	20-30	30-40	>40
Urine output (ml/h)	>30	20-30	5-15	Negligible
CNS symptoms	Normal	Anxious	Confused	Lethargic

CNS: Central nervous system, BP: Blood pressure

- Hemorrhage is the leading cause of preventable death in multisystem trauma(40 %).
- The natural history of heart rate in patients with hypovolemic first starts with a normal heart rate, tachycardia, bradycardia, ending with asystolic arrest.
- Be carful when dealing with old patient(can't cope well with shock, potential attenuated sympathetic response, and they might be HTN on anti hypertensive medications)

Other types of shock

- Cardiogenic shock
- Neurogenic shock
- Septic shock

Cardiogenic shock

- Decrease cardiac output
- Myocardial infarction is the most common cause.
- Diagnostic criteria for cardiogenic shock include: (exclude hypovolemic shock)

  Persistent SBP < 90 mm Hg

  Persistence of the need for adjuncts to augment blood pressure

  Cool extremities.

  HR> 60 beats per minute

  Cardiac index < 2.2 L/min per square meter of body surface area.

  Pulmonary capillary occlusion pressure greater than 15 mm Hg

Neurogenic shock

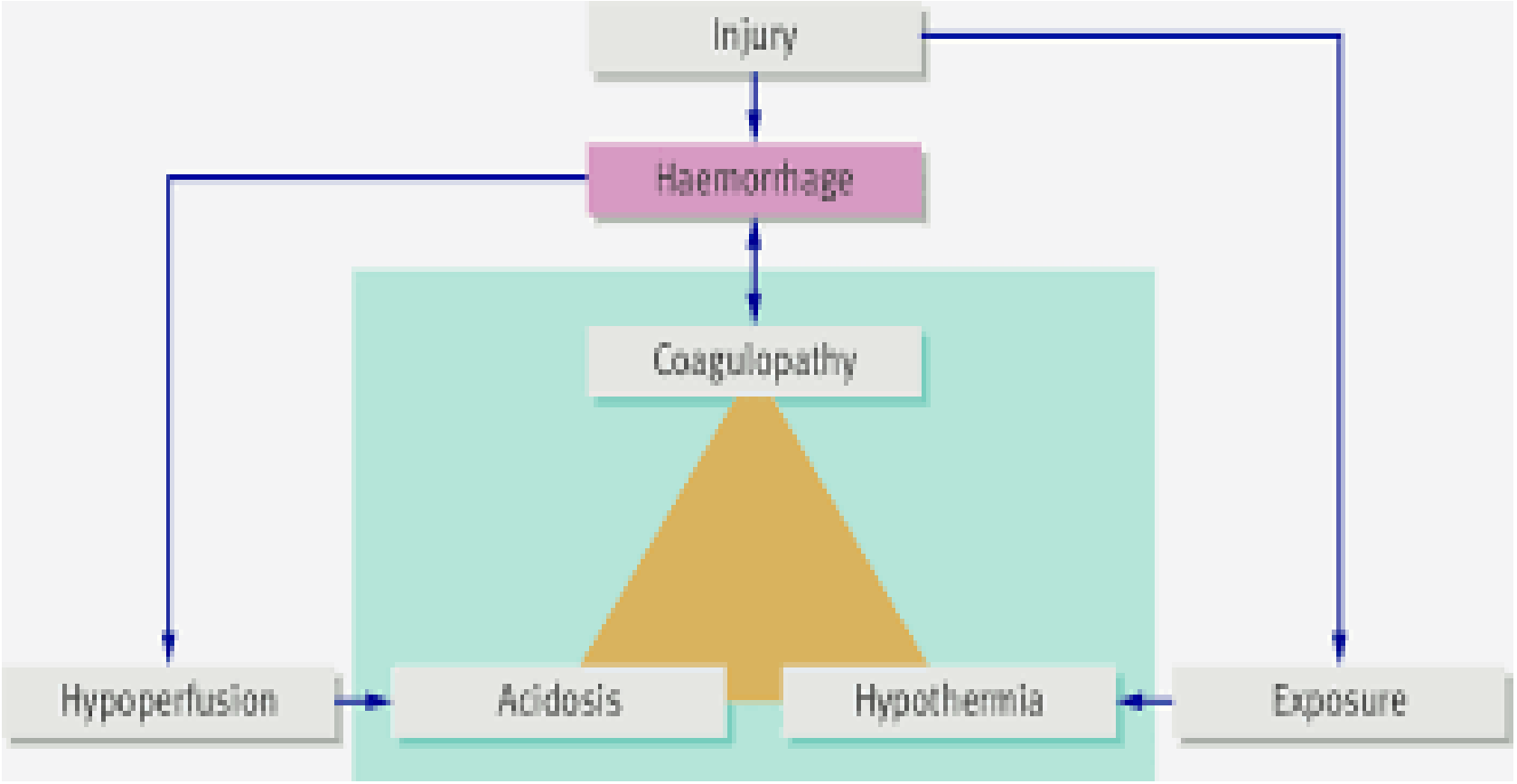
- loss of central nervous system sympathetic outflow resulting in inadequate end-organ perfusion.
- occurs in 7% to 10% of all patients who sustain spinal cord trauma.
- Exclude hypovolemic shock
- Dec PVR, Dec CO
- Dec BP , Dec HR
- Warm dry skin
- Treatment is with ionotropic support

Septic shock

- Sepsis is a clinical syndrome that is defined as “life-threatening organ dysfunction caused by dysregulated host response to infection.
- requires vasopressors to maintain a mean arterial pressure of 65 mm Hg or greater, and the patient has a serum lactate level greater than 2 mmol/L in the absence of hypovolemia

- Good resuscitation to restore circulatory volume.
- Support or augment the function of dysfunctional organs.
- Control the source of infection.

Resuscitation



- Average child (2-10 years old) has an estimated 75 - 80 ml/kg of circulating blood.
- Crystalloid isotonic solution.
- Massive transfusion protocols stipulate blood product resuscitation in a 1:1:1 product ratio (FFP:plat:PRBCs).

- Indicators of adequate resuscitation :
- Urine output 0.5-1.0 ml/kg/hr (30 cc/hr)
- Serum lactate levels (most sensitive) (normal < 2.5 mmol/L)
- Gastric mucosal ph
- Base deficit normal -2 to +2

Journal of Thoracic Disease

- New clinical criteria for septic shock: serum lactate level as new emerging vital sign

- Su Mi Lee and Won Suk An

- The mortality rate of patients with both hypotension and lactate ≥4 mmol/L is 46.1%, septic patients with hypotension alone is 36.7% and lactate ≥4 mmol/L alone is 30%.
- A serum lactate level, which measures the level of lactic acid in the blood, is a fairly reliable and accurate indication of tissue hypoperfusion and hypoxia.

Gastric mucosal pH as a prognostic index of mortality in critically ill patients. Doglio GR, Pusajo JF, Egurrola MA, Bonfigli GC, Parra C, Vetere L, Hernandez MS, Fernandez S, Palizas F, Gutierrez G.

Crit Care Med. 1991 Aug;19(8):1037-40. doi: 10.1097/00003246-199108000-00011.
PMID: 1860328

- **Conclusions:** Measurements of gastric intramucosal pH on ICU admission, and again 12 hrs later, have a high specificity for predicting patient survival in this ICU patient population (77.8% to 80.6%). Furthermore, given its relative noninvasive nature, tonometrically measured gastric intramucosal pH may be a useful addition to patient monitoring in the ICU.

Pelvic injury

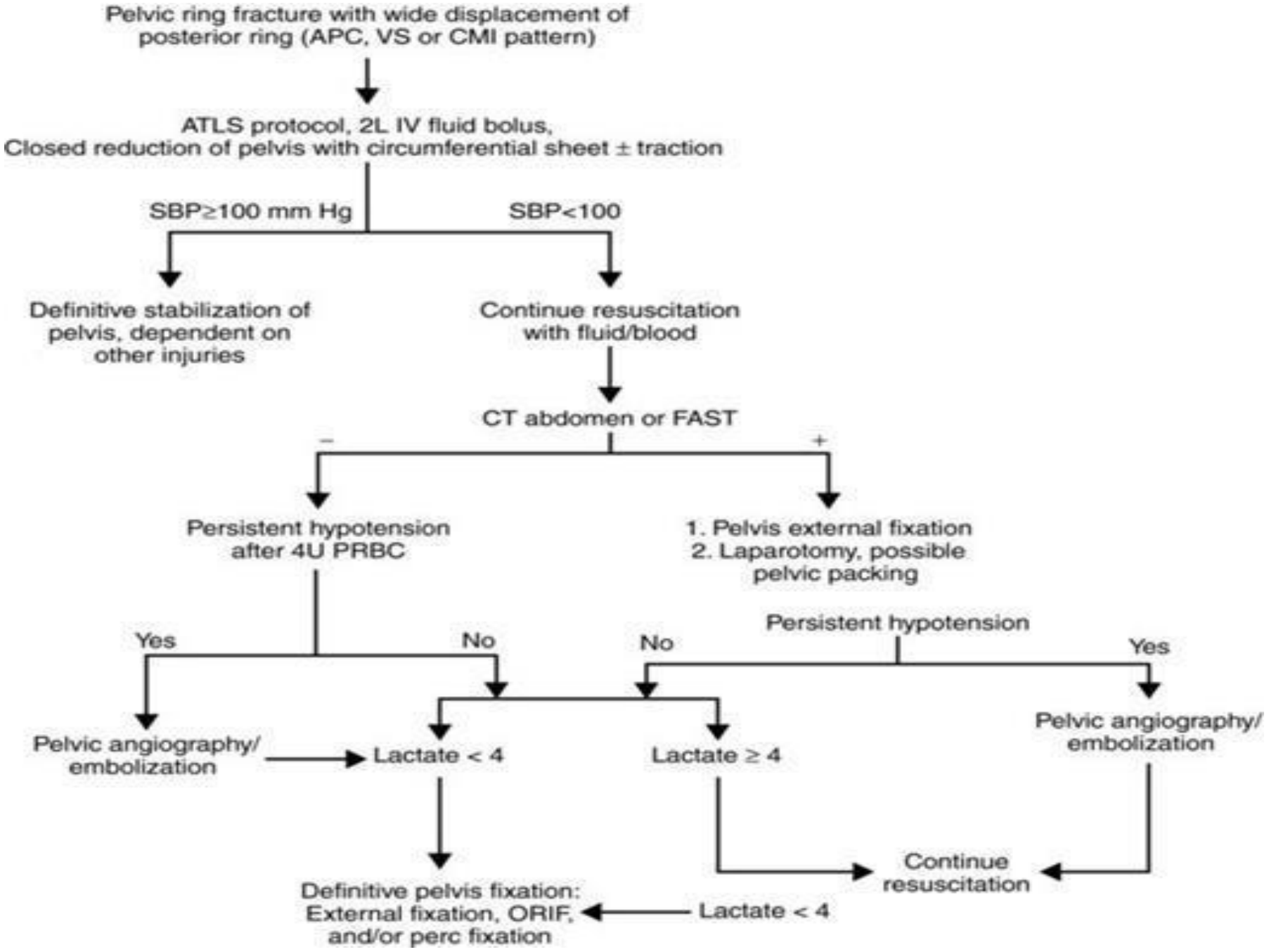
- Once you see pelvic fracture (high energy trauma)
- Good attention and care during exposure should be taken. (pain)
- pelvic asymmetry, leg length and hip rotation abnormality, ecchymosis and hematomas (with particular attention to the perineum), and soft tissue injuries.

- Bleeding in the perinum area is a good indication for pelvic fracture.(be carful)
- Blood loss is significant in APC,VS less in LC
- Bleeding could be: bony, arterial, venous(90%)
- The retroperitoneum of the *intact* pelvis can hold four liters of blood before tamponade occurs.

- Reduction by manually closing the pelvic ring with a sheet or binder and with emergent traction if vertical displacement is present is a essential step in Initial management.

From https://phemcast.co.uk/2015/11/05/podcast-episode-2-the-pelvic-binder/

- If aggressive fluid replacement and pelvic reduction doesn't stabilize the patient consider emergent angiography and embolization.
- Pelvic arteriography may detect bleeding at rates from 0.5 to 1 mL/min.


Pelvic ring fracture with wide displacement of posterior ring (APC, VS or CMI pattern)
ATLS protocol, 2L IV fluid bolus,
Closed reduction of pelvis with circumferential sheet ± traction
SBP≥100 mm Hg
SBP<100
Definitive stabilization of pelvis, dependent on other injuries
Continue resuscitation with fluid/blood
CT abdomen or FAST
−
+
Persistent hypotension after 4U PRBC
1. Pelvis external fixation
2. Laparotomy, possible pelvic packing
Yes
No
Persistent hypotension
No
Yes
Pelvic angiography/ embolization
Lactate < 4
Lactate ≥ 4
Pelvic angiography/ embolization
Continue resuscitation
Definitive pelvis fixation: External fixation, ORIF, and/or perc fixation
Lactate < 4

Trauma Scoring Systems

- Why do we need trauma scoring system?
- Common language
- Prognosis (predict outcome)
- Triage of patients
- Research

Physiologic	Anatomic	Combined
Revised Trauma Score	Abbreviated Injury Score	TRISS
APACHE	Injury Severity Score	ASCOT
SOFA	New Injury Severity Score	ICISS
SIRS	Anatomic Profile	
Emergency Trauma Score	PATI	
	ICISS	
	TMPM-ICD9	

The Revised Trauma Score

Glasgow Coma Scale (GCS)	Systolic Blood Pressure (SBP)	Respiratory Rate (RR)	RTS Value
13-15	>89	10-29	4
9-12	76-89	>29	3
6-8	50-75	6-9	2
4-5	1-49	1-5	1
3	0	0	0

Revised trauma score (RTS)

- Prehospital field triage tool
- lower score indicates higher severity
- RTS <4 proposed for transfer to trauma center
- Underestimate injury severity in patients injured in one system

Injury Severity Score (ISS)

Body Region
Head
Face
Neck
Thorax
Abdomen
Spine
Upper Extremity
Lower Extremity
External and other

Score	Abbreviated Injury Scale (AIS)
1	Minor
2	Moderate
3	Serious
4	Severe
5	Critical
6	Unsurviveable

All injuries are assigned from an internationally recognised dictionary that describes over 2000 injuries. Multiple injuries are scored by adding together the squares of the three highest AIS scores. The ISS can range from 1 to 75. Scores of 7 and 15 are unattainable because these figures cannot be obtained from summing squares. The maximum score is 75. By convention, a patient with an AIS of 6 in one body region is given an ISS of 75.

Injury Severity Score; ISS

Region	Injury Description	AIS	Square Top Three
Head & Neck	Cerebral Contusion	3	9
Face	No Injury	0	
Chest	Flail Chest	4	16
Abdomen	Minor Contusion of Liver Complex Rupture Spleen	2 5	 25
Extremity	Fractured femur	3	
External	No Injury	0	
		Injury Severity Score:	50

AIS Score	Injury
1	Minor
2	Moderate
3	Serious
4	Severe
5	Critical
6	Survivable

ISS	
1-8	Minor
9-15	Moderate
16-24	Serious
25-49	Severe
50-74	Critical
75	Maximum

- ISS > 15 associated with mortality of 10%
- Single score of 6 on any AIS region results in automatic score of 75
- New injury severity score(NISS)
- Modified injury severity score(MISS)

Mangled Extremity Severity Score (MESS)

Tissue Injury	Characteristics	Details	Points
1	Low energy	Stab wound, simple closed #, small-caliber	1
2	Medium energy	Opened #, dislocate, moderate crush	2
3	High energy	Short gun, high velocity	3
4	Massive crush	Logging, rail road	4
Shock			
1	Normotension	BP stable	0
2	Hypotensive transient	BP unstable, SBP < 90 mmHg	1
3	Hypotension	In OR	2
Ischemia			
1	None	No signs of ischemia	0
2	Mild	Diminish pulse	1
3	Moderate	Paresthesia, diminish motor activity	2
4	Advanced	Pulseless	3
Age			
1	< 30 y		0
2	30 - 50 y		1
3	> 50 y		2

Score ≤ 6: salvageable limb, Score ≥7: highly predictive of amputation

- High specificity and low sensitivity for predicting amputation

Systemic inflammatory sickness syndrome

Finding	Value
Temperature	<36 °C (96.8 °F) or >38 °C (100.4 °F)
Heart rate	>90/min
Respiratory rate	>20/min or PaCO2<32 mmHg (4.3 kPa)
WBC	<4x10^9/L (<4000/mm³), >12x10^9/L (>12,000/mm³), or 10% bands

SEPSIS STEPS

SIRS

T: >100.4 F
< 96.8 F
RR: >20
HR: >90
WBC: >12,000
<4,000
>10% bands
PCO2 < 32 mmHg

SEPSIS

2 SIRS

+

Confirmed **or** suspected infection

SEVERE SEPSIS

Sepsis +

Signs of End Organ Damage

Hypotension (SBP <90)

Lactate >4 mmol

SEPTIC SHOCK

Severe Sepsis with persistent:

Hypotension

Signs of End Organ Damage

Lactate >4 mmol

Slide Courtesy Curtis Merritt, DO

Glasgow Coma Score	Revised Trauma Score	Mangled Extremity Score	SIRS
Best Motor Response	GCS Score	Skeletal and Soft Tissue Injury	Heart Rate
Best Verbal Response	Systolic Blood Pressure	Limb Ischemia	WBC Count
Eye Opening	Respiratory Rate	Shock	Respiratory Rate
		Age	Temperature

- The time we took to interact in this talk is the time to decide the patient will

- A. Stabilized and do further management

- B. Deteriorate might be ended with death

Conclusion

- Apply ATLS protocol to every single trauma patient (routine work).
- Stick to the principle in a systematic manner.
- Able to work in team as leader or member.
- Properly categorize your patient and give priorities.