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The Trauma Team: From Prehospital Through the ED

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Objectives

At the conclusion of this presentation the participant will be able to:

- Describe the differences between Prehospital EMS and the Emergency Department (ED) environments
- Describe basic prehospital EMS operations
- Describe basic prehospital EMS care abilities
- Describe prehospital EMS to Trauma ED handoff
- Describe Trauma ED operations
- Recognize signs of trouble in the “fresh” trauma patient
- Describe evidence-based practice changes/controversies in prehospital and ED trauma care
- Explain tips to provide the best patient care

Underlying Principles

- The success of a trauma resuscitation is only as good as its team which includes providers from the prehospital environment through the ED Trauma Team
- Readiness, hyper-vigilance, consistent organization and clear-cut communication produces effective outcomes
- Practice makes perfect
- A proficient trauma team cannot function without a “skilled” team leader!

Side by Side Comparison

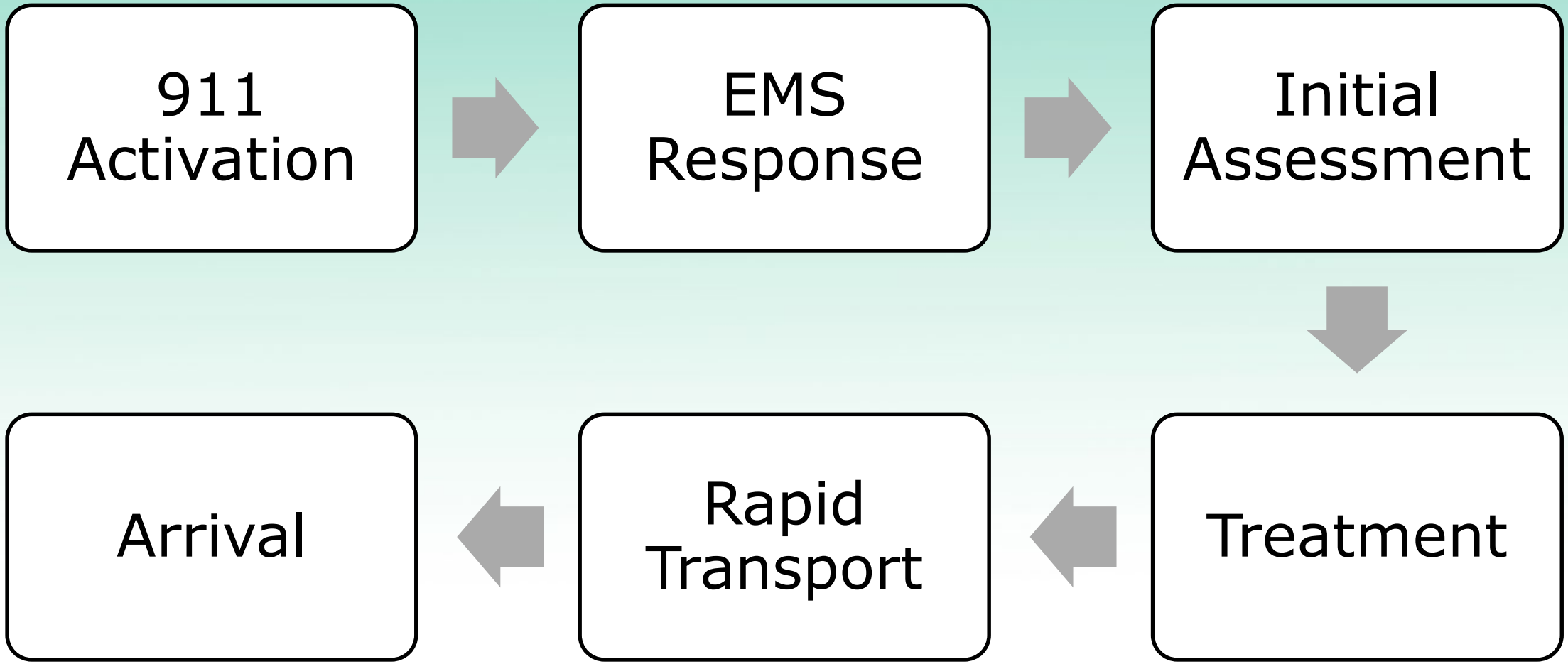
PREHOSPITAL EMS

- Protocol driven based on initial assessment
- Emphasis on rapid transport
- Limited resources

EMERGENCY DEPARTMENT

- Physician/Provider driven based on in-depth assessment
- Emphasis on treatment and resuscitation
- Vast resource availability

EMS Operations



EMS Operations

- Calls can be made any timeframe after a traumatic event occurs
- Dispatch centers are responsible for activating resources based on the information they receive
- Travel to the scene can take extended time

EMS Operations

- Preparations made based on information from dispatch center
- Air/MedEvac may be put on standby or launched
- Safe response is paramount
- Varying levels of care within the EMS system

EMS Response

Acuity of Patient	EMR	EMT/AEMT	Paramedic
Critical (Red)	Simple	Fundamental	Complex
Emergent (Yellow)		Simple	Fundamental
Low (Green)			Simple

Complex/Fundamental/Simple represent the depth of knowledge and skill each level of provider has for a particular acuity patient.

Levels of Care

EMR

- Simple lifesaving skills to provide immediate care to critical patients
- Limited equipment and education
- Cannot transport

EMT

- Basic, non-invasive, lifesaving care
- Basic equipment and basic education
- Can transport
- Comparable to an ED Tech

Levels of Care

AEMT

- Minimally invasive, low risk skills, lifesaving care
- Placement of airways
- IV/IO access with limited medication administration
- Enhanced equipment and advanced education
- Can transport

EMT-P

- Highest level of prehospital EMS care. Invasive skills with critical care level treatments
- High level equipment with extensive education building on the foundation of lower-level skills
- Can transport via ground and air

Levels of Care

Prehospital Hospital Providers

- RNs
- Advanced practitioners
- Physicians

(L-R) Dr. Stephan Russ, associate chief of staff for Vanderbilt University Medical Center and associate professor of Emergency Medicine, recently spent the day and flew with LifeFlight 3 (Clarksville) Nurses Jessica VanMeter, DNP, and Tony Smith, DNP

EMS Operations

- Scene size up
- Need for additional resources
- Primary Assessment of the patient
- Treatment of life-threatening injuries

EMS Operations

- Symptoms
- Vital Signs
- SAMPLE Assessment
  - Symptoms
  - Allergies
  - Medications
  - Past Medical History
  - Last Oral Intake
  - Events

EMS Operations

- Trauma Criteria
- Spinal Stabilization
- Reassessment
- Destination & Notification
- On Scene Delays

Treatment

Delay at the Scene

Maintain C-spine/Open Airway

While sizing up the scene the prehospital provider determines if there is a reason to maintain C-spine on their patient

Immobilization Criteria

1. Altered Mental Status for any reason, including possible intoxication from alcohol or drugs (GCS < 15 or AVPU other than A)
2. Complaint of neck and/or spine pain or tenderness
3. Weakness, tingling, or numbness of the trunk or extremities at any time since the injury
4. Deformity of the spine not present prior to this incident
5. Distracting injury or circumstances (i.e. anything producing an unreliable physical exam or history)

High risk mechanisms of injury associated with unstable spinal injuries include, but are not limited to:

- Axial load (i.e. diving injury, spearing tackle)
- High speed motorized vehicle crashes or rollover
- Falls greater than standing height

Major Trauma Criteria

- GCS ≤ 13
- Respiratory rate is < 10 or > 29
- Pulse rate < 50 or > 120
- Systolic BP < 90 mmHg
- Penetrating injuries to head, neck, torso or proximal extremities
- Two or more suspected proximal long bone fractures
- Suspected flail chest
- Suspected spinal cord injury or limb paralysis
- Amputation (except digits)
- Suspected pelvic fracture
- Open or depressed skull fracture
- Ejection/ partial ejection from vehicle
- Death in the same compartment
- Extrication time in excess of 20 minutes
- Vehicle collision resulting in 12 inches of intrusion in to the passenger compartment
- Motorcycle crash > 20 MPH or with separation of rider from motorcycle
- Falls from greater than 20 feet
- Vehicle rollover (90 degree vehicle rotation or more) with unrestrained passenger
- Vehicle vs. pedestrian or bicycle collision above 5 MPH

Pennsylvania Trauma Patient Destination Criteria

Physiologic Criteria:

- Patient does not follow commands (GCS Moto ≤ 5)
- Hypotension, even a single episode (SBP < 90 mmHg)
- Respiratory rate < 10 or > 29 breaths/minute or need for ventilator support (< 20 in age < 1 year)

Anatomic Criteria:

- Penetrating injury to head, neck, torso, and extremities proximal to elbow or knee (unless obviously superficial)
- Chest wall instability or deformity (for example, flail chest)
- Two or more proximal lone-bone (humerus or femur) fractures
- Crushed/degloved/mangled or pulseless extremity
- Amputation proximal to wrist or ankle
- Pelvis fractures
- Paralysis (spinal cord injury)

YES →

CATEGORY 1 TRAUMA

- Requires immediate transport to a trauma center (Level 1 or 2), if within 45 minutes
- Otherwise, transport to a Level 3 (preferred) or Level 4 trauma center if patient can arrive at the Level 3 or Level 4 center within 45 minutes or before an air ambulance can arrive to the patient's location
- Notify Trauma Center ASAP (including category and ETA)

Pennsylvania Trauma Patient Destination Criteria

Mechanism of Injury:

- Falls
  - Adult: > 20 feet (one story = 10 feet)
  - Children: > 10 feet or 2-3 x height of child
- High Risk Auto Crash
  - Passenger compartment intrusion, including roof: > 12 in. occupant site or > 18 in. into compartment at any site
  - Ejection (partial or complete) from automobile
  - Death in same passenger compartment
- Auto v. pedestrian/bicyclist thrown, run over, or significant (> 20 mph) impact
- Motorcycle crash > 20 mph

Other factors combined with traumatic injuries:

- Older Adults: SBP < 110 may indicate shock after age 65
- Anticoagulants or bleeding disorder
- Burns with trauma mechanism
- Pregnancy (> 20 weeks)
- Finger amputation

YES →

CATEGORY 2 TRAUMA

EITHER:

- **Contact Medical Command at closest Trauma Center (Level 1, 2, or 3) for authorization for air medical transport if needed.**

OR

- **Transport by ground to closest Trauma Center (Level 1, 2, or 3) (if within 45 minutes)**
- **Otherwise, transport to closest Level 4 Trauma Center (if within 45 minutes)**

Pennsylvania Trauma Patient Destination Criteria

NO

CATEGORY 3 TRAUMA

TRANSPORT TO CLOSEST APPROPRIATE RECEIVING FACILITY:

- **Frequently reassess for Category 1 or 2 criteria**
- **Contact medical command, if doubt about appropriate destination**

General Trauma Guidelines

- Trauma Alert Criteria
- Scene Time
- Destination Protocols
- Vascular Access & Fluid Administration

2011 CDC GUIDELINES

Physiologic Criteria	Highest Level of Care (Level 1 or 2 Trauma Center)
High Mechanism of Injury Indication	Highest Level of Care (Level 1 or 2 Trauma Center)

2011 CDC Guidelines

Lower Mechanism of Injury	Closest Trauma Center (regardless of level of care)
Special Patient or System Considerations	Possibly to a Trauma Center

EMS Operations

Rapid Transport

- Time to Transport:
  - 10 minutes or less if not entrapped
  - 20 minutes or less if entrapped
- Reasons to delay transport
  - Very few
- Enroute Treatments

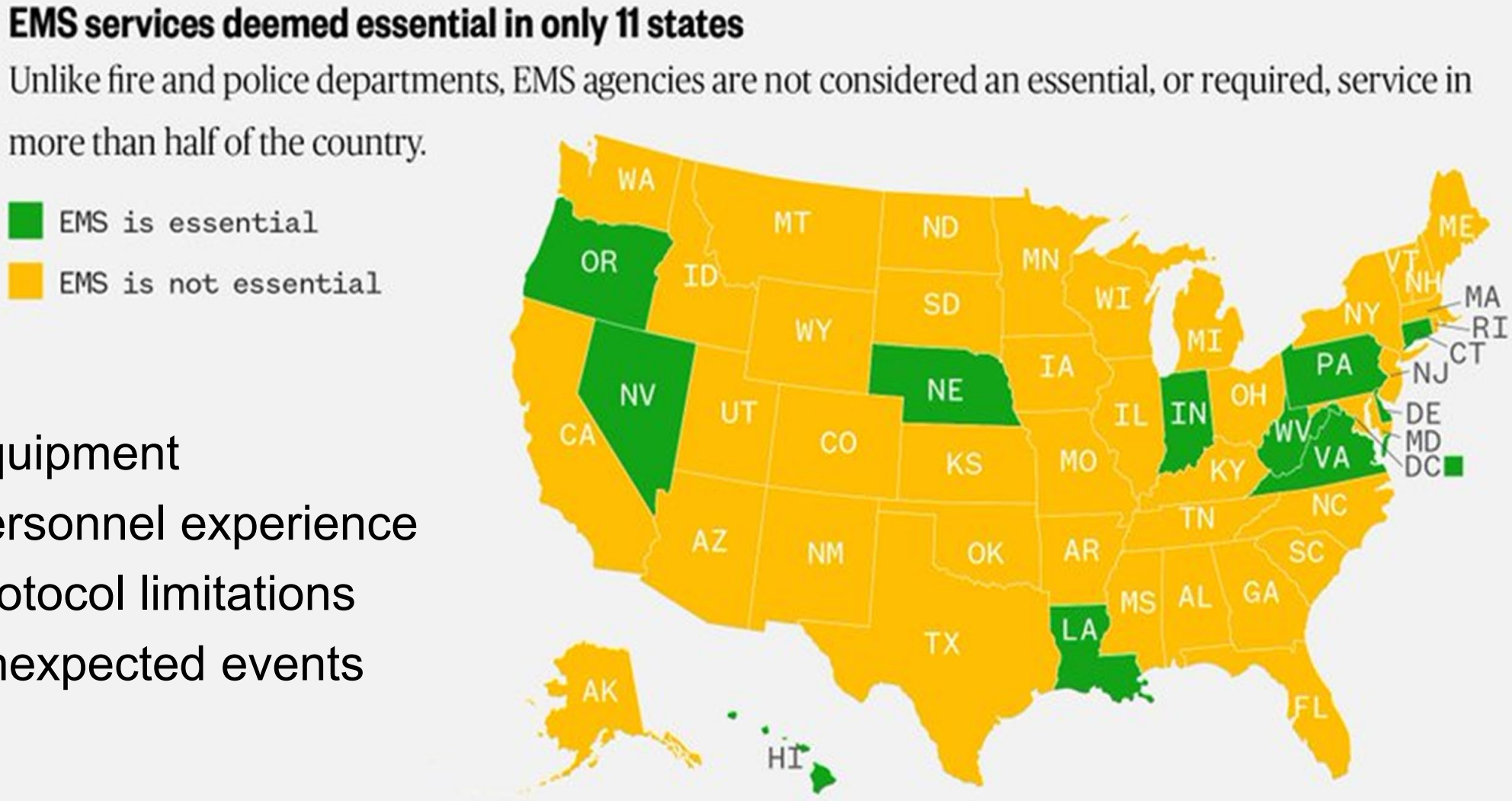
EMS Operations

- Arriving in the Trauma Bay
- Giving Report
- Assisting with Care
- Decon & Resupply

Prehospital Care - Challenges

Environment
at the call

Prehospital Care Challenges



- Equipment
- Personnel experience
- Protocol limitations
- Unexpected events

https://www.nbcnews.com/health/health-care/there-s-shortage-volunteer-ems-workers-ambulances-rural-america-n1068556

Prehospital Care - Ventilation

You Can (almost) Always Bag

Prehospital Care - Airway Adjuncts

King Airway

LMA

iGel

Combitube

Prehospital Care: Intubation

There have been numerous studies to evaluate the effectiveness of prehospital intubation.

Results range from improving to worsening outcomes for the patient.

Protocols vary state-by-state on how intubation can be performed.

EMS Intubation Protocol Sample

- Consider intubation if GCS is less than 8 or airway cannot be maintained.
- If patient is intubated or has an airway such as Combitube, King, LMA $P_{ET}CO2$ levels should be continually monitored and maintained at 33 – 43 mmHg if available.

Prehospital Care – Hemorrhage Control

Proven effective techniques of hemorrhage control:

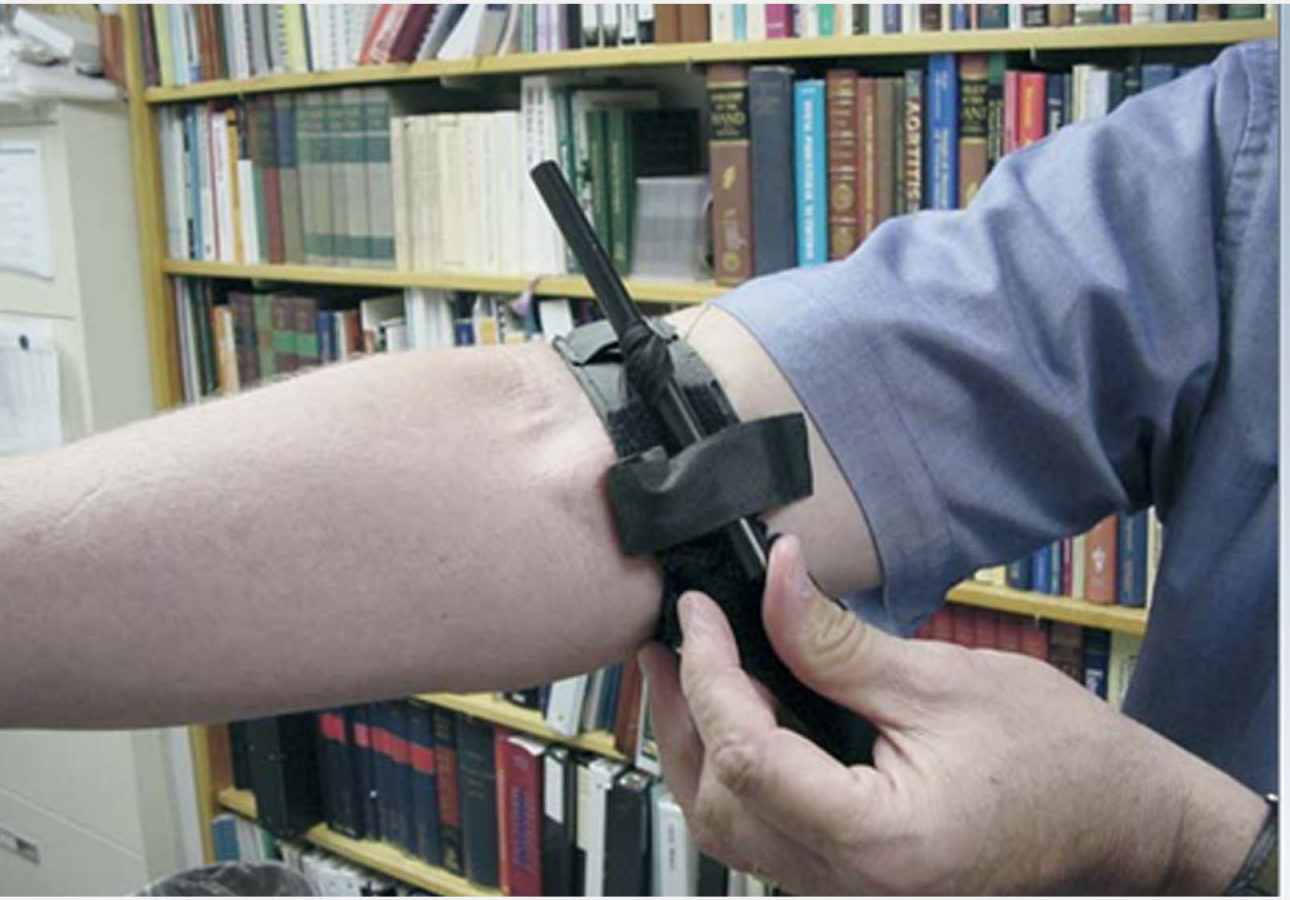
- Direct pressure
- Tourniquets

Unproven techniques:

- Elevation of limb
- Pressure points
- Cold application

Prehospital Care - Tourniquets

Special Operations Forces Tactical Tourniquet



Indications for Tourniquet

- Hemorrhage from an extremity that cannot be controlled with direct pressure or a pressure bandage
- Traumatic amputation
- There may be times (tactical, rescue, entrapped patient, multiple patient scene, backwoods environment) when tourniquet application is the best first option

There are no contraindications for applying a tourniquet

Tourniquet Safety

Prehospital Care – Intravascular Access

2 large bore IV's?

Common EMS Protocol

- *Do not delay transport to establish IV/IO access.*
- Initiate IV/IO (18ga or larger) and hang NS, if approved.
- Consider 2nd IV/IO where hypovolemia is suspected (Adult only)
- (Adult) If SBP < 100 mmHg or heart rate > 120, initiate a fluid bolus of Normal Saline: 500 ml

Prehospital Care – Intravascular Access

via Intraosseous Access

VIEWER DISCRETION IS ADVISED

https://youtu.be/SYfVFq0rc7c

Prehospital Care - Splinting

Prehospital Care – Splinting

Traction Splints

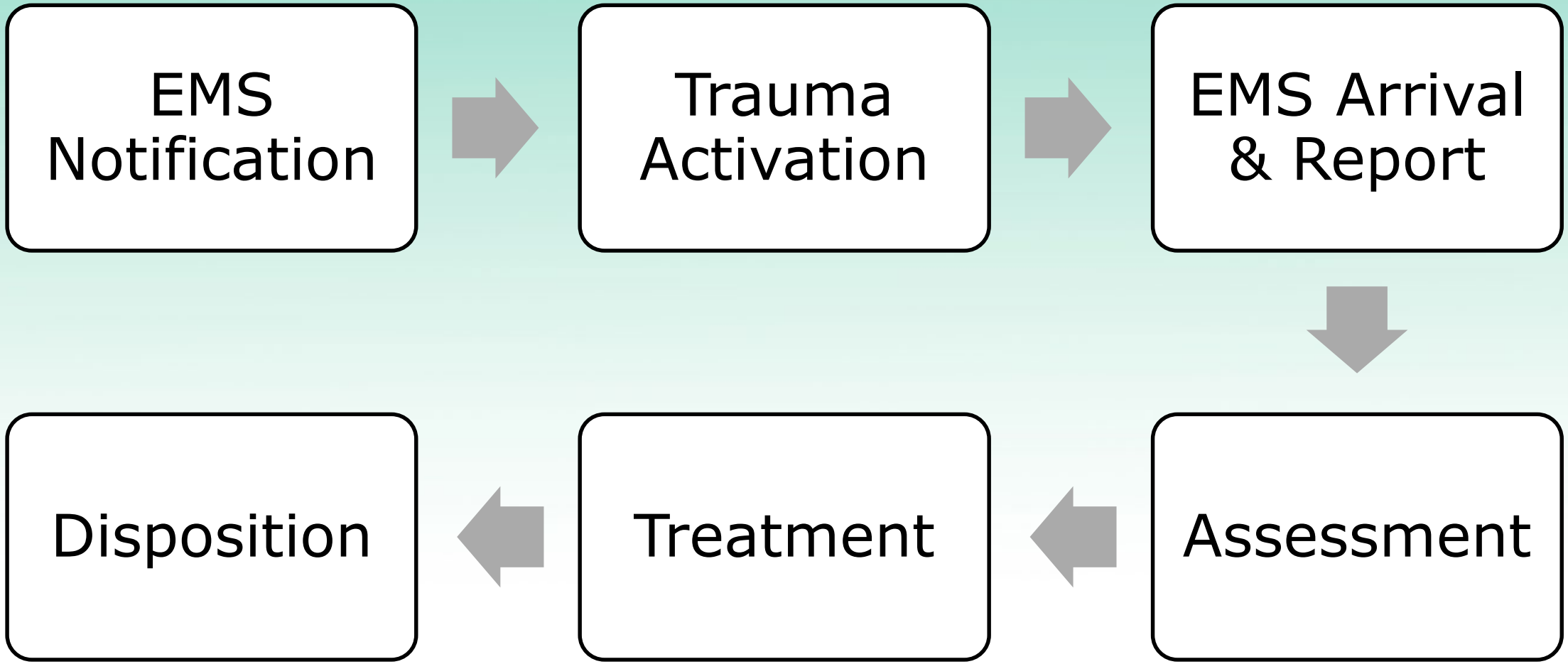
Prehospital Care – Splinting

Pelvic Fractures

- Physical exam is unreliable
- DO NOT ROCK or palpate the pelvis in the prehospital arena
- Avoid log rolling as much as possible
- Apply splint if in your area protocols

www.expeditionmedicine.co.uk/

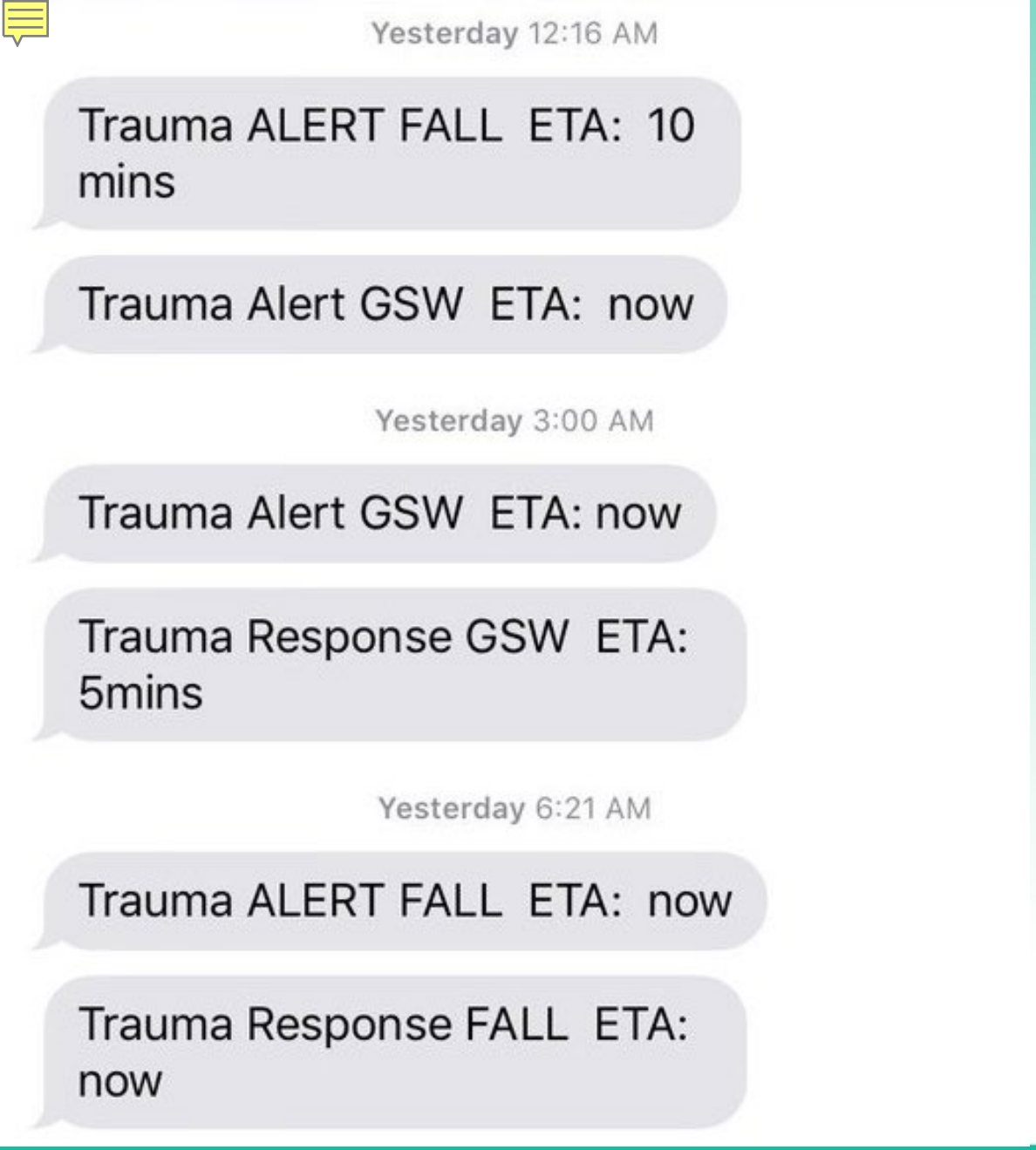
Trauma ED Operations



Trauma ED Operations

- Notification received from EMS
- Information interpreted and plan is developed
- Questions asked

EMS Notification



Trauma ED Operations

- Method of Trauma Alert Activation
- Personnel at Trauma Alert Activation
- Clearing Trauma Alert Activation

Trauma Activation

Trauma ED Operations

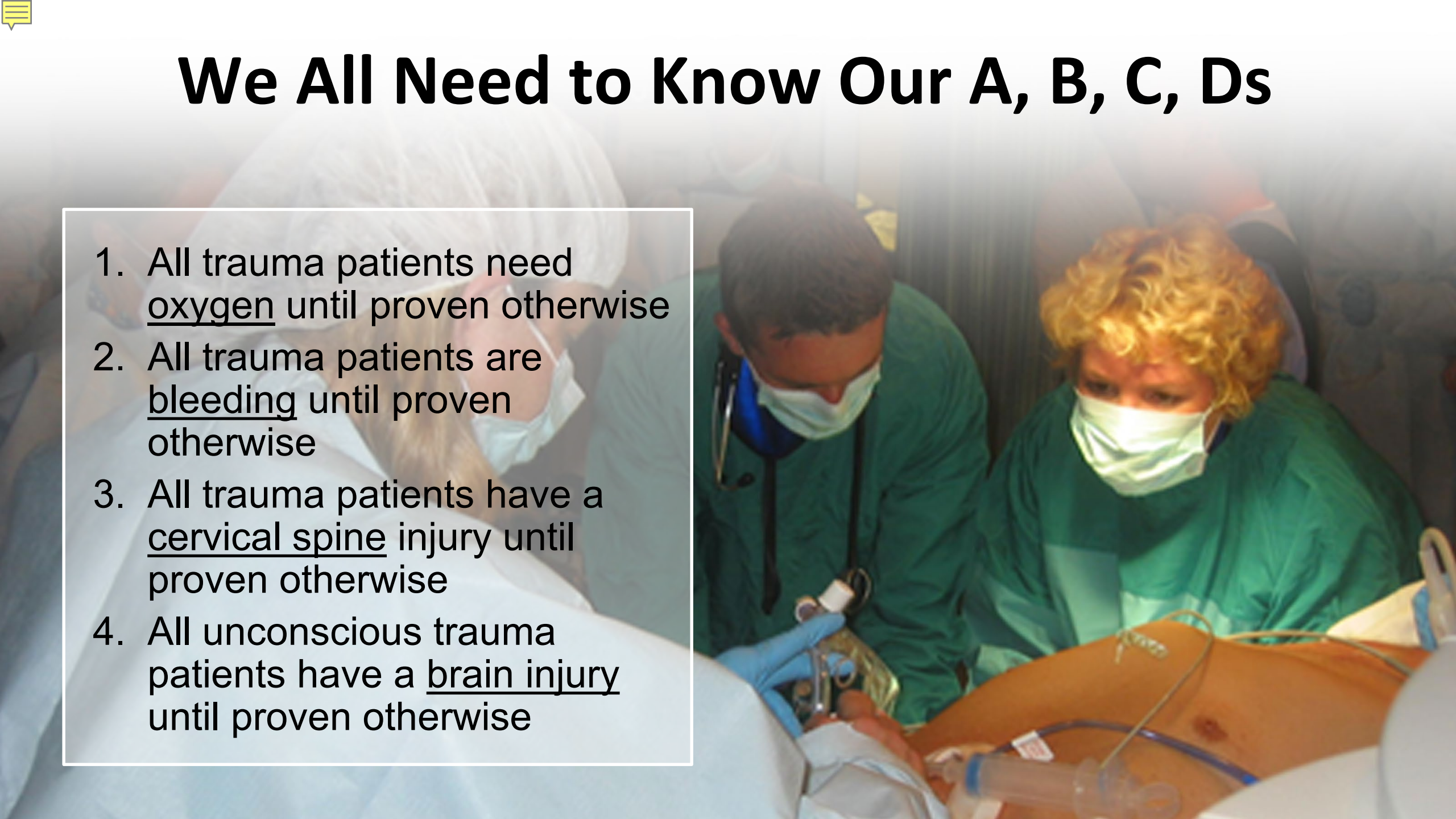
- First ED encounter with the patient
- Report is given and questions are asked
- Care of the patient begins

ED Patient Care

- A-B-Cs
- Primary Assessment
- Imaging / Procedures
- Reassessment

We All Need to Know Our A, B, C, Ds

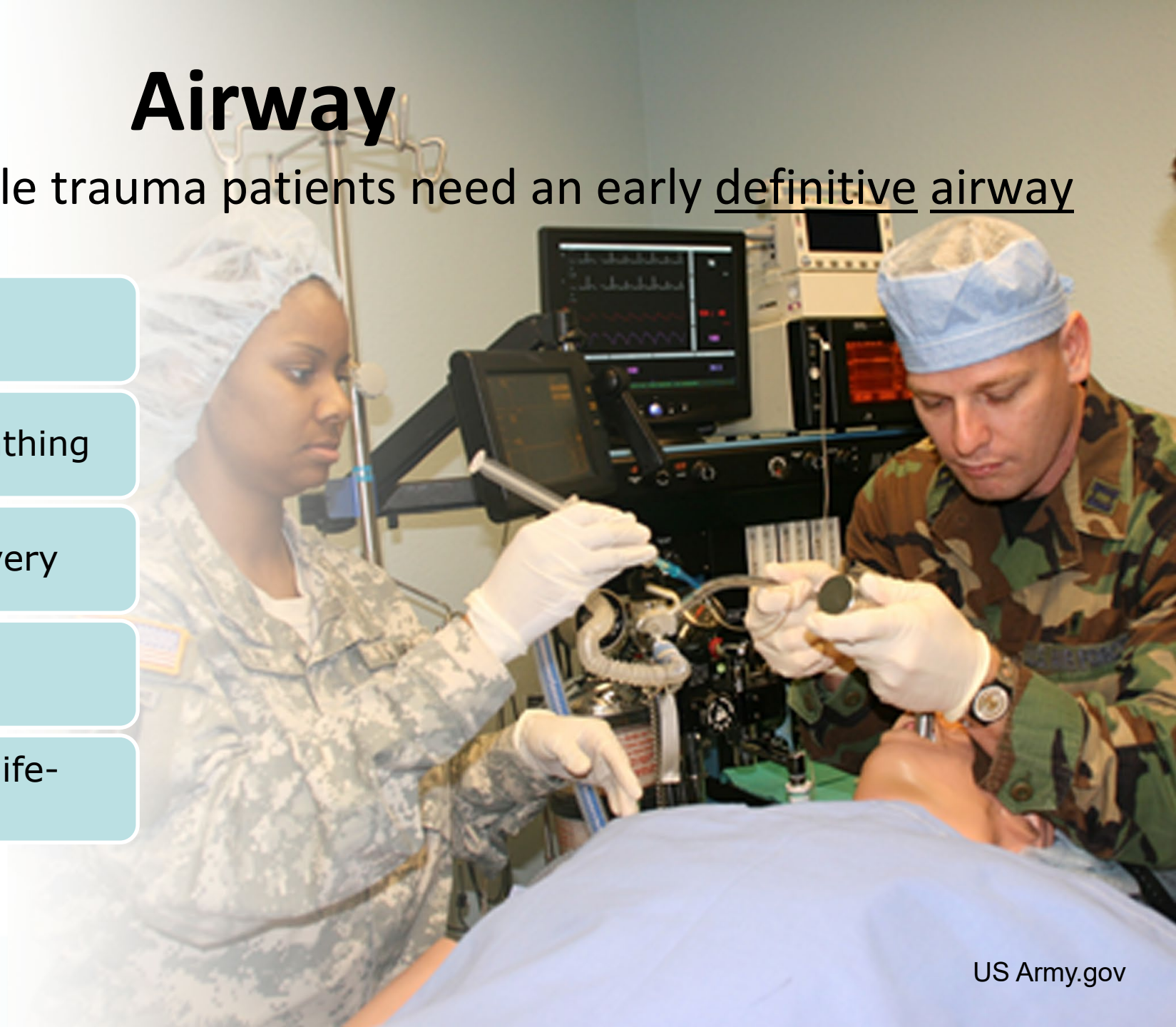
1. All trauma patients need oxygen until proven otherwise
2. All trauma patients are bleeding until proven otherwise
3. All trauma patients have a cervical spine injury until proven otherwise
4. All unconscious trauma patients have a brain injury until proven otherwise



Airway

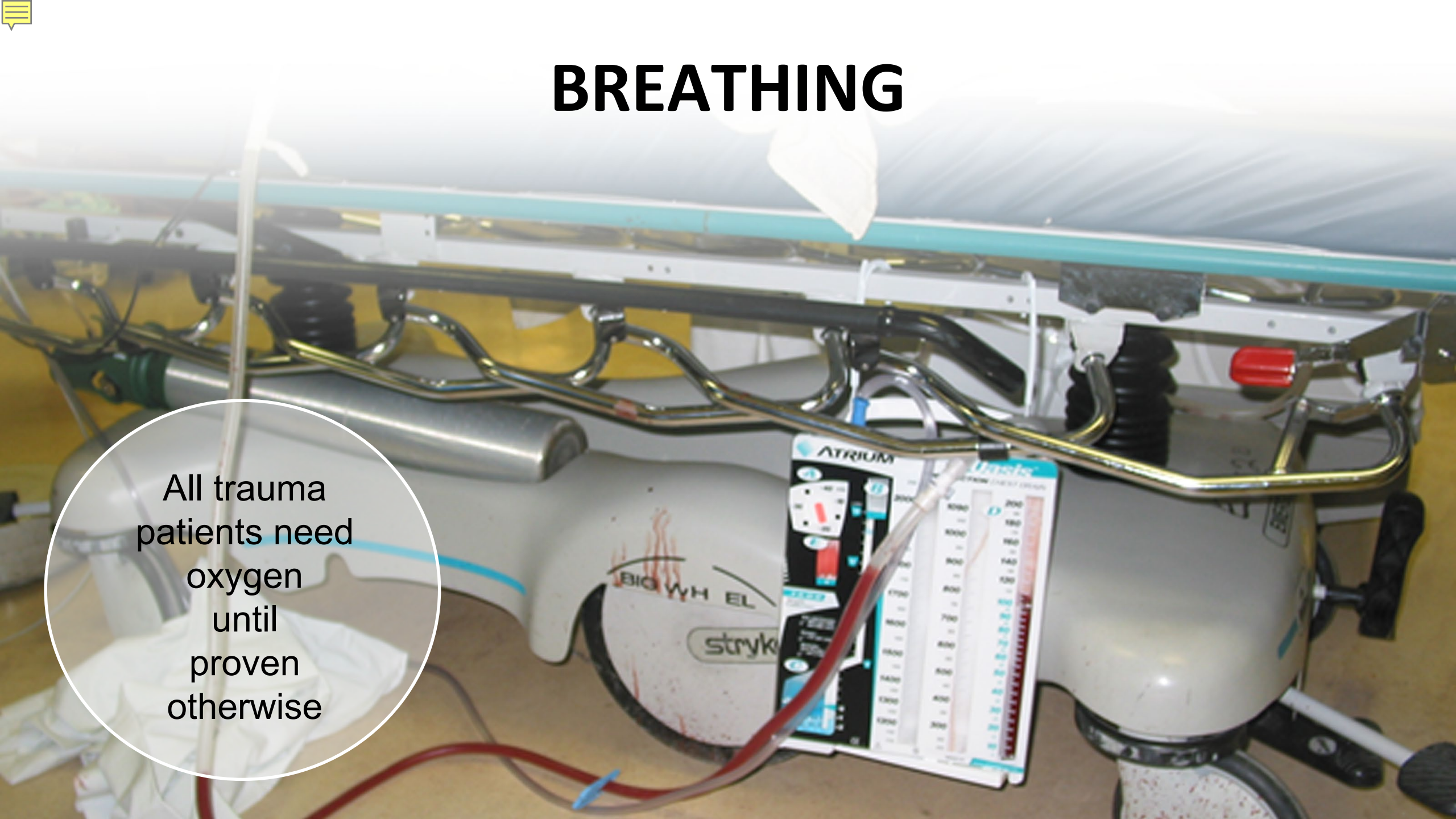
Hemodynamically unstable trauma patients need an early definitive airway

- Prevents aspiration
- Reduces the oxygen debt of breathing
- Maximizes systemic oxygen delivery
- Corrects acid base disturbances
- Allow clinician to focus on other life-threatening issues



US Army.gov

BREATHING



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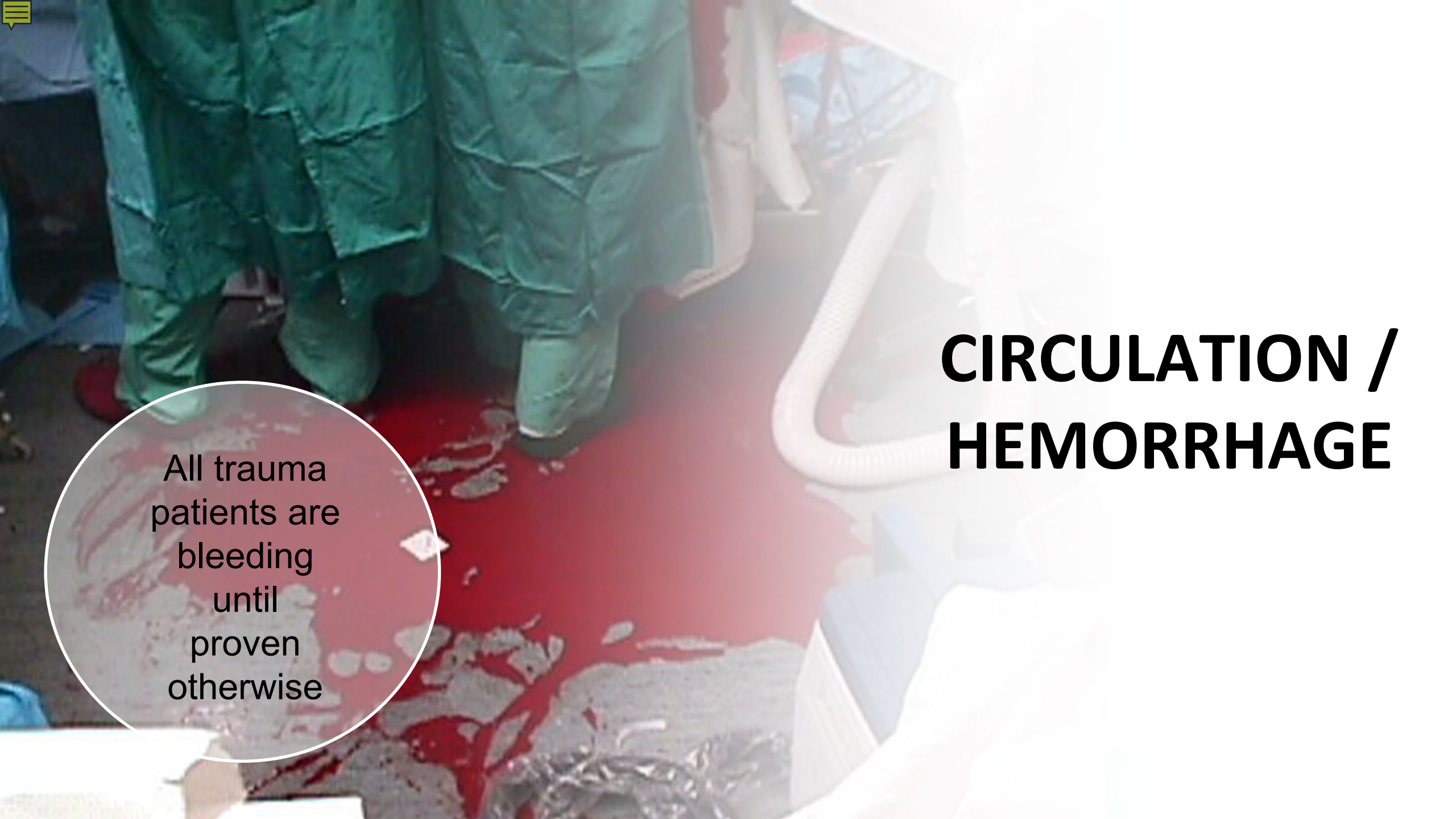
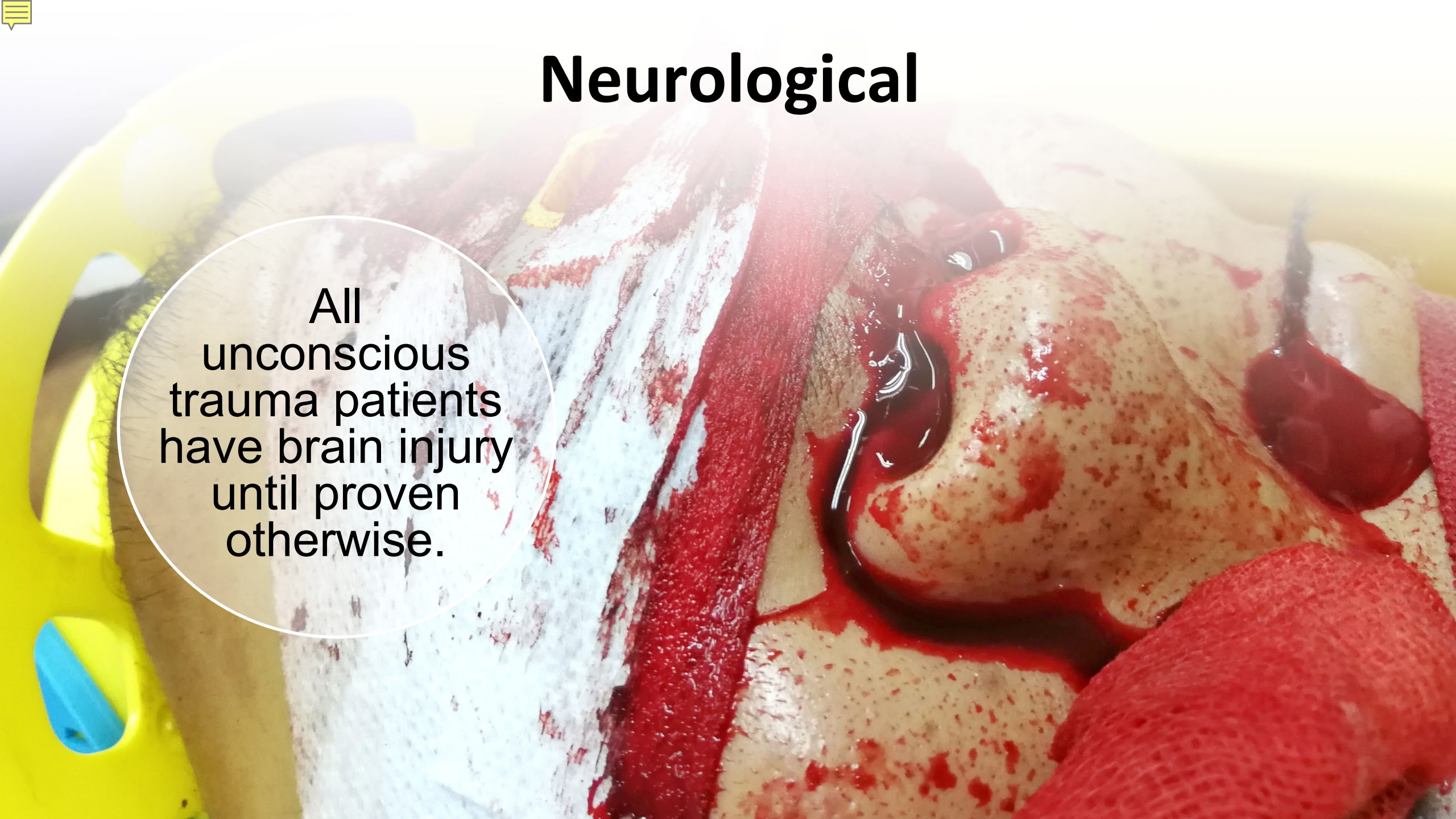


CIRCULATION / HEMORRHAGE

Hemorrhage: Five Anatomic Areas of Origin

Anatomic site	Modality	Reliability
Intraperitoneal	FAST	Positive test is diagnostic; negative test is suspect
	DPL	Gross positive is diagnostic; technically positive only is suspect
Retroperitoneal	Pelvic radiograph	Unstable fracture pattern is suggestive
Thoracic (pleural)	Chest radiograph	Positive test is usually diagnostic
Multiple long-bone fractures	Physical examination	US and radiograph confirmatory but do not quantify blood loss
External bleeding	Physical examination	Positive findings diagnostic but do not quantify blood loss

Neurological

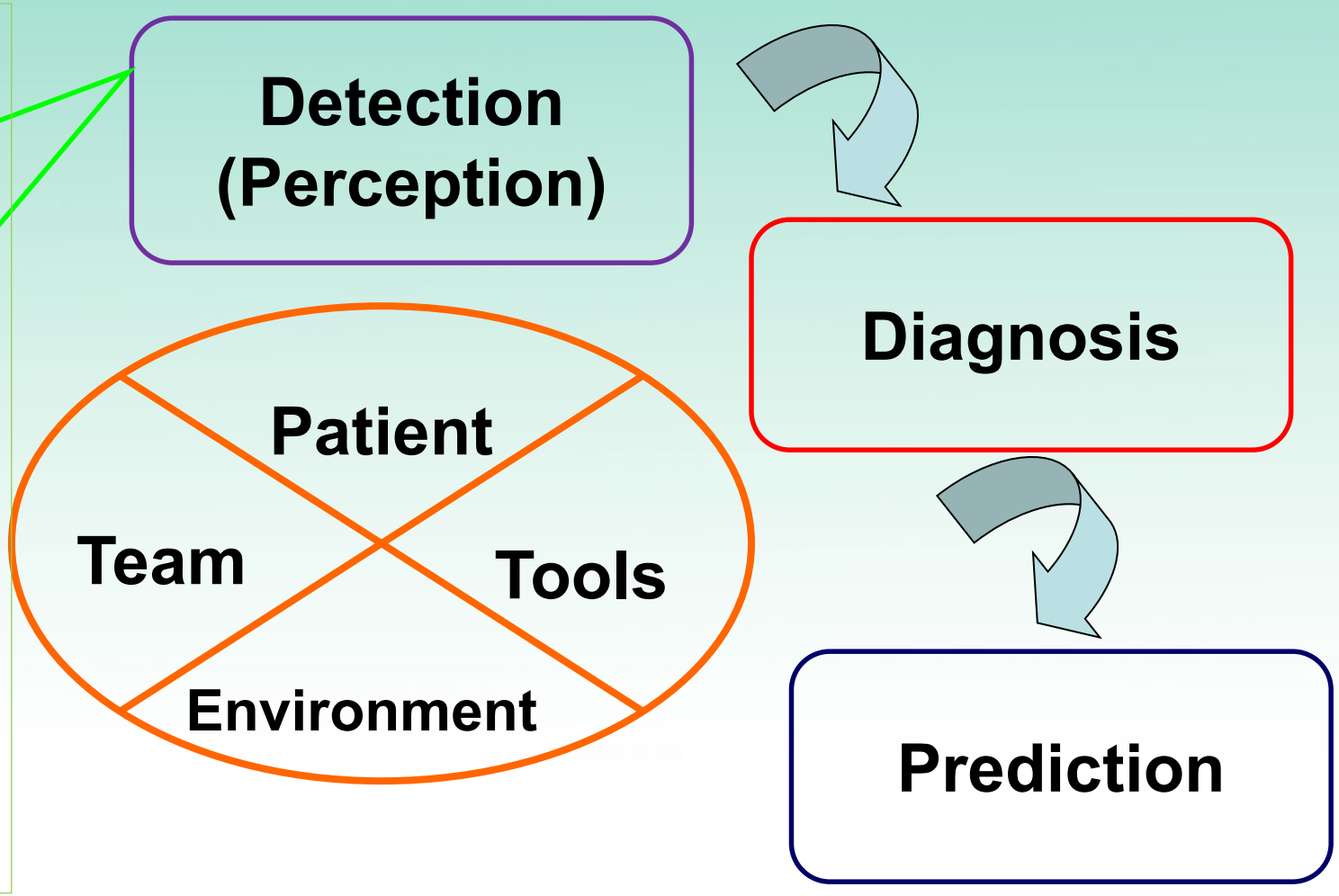


Most Potentially Preventable Trauma Deaths Are Related to:

- Airway obstruction
- Hemorrhage
  - Hemopneumothorax
  - Intracavitary bleeding
  - Intracranial hemorrhage

Situation Awareness

- Cause of instability must be recognized and corrected quickly by using a systematic approach.
- It is important to identify and prioritize systemic compromise.

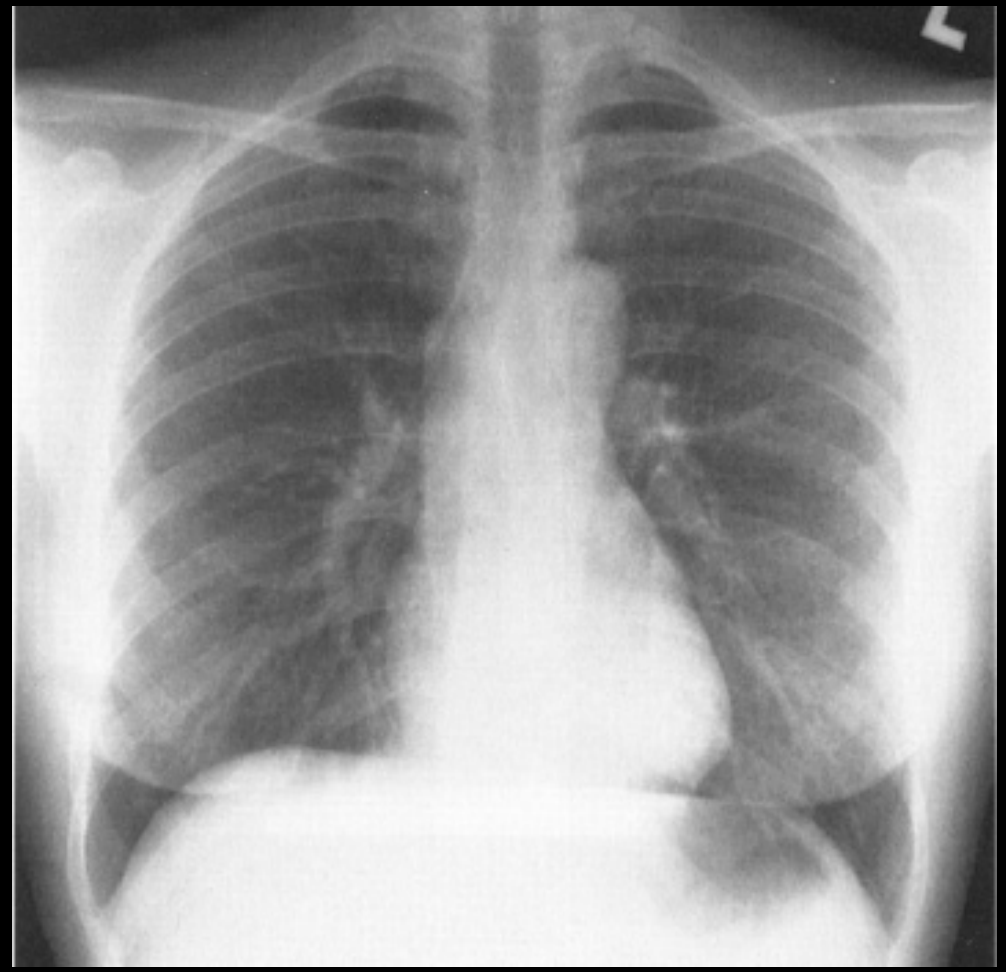


Recognize Trouble!

Episodic Hypotension

Trauma patients with prehospital hypotension that are normotensive on arrival should have an arterial blood gas with Base Deficit (BD) interpreted early upon admission to help identify those patients who are at risk for “crumping.”

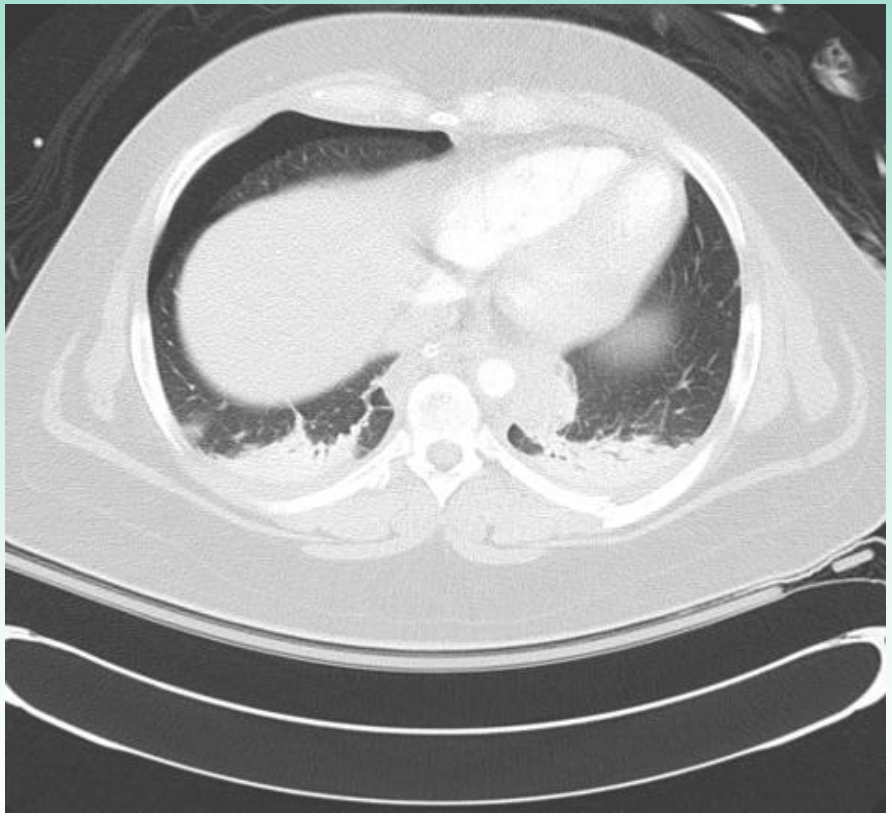
Routine Chest X-ray



Chest x-ray

- Early
- Valuable
- Significant injury
- Position of patient
- Never delay procedures for x-ray

CT Scan for Thoracic Trauma



An occult pneumothorax seen on a CT scan that was not detected on a plain anteroposterior supine chest radiograph.

- Recognize the insensitivity of the AP CXR to detection of pneumothoraces
- Remarkably large occult pneumothoraces may be present without an obvious anterolateral pleural stripe on AP CXR

Routine Pelvic X-ray

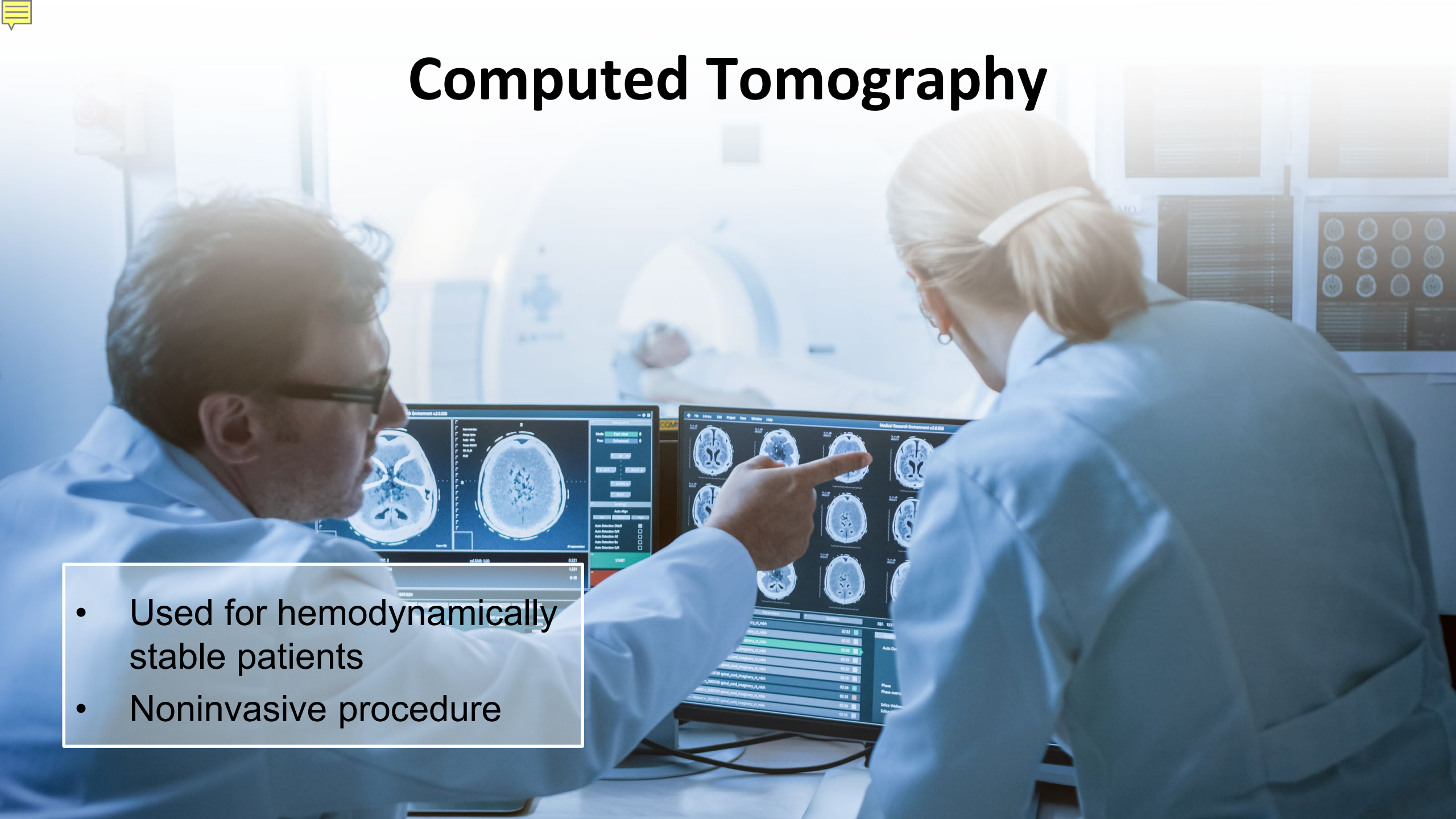
ATLS advocates that a routine pelvic x-ray be an adjunct to primary survey in trauma patients with **multiple injuries.**

Roberts, Radiopaedia

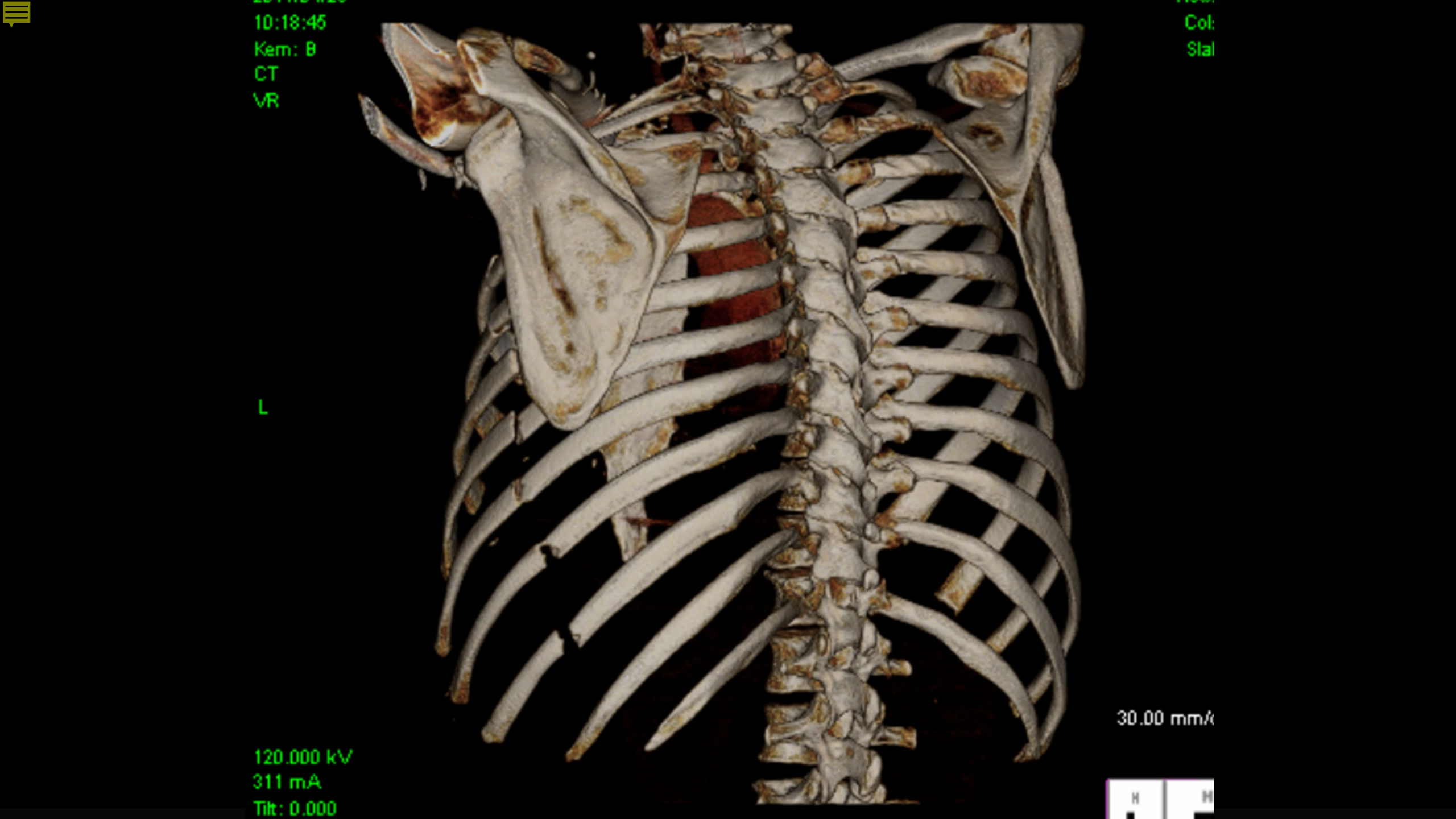
Routine Cervical Spine X-ray

- The primary screening modality is axial computed tomography (CT) from the occiput to T1 with sagittal and coronal reconstructions.
- Plain radiographs contribute no additional information and should not be obtained.

Computed Tomography



- Used for hemodynamically stable patients
- Noninvasive procedure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Kern: B
CT
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ED Patient Care

- Resuscitation
- Bedside Invasive Procedures

Resuscitation

- For Resuscitation to occur:
  - Adequate perfusion and tissue oxygenation must be restored
- Resuscitation measures directed at:
  - Control the bleeding
  - Maintaining or restoring
    - Hematocrit
    - Normothermia
    - Normal INR
    - Base deficit within normal limits

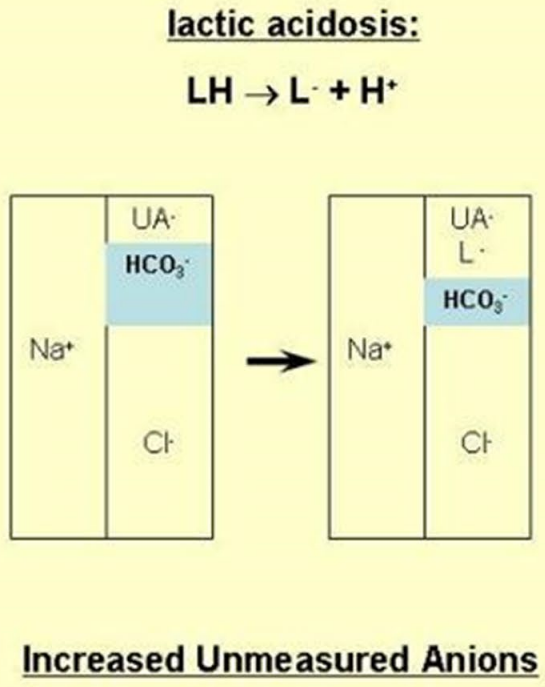
Recognize Trouble!

Indicators of Anaerobic Metabolism and Acidosis

↓ serum pH (7.35 – 7.45)

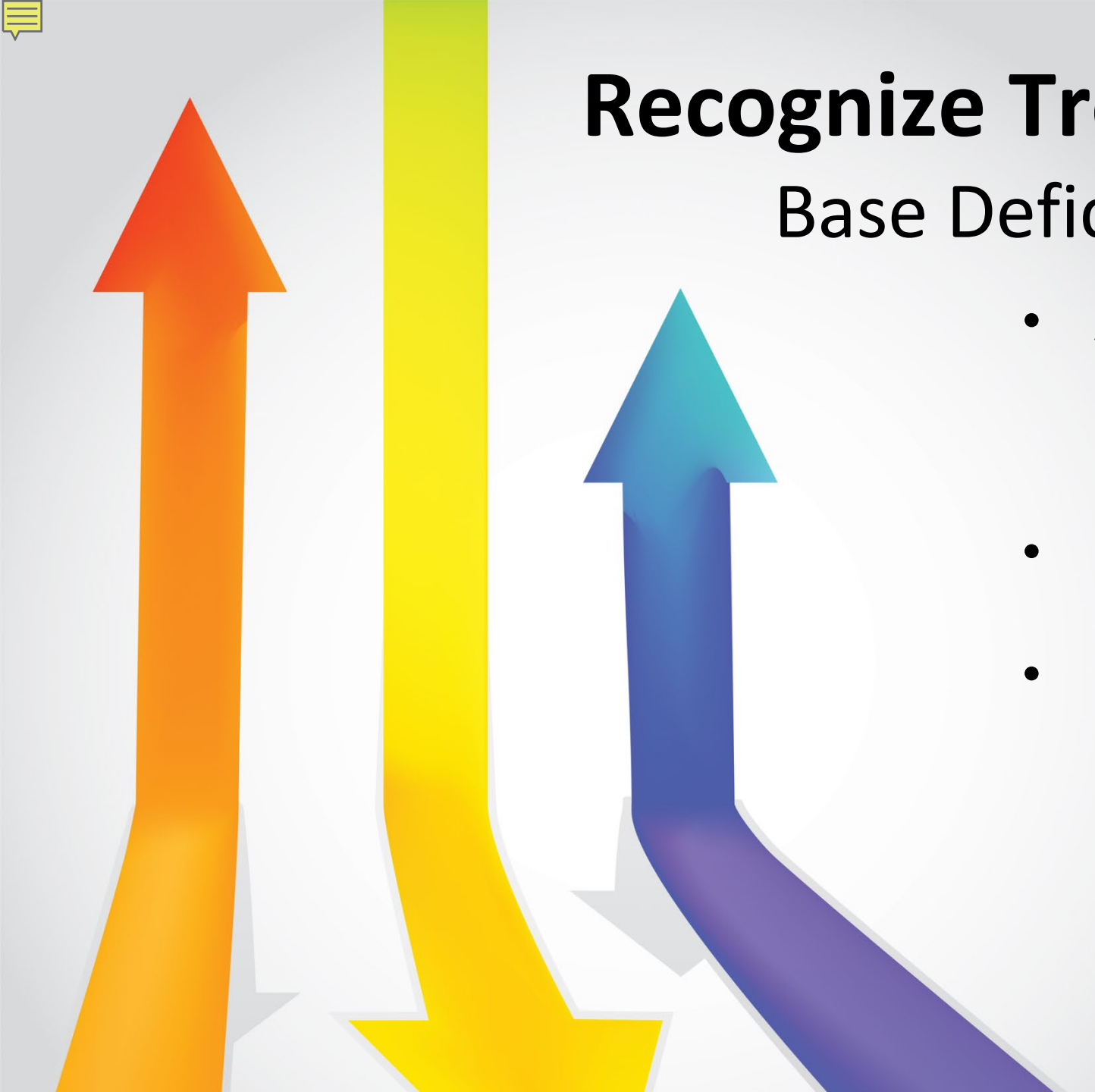
↑ base deficit (2 to -2)

↑ serum lactate (0.4 – 1.8 mmol/L)



Recognize Trouble!

Base Deficit



- Amount of fixed base (bicarbonate) required to correct the pH of an aliquot of blood to 7.40 at 37 C
- Excellent correlation of base deficit to lactate and pH
- Normalizes rapidly with adequate resuscitation and control of hemorrhage

Optimizing Resuscitation

Prevent Unnecessary Blood Loss

- Low volume blood sampling
  - 3 cc for ISTAT: Na/K/Cl/Ca, Hgb, Hct, PO2, PCO2, pH, PT, INR, Lactic acid, Creatinine, Troponin
- Use FAST to rapidly detect intra-abdominal fluid
- Auto transfusion of thoracic blood using a chest tube drainage/auto-transfusion system
  - Avoid spilling blood on floor during chest tube insertion

Optimizing Resuscitation

Controlling Hemorrhage

- Direct pressure to all external bleeding
- Rapid suturing of all scalp and facial wounds
- Rapid application or evaluation of traction splints for femur fracture
- Binder for pelvic fracture
- Rapid reduction and pressure dressings of mangled extremities
- Leaving prehospital tourniquets in place until ready for surgical intervention

Endpoints of Resuscitation

- B/P & HR WNL
- Increased urine output
- Improved base deficit
- Decreased serum lactate
- Improved serum pH
- Normothermia
- Adequate coagulation status

Damage Control Resuscitation

Lifesaving interventions aimed to prevent and/or rapidly treat blood loss, irreversible hypothermia, acidosis, and coagulopathy in the unstable trauma patient with severe injuries.

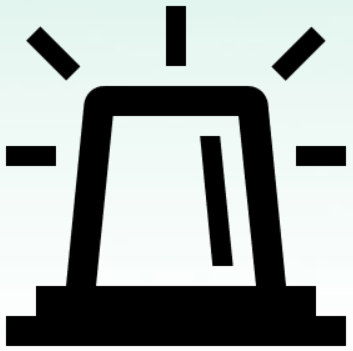
- A = acidosis
- B = blood loss
- C = cold
- D = damage

Interventions to Decrease the Need for Blood Transfusion

- Intervene early in resuscitation to STOP bleeding
- Conserve blood early
- Aggressive, rapid, and efficient operative interventions
- Use novel surgical methods to STOP bleeding in the operating theater
- Early use of interventional radiology when appropriate
- Correct hypothermia, acidosis, coagulopathy

Trauma ED Operations

Disposition



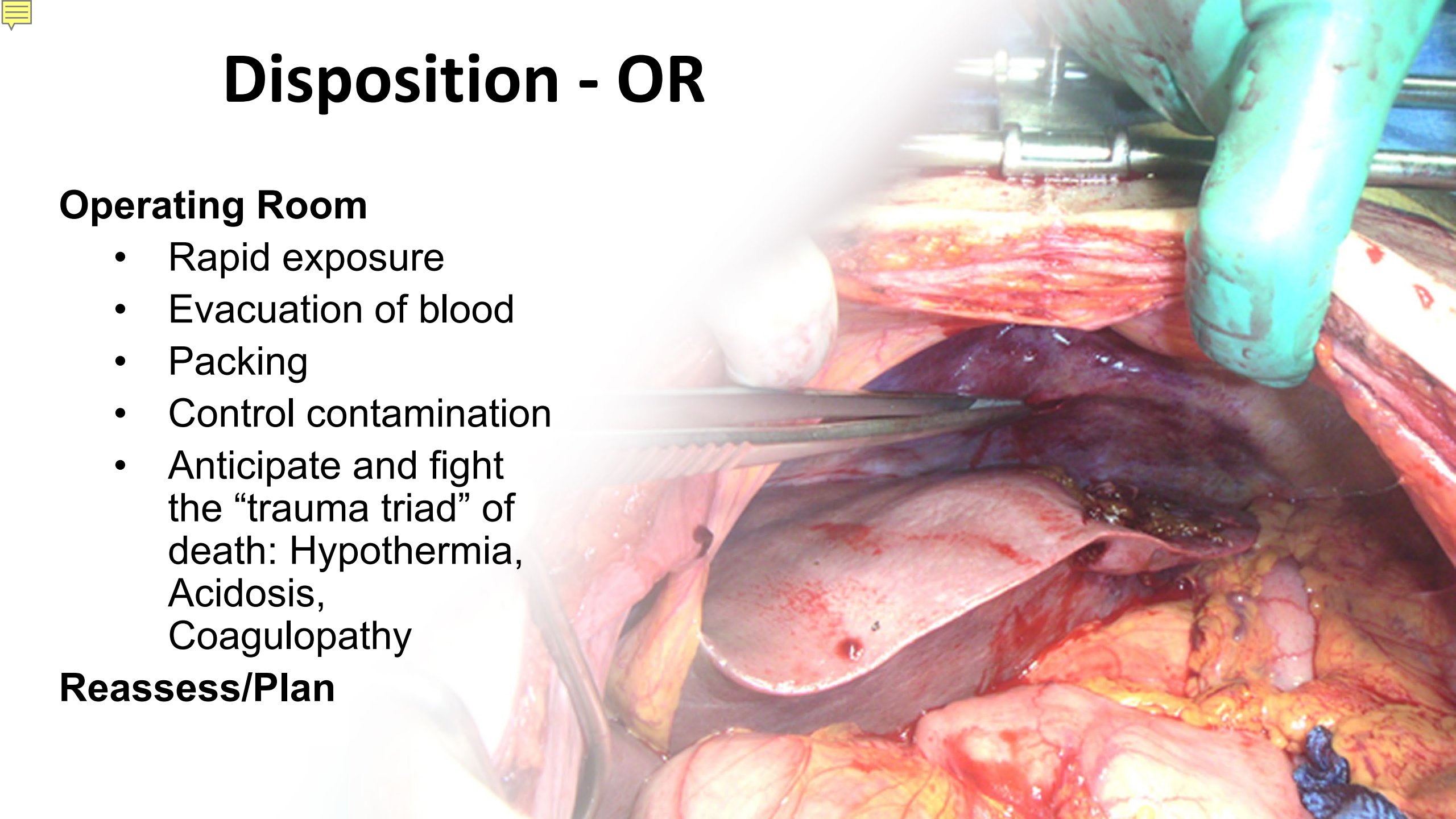
- Operating Room
- Interventional Radiology
- Intensive Care Unit
- Termination of Efforts

Disposition - OR

Operating Room

- Rapid exposure
- Evacuation of blood
- Packing
- Control contamination
- Anticipate and fight the “trauma triad” of death: Hypothermia, Acidosis, Coagulopathy

Reassess/Plan



Disposition - ICU

Recognize Trouble!

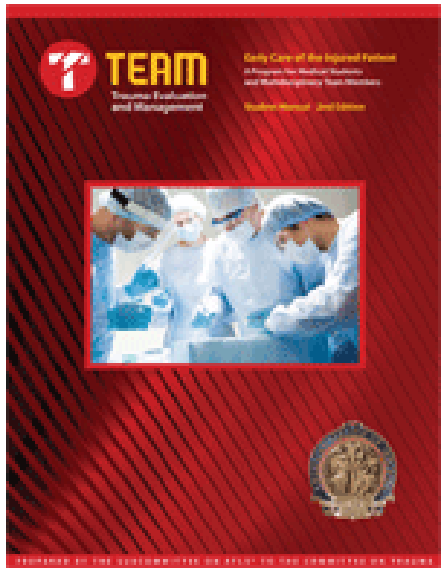
Persistent Metabolic Acidosis

- Continued bleeding
- Inadequate resuscitation
- Myocardial dysfunction

Defense.gov

Providing the Best Care

Leadership & Teamwork



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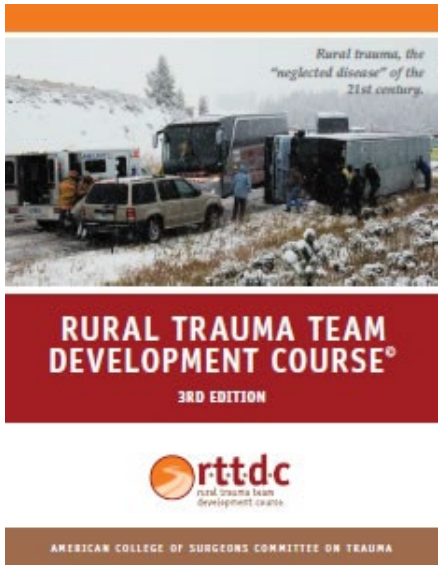
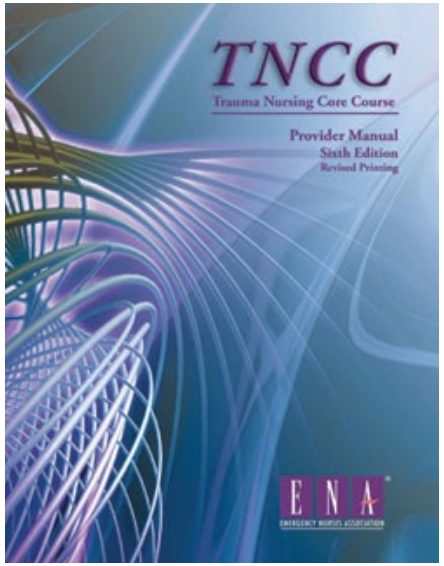
ADVANCED TRAUMA CARE FOR NURSES®





ATLS
ADVANCED TRAUMA LIFE SUPPORT

Providing the Best Care

Communication

- Physiologic Criteria
- Mechanism of Injury
- Interventions

Providing the Best Care

Trauma Team Training Course

Prepares teams of five to care for trauma victims with the limited resources found at African rural hospital and health centers

CNIS Safer Surgery, Obstetrics + Communities in Africa
Canadian Network for International Surgery

Providing the Best Care

Goal Directed Therapy

- High risk patients
  - Geriatric patients
  - Pediatric patients
  - Pregnant women
- Anticoagulants
- Beta blockers

Providing the Best Care

“Routine Trauma Labs”

Information provided by routine admission chemistry and coagulation profiles in trauma patients seldom lead to clinical interventions.

Should not be ordered routinely on admission in trauma patients

Providing the Best Care

EAST Practice Guidelines

"Withholding and termination of resuscitation of adult cardiopulmonary arrest secondary to trauma: Resource document to the joint NAEMSP-ASCOT position statements"

east

The Eastern Association for the Surgery of Trauma

Consistent Organization and Clear-cut Communication Produce Effective Outcomes

Well established and maintained clear roles and goals

Similar training- street through hospital

Effective function of the team begins with the Team Leader

Summary and Conclusions

- It takes a team.
- Efficient teams communicate and have a defined leader.
- Effective teams use research-based protocols.
- Trauma centers save lives!