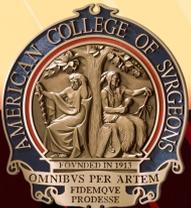


# The Committee on Trauma Presents

## TEAM

### Trauma Evaluation and Management: Early Care of the Injured Patient

Program for Medical Students and Multidisciplinary Team  
Members based on the ATLS® Course for Doctors



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Trauma Evaluation  
and Management

# Goals/ Principles of Trauma Care

- Rapid, accurate, and physiologic assessment
- Resuscitate, stabilize, and monitor by priority
- Prepare for transfer to definitive care
- Teamwork for optimal, safe patient care



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# Objectives

- Describe fundamental principles of initial assessment and management
- Identify correct sequence of management priorities
- Describe appropriate techniques of resuscitation



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# Objectives

- Recognize value of patient's history
- Understand importance of injury mechanism
- Identify concepts of teamwork in caring for injured patient



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# The Need for Early TEAM

- Leading cause of death in ages 1 through 44
- Disabilities exceed deaths by ratio of 3:1
- Trauma-related costs > \$400 billion per year
- Lack of public awareness for injury prevention



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# Injury Prevention



Analyze injury data



Build local coalitions



Communicate the problem



Develop prevention activities



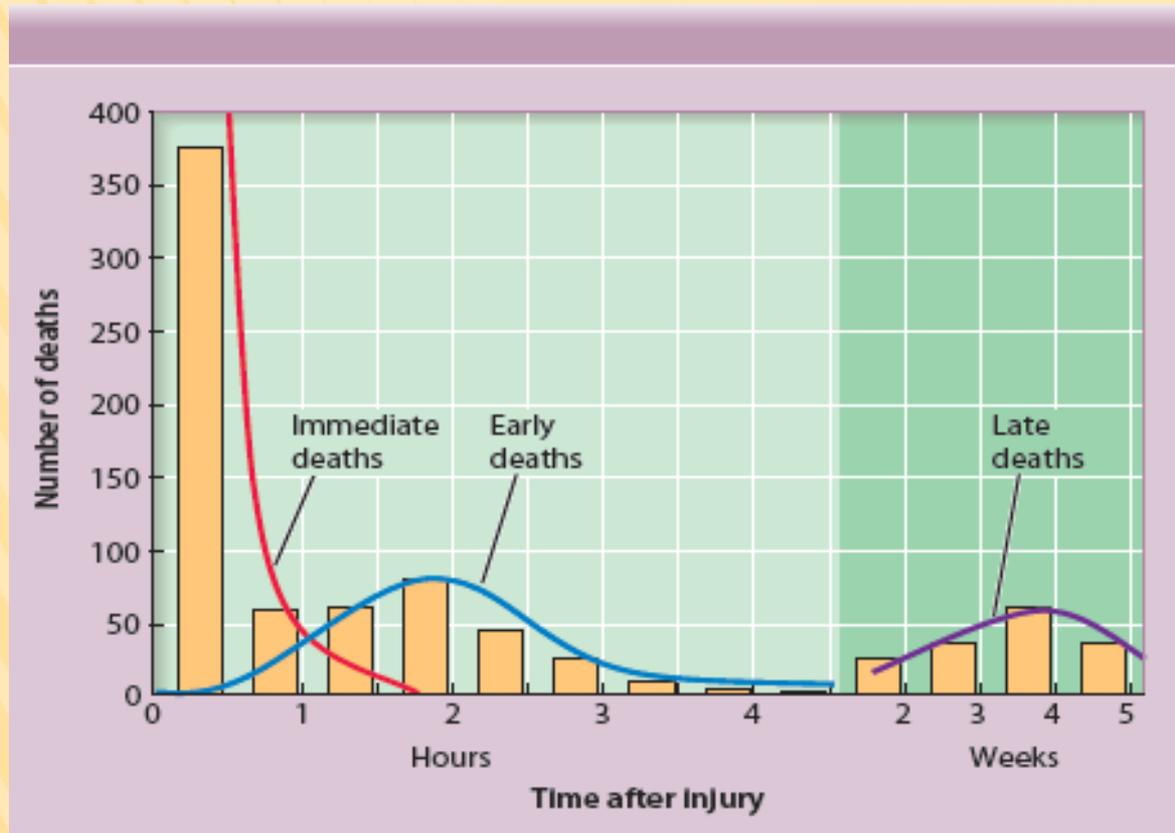
Evaluate the interventions



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# Trimodal Death Distribution



# TEAM Principles

- Treat greatest threat to life first
- Definitive diagnosis less important
- Physiologic approach
- Time is of the essence
- Do no further harm
- Teamwork required for TEAM to succeed



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# TEAM Approach



Airway with c-spine protection



Breathing/ ventilation/ oxygenation



Circulation: Stop the bleeding!



Disability (neuro status)



Expose/ Environment/ body temp



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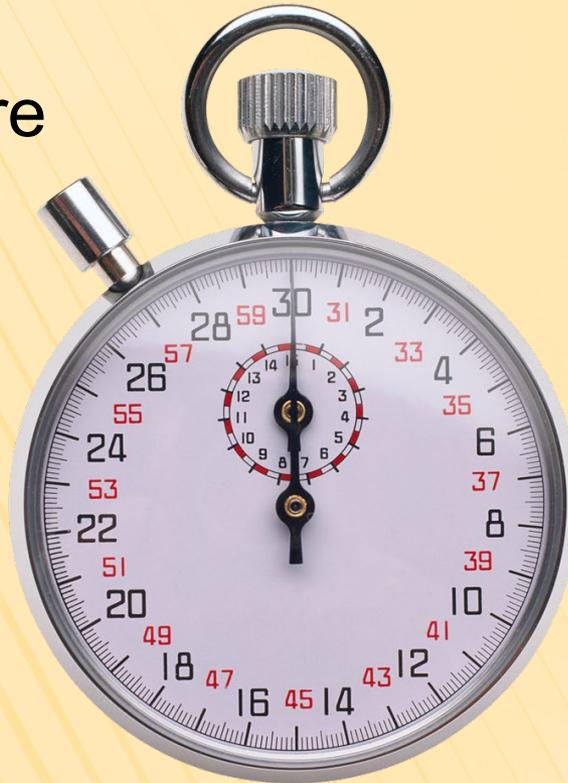
# TEAM Sequence

Definitive Care

Rapid primary survey  
ABCDE + Adjuncts

Safe transfer

Detailed secondary  
survey/ reevaluation  
Head-to-toe + Adjuncts



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# TEAM Sequence and Teamwork

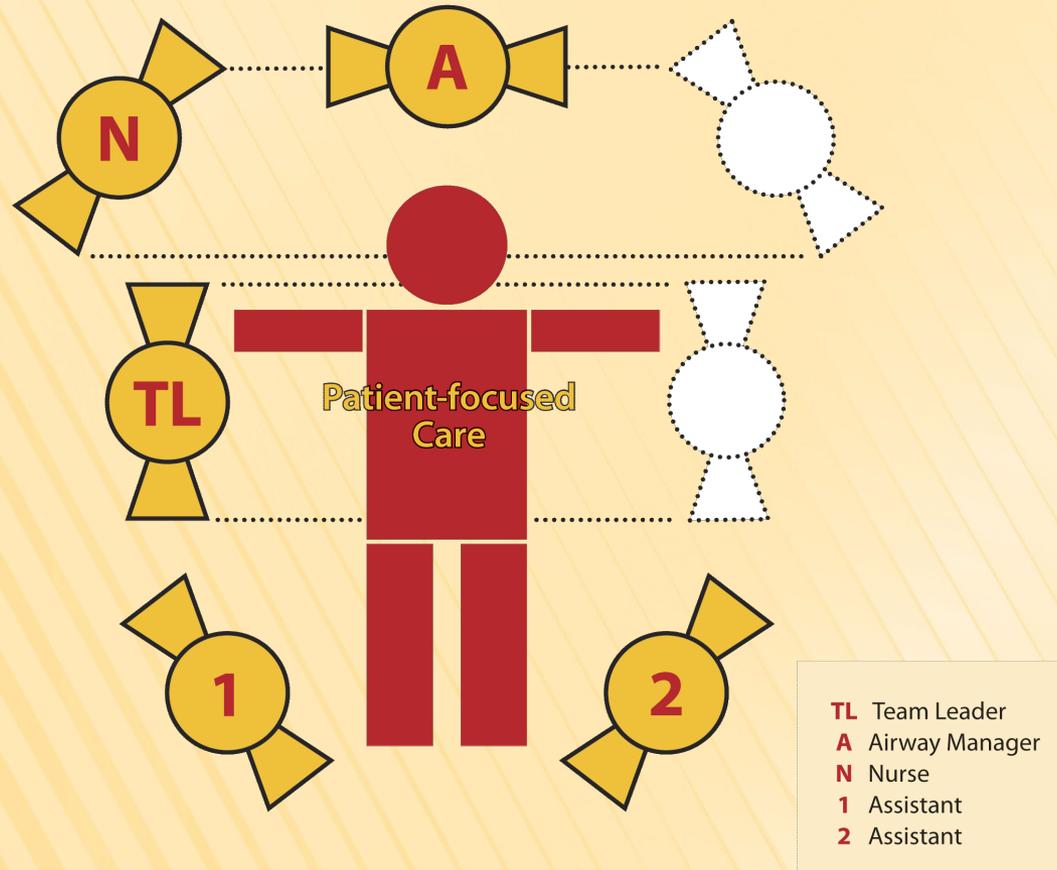
- Simultaneous primary survey and resuscitation of vital functions
- Simultaneous secondary survey and reevaluation of vital functions



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# “TEAM” Work and Teamwork



Together Everyone Achieves More



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# Pre-hospital Preparation

- Closest appropriate facility
- Transport guidelines/ protocols
- On-line medical direction
- Mobilization of resources
- Periodic review of care



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# In-hospital Preparation

- Preplanning essential
- Team approach
- Trained personnel
- Proper equipment
- Lab / x-ray capabilities
- Standard precautions
- Transfer agreements
- QI Program



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# Standard Precautions

- Cap
- Gown
- Gloves
- Mask
- Shoe covers
- Goggles/ face shield



# Triage

- Sorting of patients according to
  - ABCDE's
  - Available resources
  - Other factors, e.g., salvageability



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# Primary Survey



Priorities are the same for all!



# Primary Survey

- A** Airway / C-spine protection
- B** Breathing / Life-threatening chest injury
- C** Circulation / Stop the bleeding
- D** Disability / Intracranial mass lesion
- E** Exposure / Environment/ Body temp



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# Special Considerations: Children

- Leading cause of death
- Immature, anatomic/ mechanical features
- Vigorous physiologic response
- Limited physiologic reserve
- Outcome depends on early aggressive care



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# Special Considerations: Children

- Size, dosage, equipment, surface area, and psychology
- Airway: Larynx anterior and cephalad, short tracheal length
- Breathing: Chest wall pliability, mediastinal mobility



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# Special Considerations: Children

- Circulation: Vascular access, fluid volume, vital signs, and urinary output
- Neurologic: Vomiting, seizures, and diffuse brain injury
- Musculoskeletal: Immature skeleton, fracture patterns



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# Special Considerations: Pregnancy

- Anatomic/ physiologic changes modify response to injury
- Need for fetal assessment
- 1<sup>st</sup> Priority: Maternal resuscitation
- Outcome depends on early, aggressive care



# Special Considerations: Pregnancy

- Gestation and position of uterus
- Physiologic anemia
- ↓  $P_{CO_2}$
- ↓ Gastric emptying
- Supine hypotension
- Isoimmunization
- Sensitivity of fetus



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# Special Considerations: Elders

- 5<sup>th</sup> leading cause of death
- Diminished physiologic reserve and response
- Co-morbidities:  
Diseases/ Medications
- Outcome depends on early, aggressive care



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# Primary Survey: Airway

- Assess for airway patency
- Snoring
- Gurgling
- Stridor
- Rocking chest wall motions
- Maxillofacial trauma/ laryngeal injury



C-Spine Injury



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# Resuscitation: Patent Airway

- Chin lift/ Modified jaw thrust
- Look, listen, feel
- Remove particulate matter
- Definitive airway as necessary
- Reassess frequently



C-Spine Injury



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# Resuscitation: Assess Breathing

- Chest rise and symmetry
- Air entry
- Rate/ Effort
- Color/ Sensorium



Tension / open  
pneumothorax



# Resuscitation: Breathing

- Administer supplemental oxygen
- Ventilate as needed
- Tension pneumothorax: Needle decompression
- Open pneumothorax: Occlusive dressing
- Reassess frequently



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# Primary Survey: Circulation

- Children
- Elderly
- Athletes
- Pregnancy
- Medications



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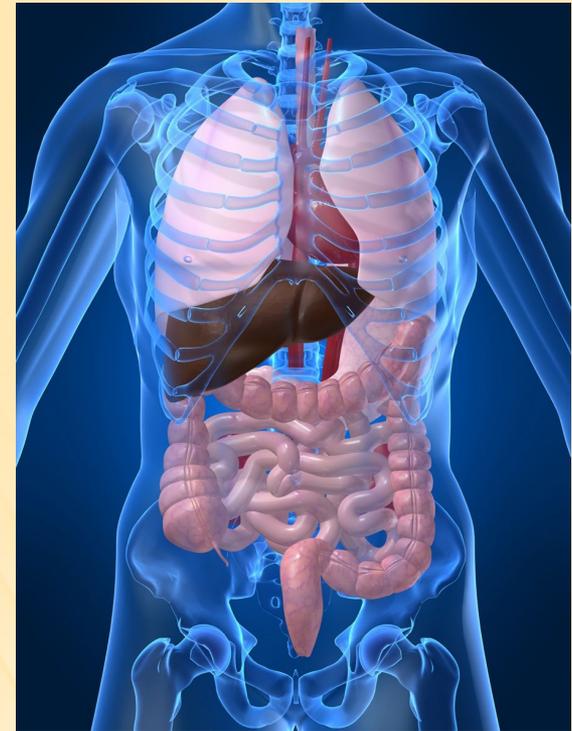
# Primary Survey: Circulation

- Non hemorrhagic shock
  - Cardiac tamponade
  - Tension pneumothorax
  - Neurogenic
  - Septic (late)



# Primary Survey: Circulation

- Assess organ perfusion
  - Level of consciousness
  - Skin color
  - Pulse rate and character



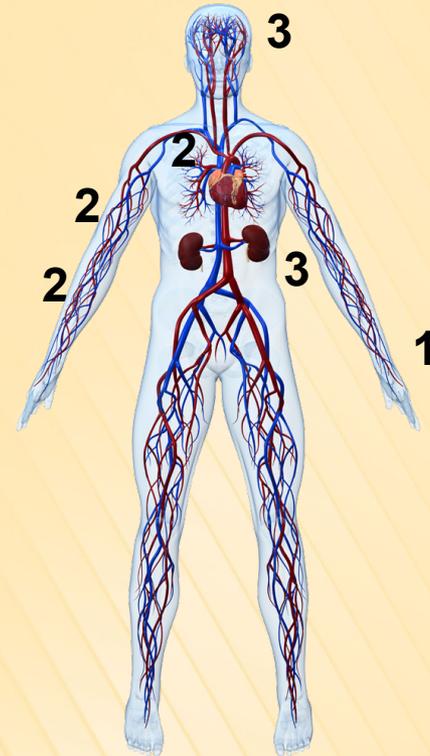
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# Primary Survey: Circulation

## Assess Organ Perfusion

1. Tachycardia
2. Vasoconstriction
2. ↓ Cardiac output
2. Narrow pulse pressure
3. ↓ MAP
3. ↓ Blood flow



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# Primary Survey: Circulation



- Children
- Elderly
- Athletes
- Pregnancy
- Medications



# Resuscitation: Circulation

Bleeding?



Find it!



- Direct pressure
- Operation
- Avoid blind clamping



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# Resuscitation: Circulation

- Obtain venous access
- Restore circulating volume
  - Ringer's lactate, 1-2 L
  - PRBCs if transient response or no response
- Reassess frequently



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# Resuscitation: Circulation

**Table 1**

Estimated Fluid and Blood Losses<sup>1</sup>  
Based on Patient's Initial Presentation

|                              | <b>Class I</b>   | <b>Class II</b> | <b>Class III</b>      | <b>Class IV</b>       |
|------------------------------|------------------|-----------------|-----------------------|-----------------------|
| Blood loss (mL)              | Up to 750        | 750–1500        | 1500–2000             | >2000                 |
| Blood loss (% blood volume)  | Up to 15%        | 15%–30%         | 30%–40%               | >40%                  |
| Heart rate                   | <100             | >100            | >120                  | >140                  |
| Blood pressure               | Normal           | Normal          | Decreased             | Decreased             |
| Pulse pressure (mm Hg)       | Normal           | Decreased       | Decreased             | Decreased             |
| Respiratory rate             | 14–20            | 20–30           | 30–40                 | >35                   |
| Urine output (mL/hr)         | >30              | 20–30           | 5–15                  | Negligible            |
| CNS mental status            | Slightly anxious | Mildly anxious  | Anxious, confused     | Confused, lethargic   |
| Fluid replacement (3:1 rule) | Crystalloid      | Crystalloid     | Crystalloid and blood | Crystalloid and blood |

<sup>1</sup>For a 70-kg man.



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# Resuscitation: Circulation

## Consider

- Tension pneumothorax: Needle decompression and tube thoracostomy
- Massive hemothorax: Volume resuscitation and tube thoracostomy
- Cardiac tamponade: Pericardiocentesis and direct operative repair



# Primary Survey: Disability

- Baseline neurologic evaluation
  - Pupillary response
  - Neurosurgical consult as indicated



Observe for neurologic deterioration

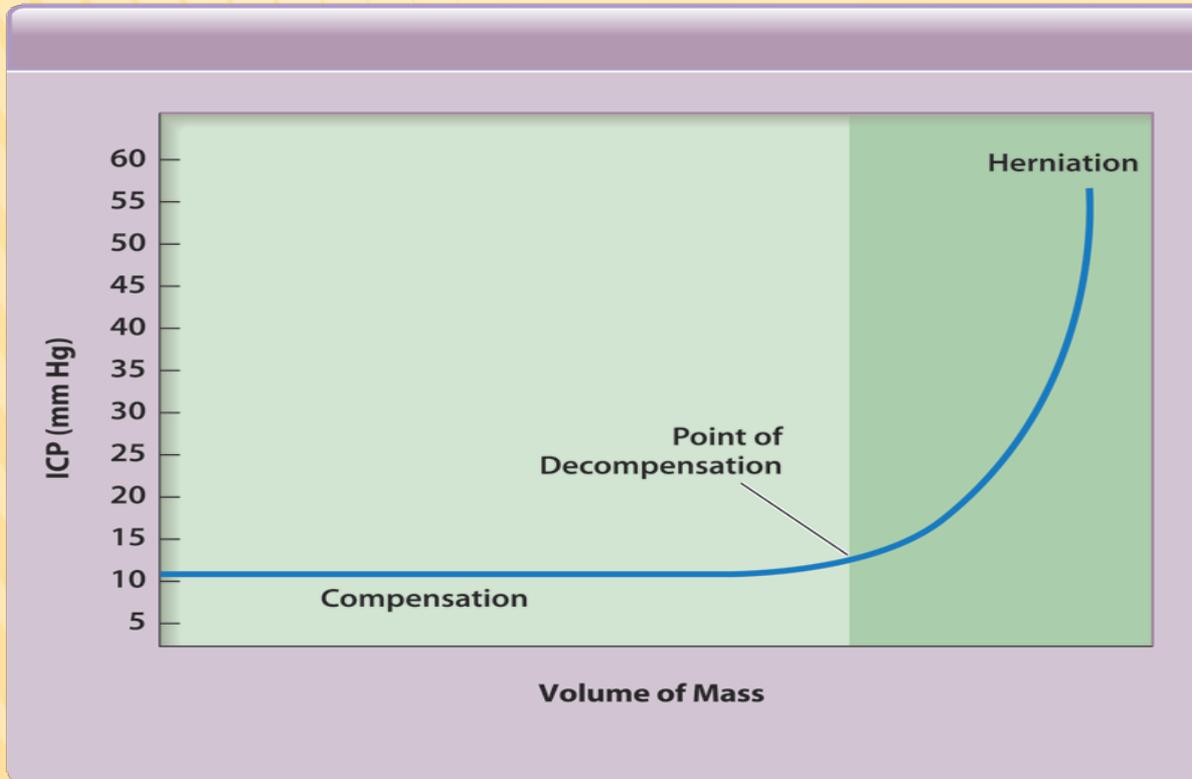


# Primary Survey: GCS Score

- Eye opening: Range 1-4
- BEST Motor response: Range 1-6
- Verbal response: Range 1-5
- Score = (E + M + V)
- Best score = 15
- Worst score = 3



# Primary Survey: Disability



# Primary Survey: Exposure

- Completely undress the patient
- Remove helmet if present
- Look for visible / palpable injuries
- Log roll, protect spine



Prevent  
hypothermia



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# Resuscitation: Overview

- If in doubt, establish definitive airway
- Oxygen for all trauma patients
- Chest tube may be definitive for chest injury
- Stop the bleeding!
- 2 large-caliber IVs
- Prevent hypothermia



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# Adjuncts: Urinary Catheter

- Blood?
- Decompress bladder
- Monitor urinary output



- ❖ Blood at meatus
- ❖ Perineal ecchymosis/hematoma
- ❖ High-riding prostate



# Adjuncts: Gastric Catheter

- Blood or bile?
- Decompress stomach



- ❖ CSF rhinorrhea / otorrhea
- ❖ Periorbital ecchymosis
- ❖ Mid-face instability
- ❖ Hemotympanum



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# Primary Survey: Adjuncts

## Monitoring

- Vital signs
- ABGs
- ECG
- Pulse oximetry
- End-tidal CO<sub>2</sub>

## Diagnostic Tools

- Chest / pelvis x-ray
- C-spine x-rays  
when appropriate
- FAST
- DPL

Consider need for transfer



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# Secondary Survey: Start After

- Primary survey completed
- Resuscitation in process
- ABCDEs reassessed
- Vital functions returning to normal



# Secondary Survey: Key Parts

- AMPLE History
- Complete physical exam: Head-to-toe
- Complete neurologic exam
- Special diagnostic tests
- Reevaluation



# Secondary Survey: History

- A Allergies
- M Medications
- P Past illnesses / Pregnancy
- L Last meal
- E Events / Environment

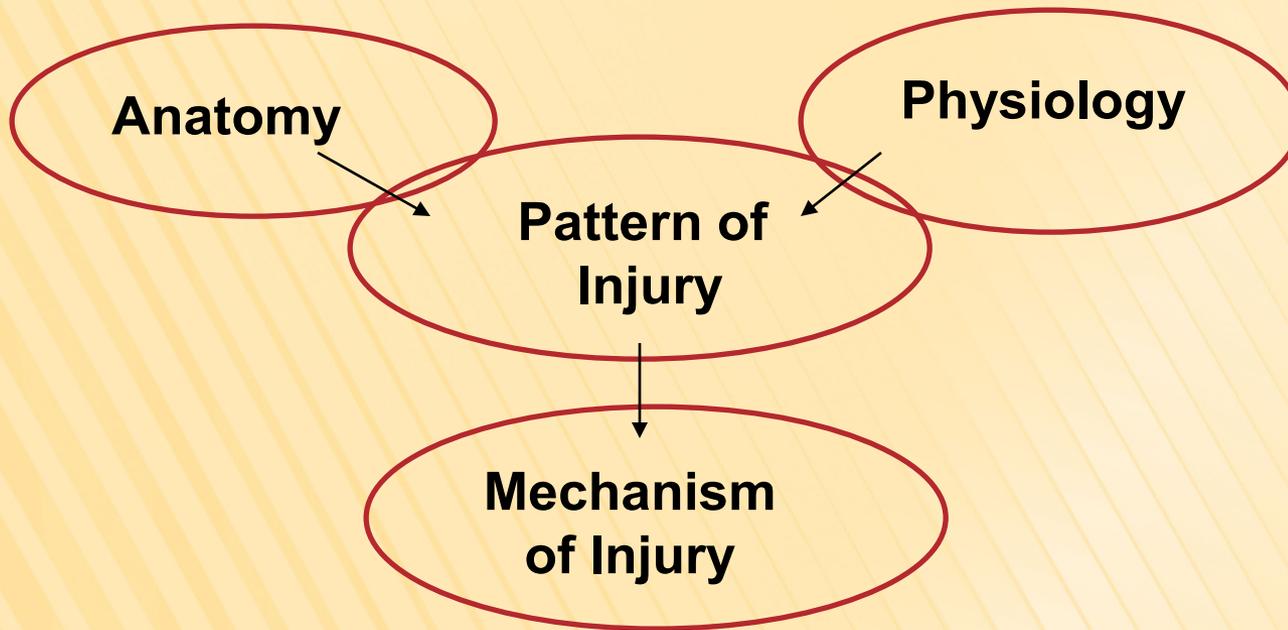


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# Secondary Survey

## Mechanism of Injury



# Burn Injury

- Inhalation injury: Intubate and administer 100% oxygen
- Administer 2 – 4 mL / kg / % BSA burn in 24 hours (+ maintenance in children)
- Monitor urinary output
- Expose and prevent hypothermia
- Chemical burns: Brush and irrigate

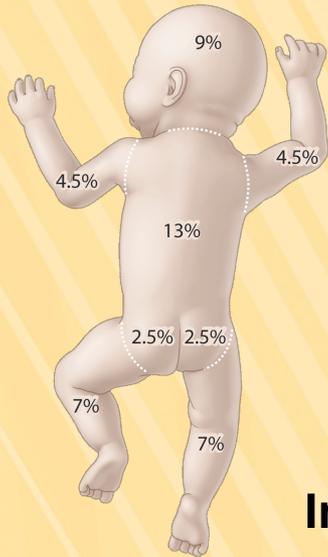


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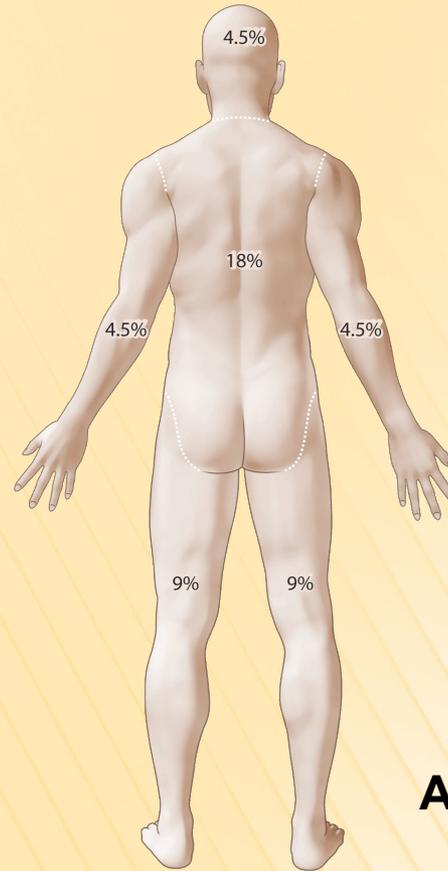
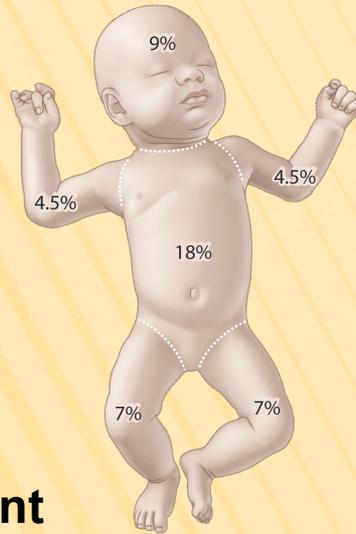
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# Burn Injury

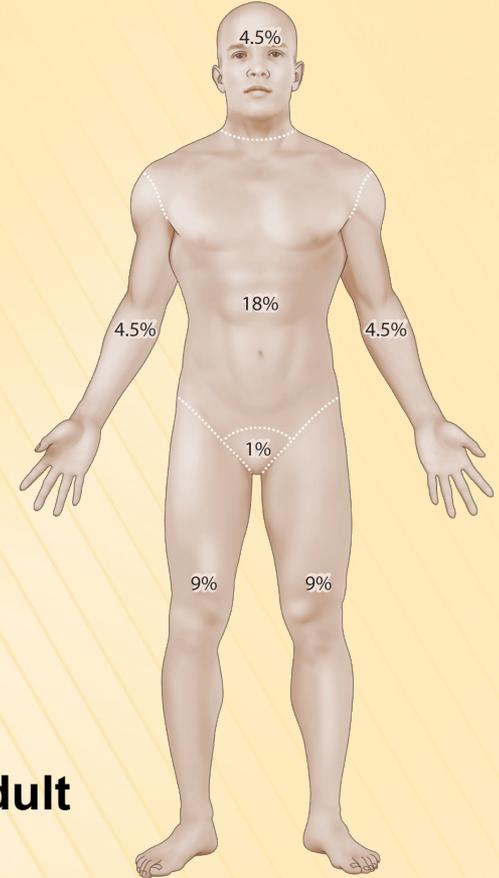
## Rule of Nines



Infant



Adult



# Cold Injury

- Frostbite: Rewarm with moist heat (40°C); wait for demarcation
- Hypothermia: Passive or active rewarming
- Monitor: Not dead until warm and dead



# Secondary Survey: Head

- Complete neurologic exam
- GCS Score determination
- Comprehensive eye / ear exam



- ❖ Unconscious patient
- ❖ Periorbital edema
- ❖ Occluded auditory canal



# Secondary Survey: Maxillofacial

- Bony crepitus / instability
- Palpable deformity
- Comprehensive oral / dental exams



- ❖ Potential airway obstruction
- ❖ Cribriform plate fracture
- ❖ Frequently missed injury



# Secondary Survey: C-spine

- Palpate for tenderness
- Complete motor / sensory exams
- Reflexes
- C-spine imaging



- ❖ Injury above clavicles
- ❖ Altered LOC
- ❖ Other severe, painful injury



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# Secondary Survey: Neck

- Blunt vs penetrating
- Airway obstruction, hoarseness
- Crepitus, hematoma, stridor, bruit



- ❖ Delayed symptoms / signs
- ❖ Progressive airway obstruction
- ❖ Occult injuries



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# Secondary Survey: Chest

- Inspect, auscultate, palpate, percuss
- Reevaluate frequently
- Chest x-rays



- ❖ Missed injury
- ❖ ↑ Chest tube drainage



# Secondary Survey: Abdomen

- Inspect, auscultate, palpate, and percuss
- Reevaluate frequently
- Special studies: FAST, DPL, CT



- ❖ Hollow viscus and retroperitoneal injuries
- ❖ Excessive pelvic manipulation



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# Secondary Survey

Perineum

Contusions, hematomas,  
lacerations, urethral blood

Rectum

Sphincter tone, high-riding  
prostate, pelvic fracture  
rectal wall integrity, blood

Vagina

Blood, lacerations



Pregnancy



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# Secondary Survey: Musculoskeletal

- Potential blood loss
- Limb or life threat (primary survey)
- Missed fractures
- Soft-tissue or ligamentous injury



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# Secondary Survey: Musculoskeletal

- Occult compartment syndrome  
(especially with altered LOC / hypotension)
- Examine patient's back



# Secondary Survey: Pelvis

- Pain on palpation
- Symphysis width  $\uparrow$
- Leg length unequal
- Instability
- Pelvic x-rays



# Pelvic Fracture

- Major source of hemorrhage
- Volume resuscitation
- Reduce pelvic volume
- External fixator
- Angiography / embolization



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# Secondary Survey: CNS

- Frequent reevaluation
- Prevent secondary brain injury
- Imaging as indicated
- Early neurosurgical consultation



# Secondary Survey: Spine

- Complete motor and sensory exams
- Imaging as indicated
- Maintain inline immobilization
- Early neurosurgical consultation



# Secondary Survey: Neurologic

- Incomplete immobilization
- Subtle  $\uparrow$  in ICP with manipulation
- Rapid deterioration



# Secondary Survey: Adjuncts

- Blood tests
- Urinalysis
- X- rays
- CT
- Urography
- Angiography
- Ultrasonography
- Echocardiography
- Bronchoscopy
- Esophagoscopy

Do not delay transfer!



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# Reevaluation: Missed Injuries

- High index of suspicion
- Frequent reevaluation
- Continuous monitoring
- Rapidly recognize patient deterioration



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# Pain Management

- Relieve pain and anxiety as appropriate
- Administer intravenously
- Careful patient monitoring is essential



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# Safe Transfer

When patient's needs exceed institutional resources...

- Use time before transfer for resuscitation
- Do not delay transfer for diagnostic tests
- Physician- to – physician communication



# Transfer to Definitive Care



Local facility

Transfer agreements  
Local resources

Trauma center

Specialty center



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# Emergency Preparedness



- Simple Plan
- Command structure
- Disaster triage scheme
- Traffic control system





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# Summary

**Definitive care**

**Primary Survey  
Adjuncts**

**Safe transfer**

**Resuscitation**

**Continuous  
Reevaluation**

**Secondary Survey  
Adjuncts**



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# Summary



- One, safe way
- Do no further harm
- Treat greatest threat to life first
- Teamwork



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