
In the name of God


Weekly conference

Trauma in children

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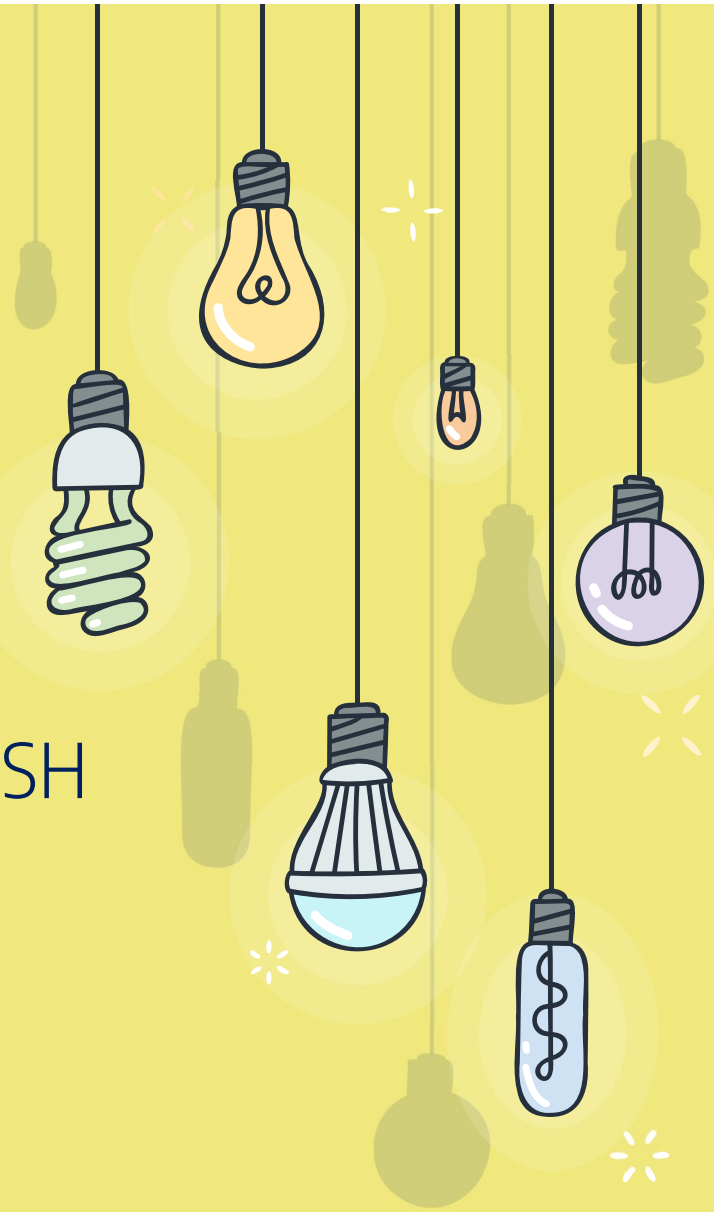
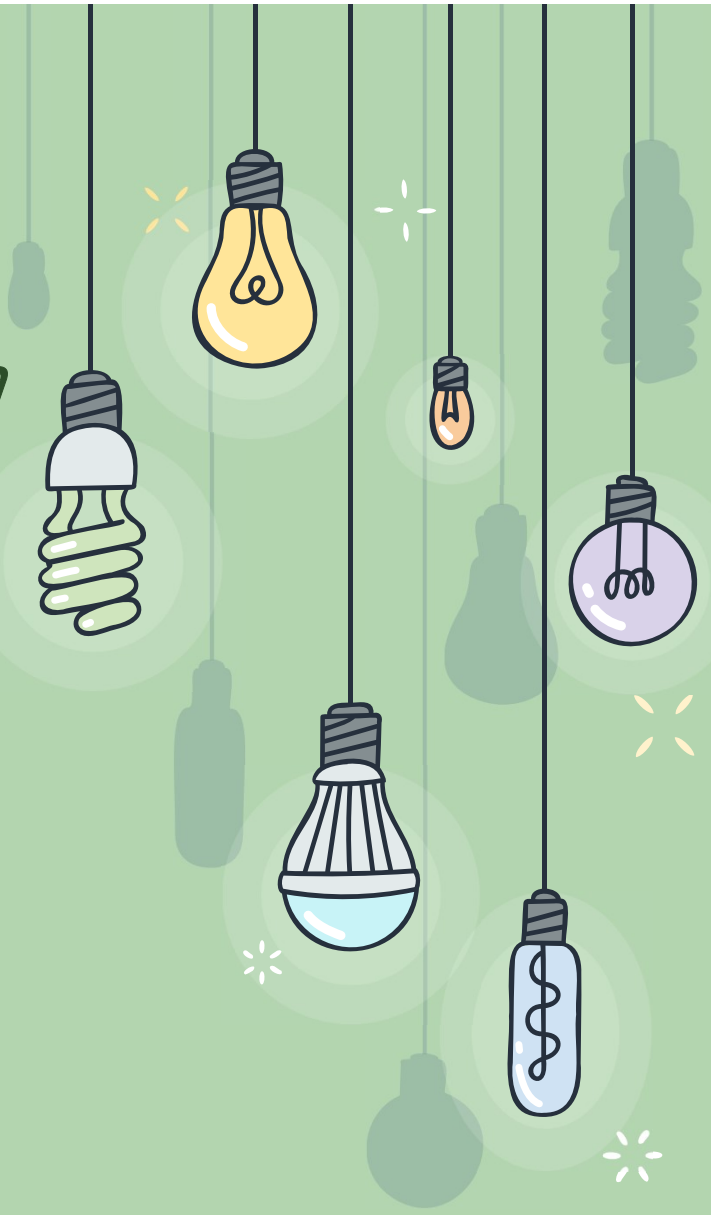
REFERENCES

- Nelson textbook of pediatric ٢٠٢٠
- Up to date
- Pediatric trauma guideline (Victorian state trauma system)
- Pediatric major guideline (heart of England NSH foundation of trust)

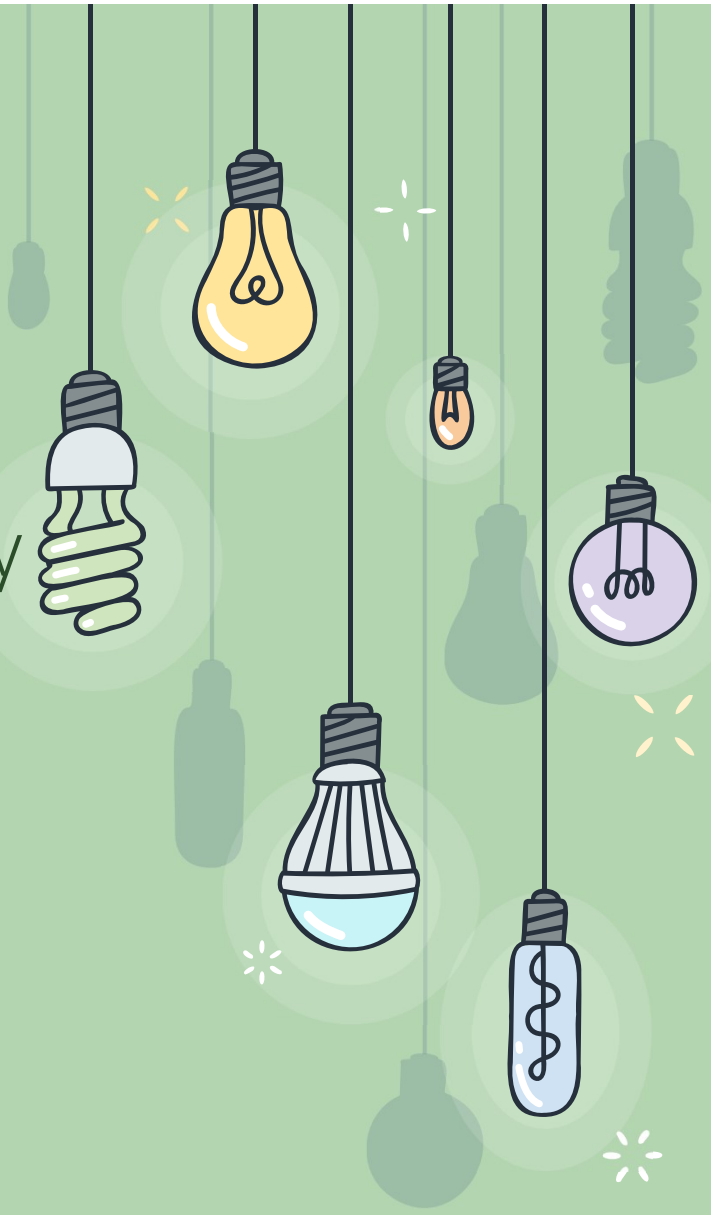


Trauma is *the most common cause of death* in people under the age of ١٨

Blunt injury accounts for approximately ٩٠ percent of all pediatric trauma

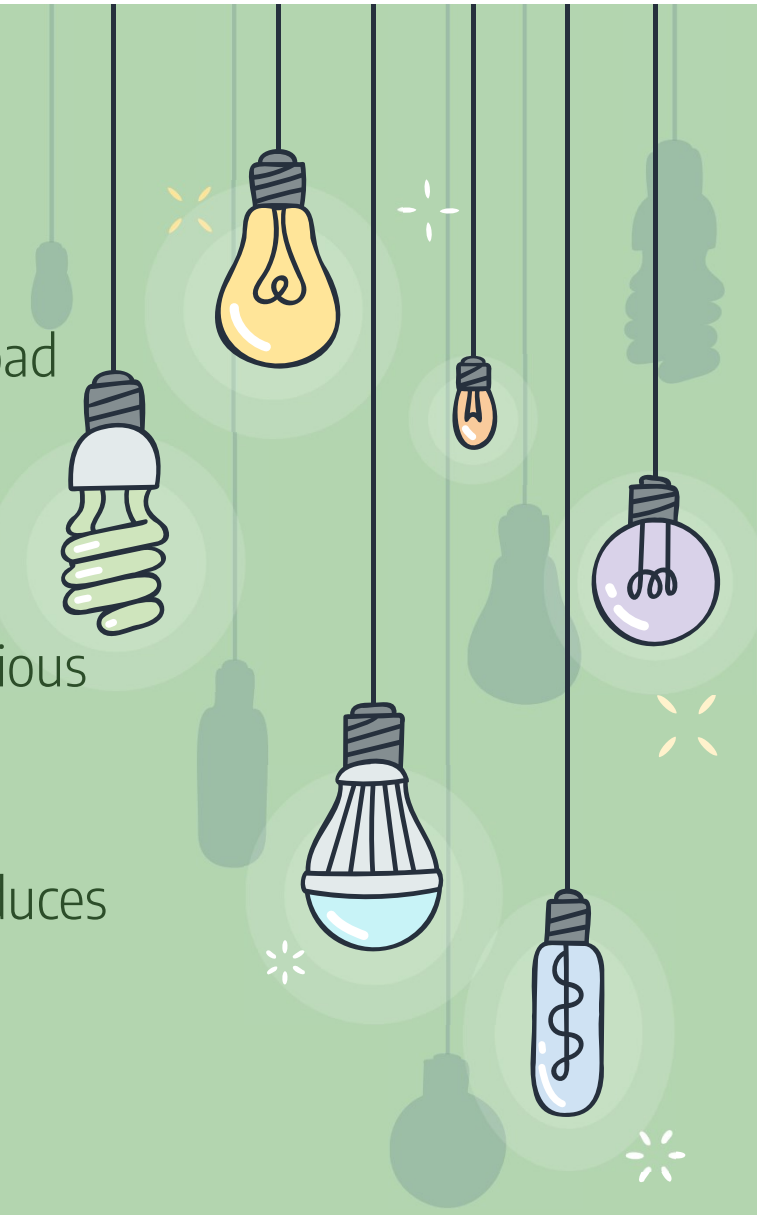


When blunt force is applied to a child's small body, multisystem trauma occurs frequently



INJURY PREVENTION:

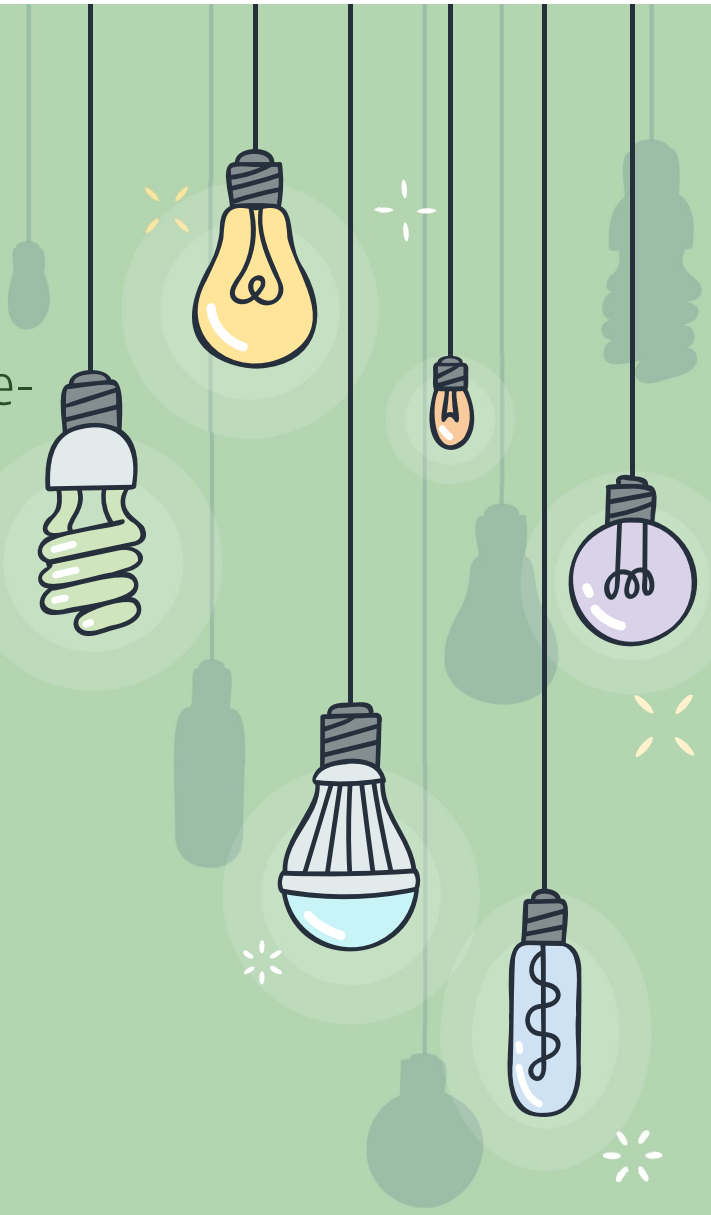
- Primary injury prevention seeks to prevent the incident. (road construction that separates the directions of traffic with impregnable barriers)
- Secondary injury prevention decreases the likelihood of serious injury during a traumatic event.(Seat belts or air bags)
- Tertiary prevention minimizes further deterioration and reduces complications.



Tertiary prevention

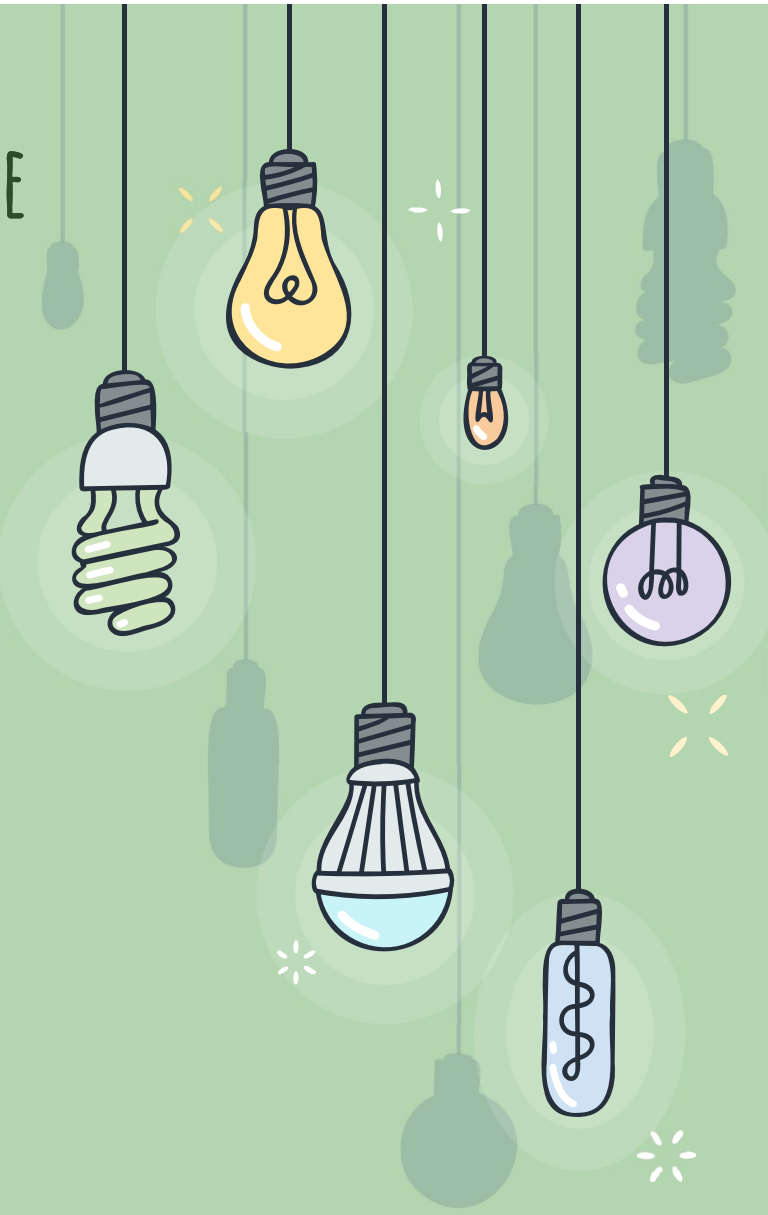
- rapid identification of children with major trauma in the pre-hospital setting so that appropriate management.

- This critical field decision requires the evaluation of vital signs, level of consciousness, injury anatomy, injury mechanism, and special patient or local emergency medical systems considerations.



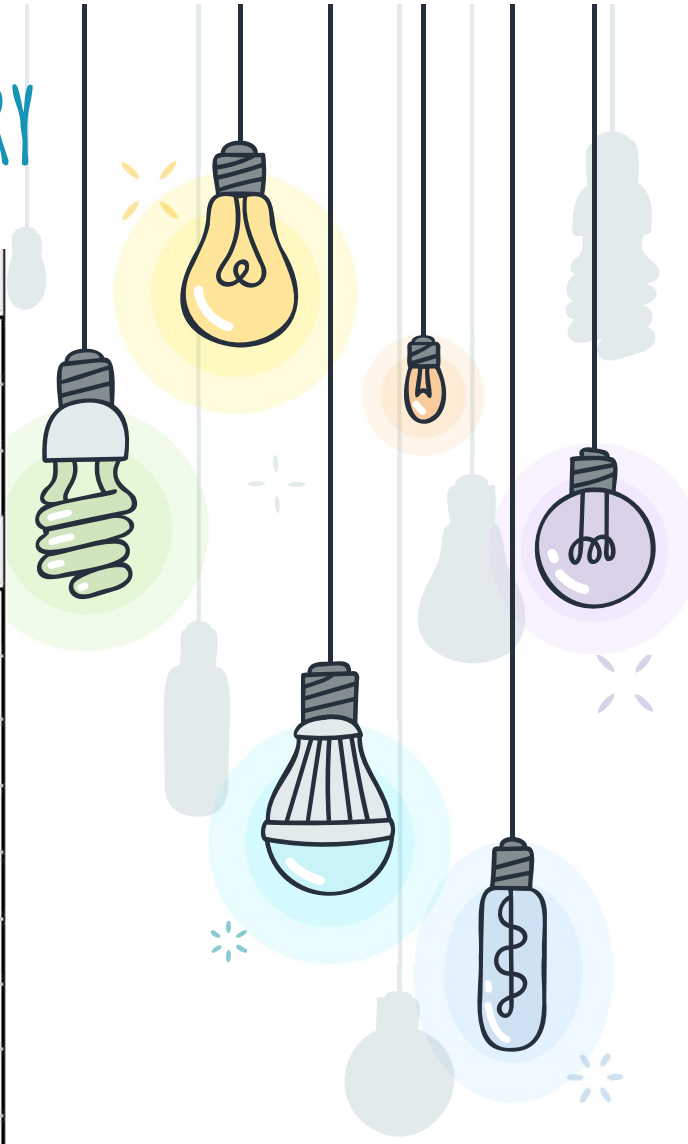
What matters are important in determining the severity of trauma in triage:

- Injury extent
- Injury type
- Injury severity



PHYSICAL FINDIGS ASSOCIATED WITH CRITICAL INJURY

Vital signs and level of consciousness
GCS <14
Shock (compensated or uncompensated)
RR lower or higher than normal for age
Anatomy of injury
Airway trauma with respiratory distress, anterior neck tenderness, or deformity
Chest trauma with persistent tachycardia, chest tenderness, or deformity with respiratory distress
Abdominal tenderness or distension with persistent tachycardia
Pelvic fracture
Two or more proximal long-bone fractures
Amputation proximal to wrist or ankle
Crushed, mangled, or degloved extremity
Open or depressed skull fracture
Paralysis
Penetrating trauma to head, neck, chest, abdomen, or proximal extremities



Blunt
Motor vehicle collision
Ejection from the automobile
Death of another passenger in same vehicle compartment
Vehicle roll-over
High-speed automobile crash
• Initial speed >40 mph (64 kph)
• Auto deformity >20 inches (50 cm)
• Intrusion into passenger compartment >12 inches (30 cm)
Extrication time >20 minutes
Motorcycle crash >20 mph (32 kph) or with separation of rider from bike
Motor vehicle pedestrian injury
Pedestrian thrown or run over
Automobile-pedestrian injury with >5 mph (8 kph) impact
Falls
Adult: >20 ft (6 m)
Child: >10 ft (3 m) or more than 2 to 3 times patient height
Penetrating
Any penetrating trauma to head, neck, chest, abdomen, or extremities proximal to elbow or knee

PEDIATRIC TRAUMA SCORE:

Pediatric Trauma Score (PTS)	+2	+1	-1
Weight	> 20 kg (44 lbs.)	10-20 kg (22-44 lbs.)	< 10 kg (22 lbs.)
Airway	Patent	Maintainable	Unmaintainable
Systolic B/P	> 90 mm Hg	50-90 mm Hg	< 50 mm Hg
CNS	Awake	+ LOC	Unresponsive
Fractures	None	Closed or suspected	Multiple closed or open
Wounds	None	Minor	Major, penetrating or burns

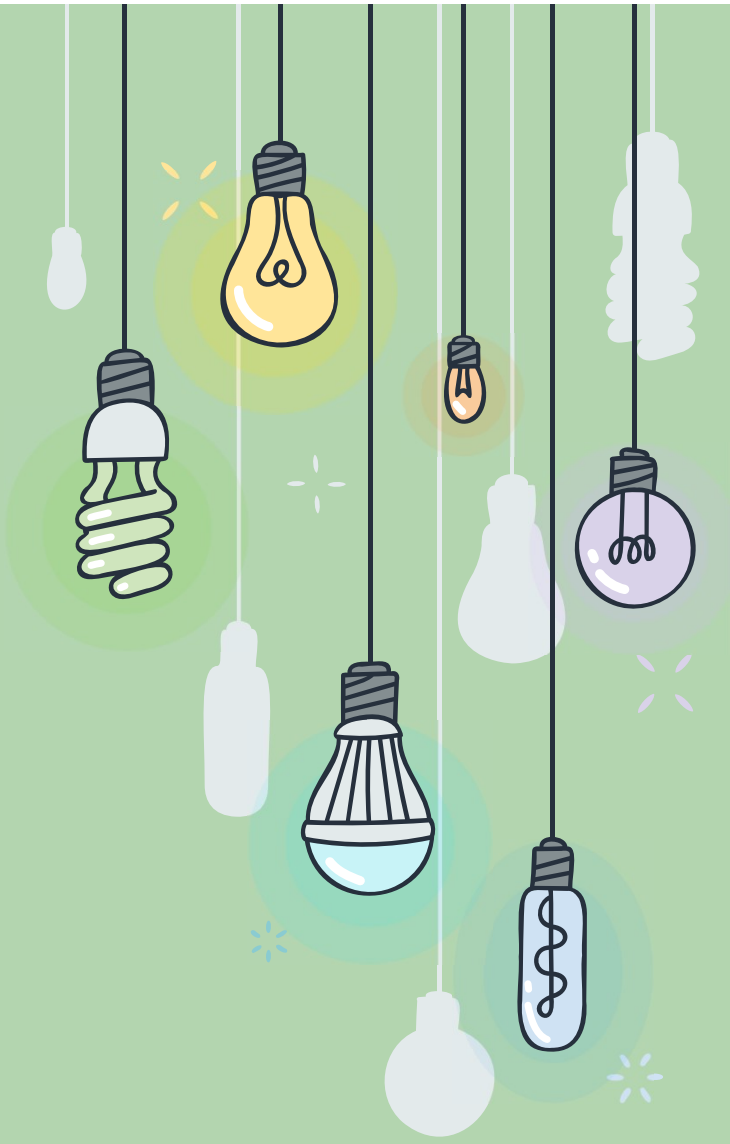
Abbreviated injury scale

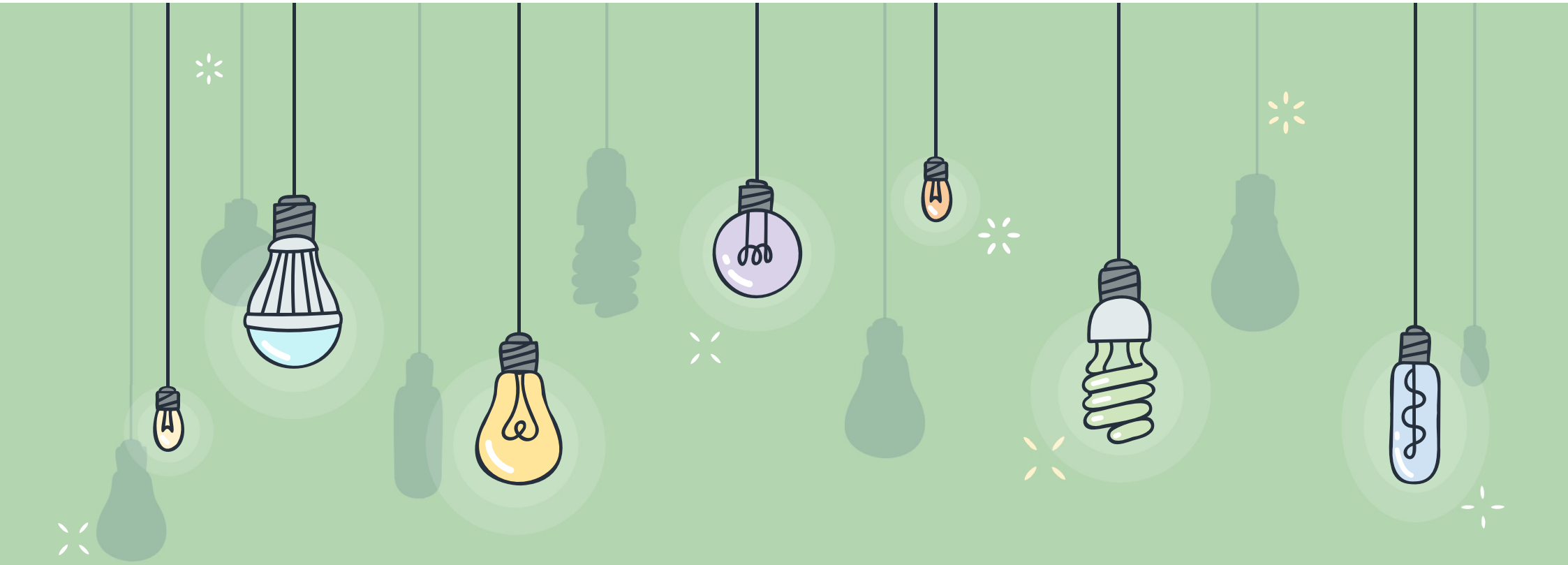
Body region

١. head &neck
٢. Face
٣. Chest
٤. Abdomen&pelvic
٥. Exterimities
٦. Skin &general

Severity

١. Minor
٢. Moderated
٣. Serious
٤. Severe
٥. Critical
٦. lethal



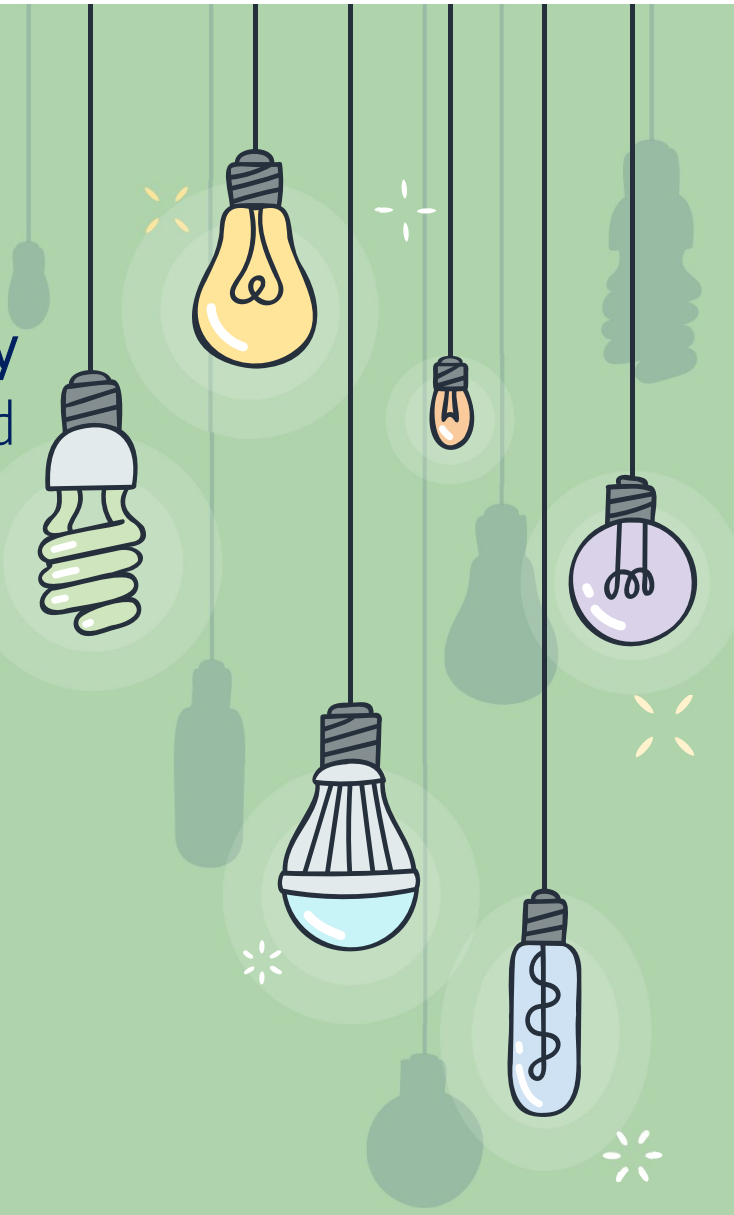


Injury severity score: (AIS ١)٨٢ + (AIS ٢)٨٢ + (AIS ٣)٨٢

Initial approach:

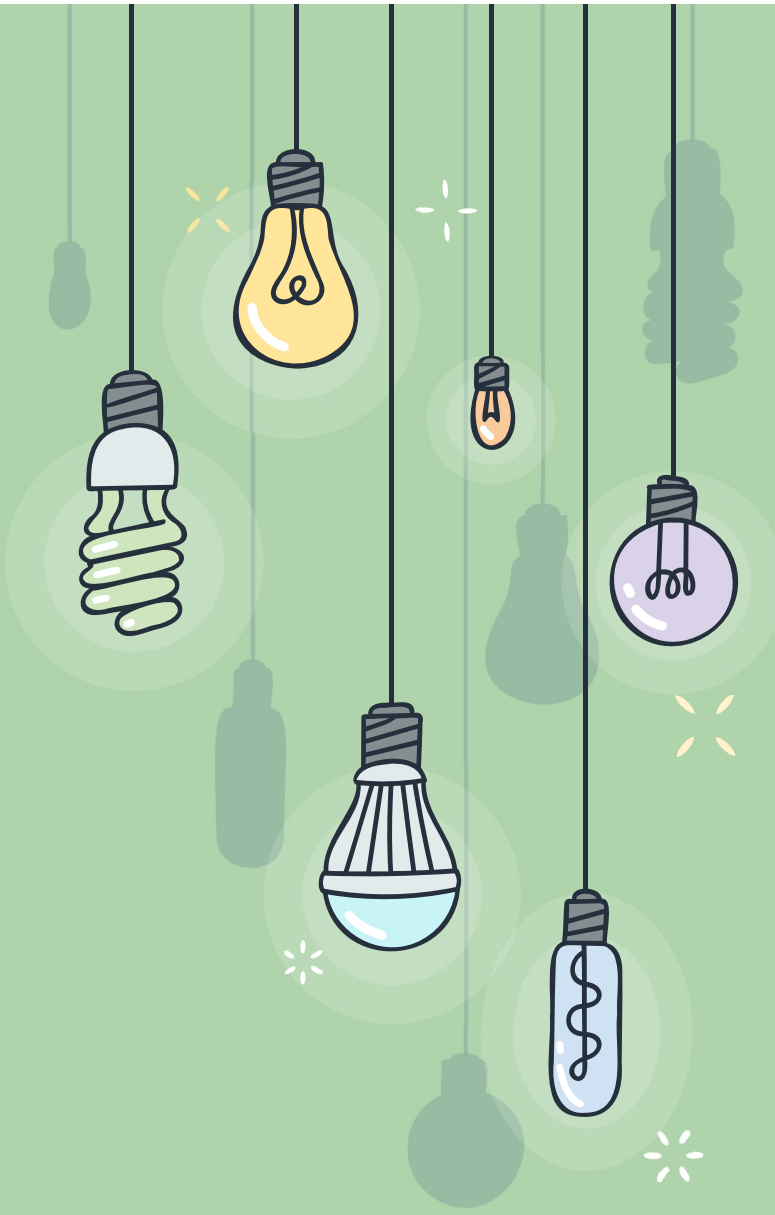
The goal of initial trauma management in children is to **rapidly assess the injuries**, **determine management priorities** and **critical interventions**

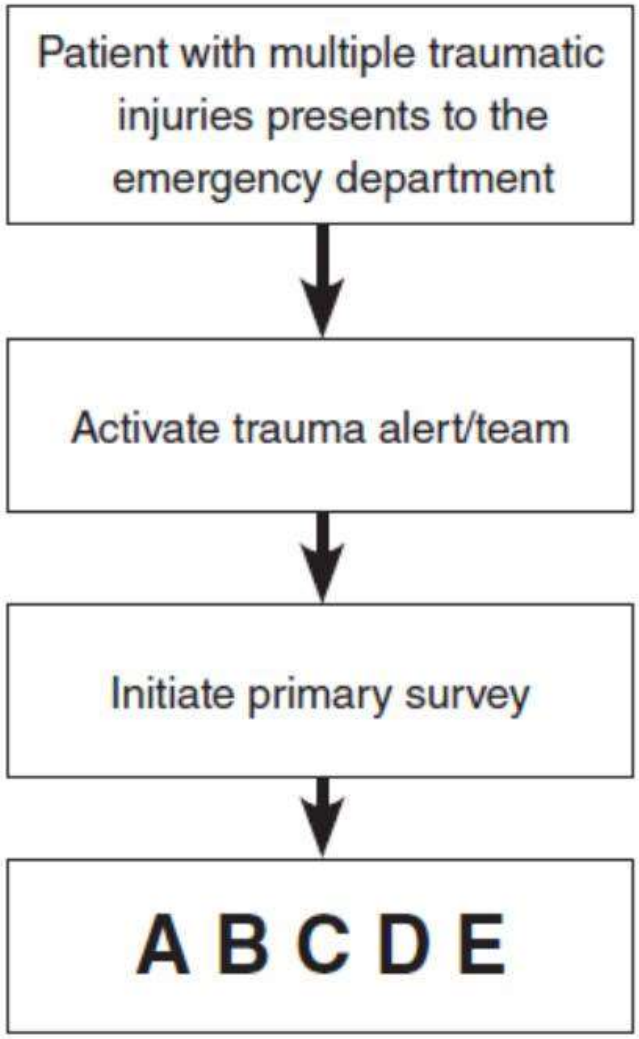
- Primary survey
- Resuscitation of vital functions
- Secondary survey
- Transition to definitive care

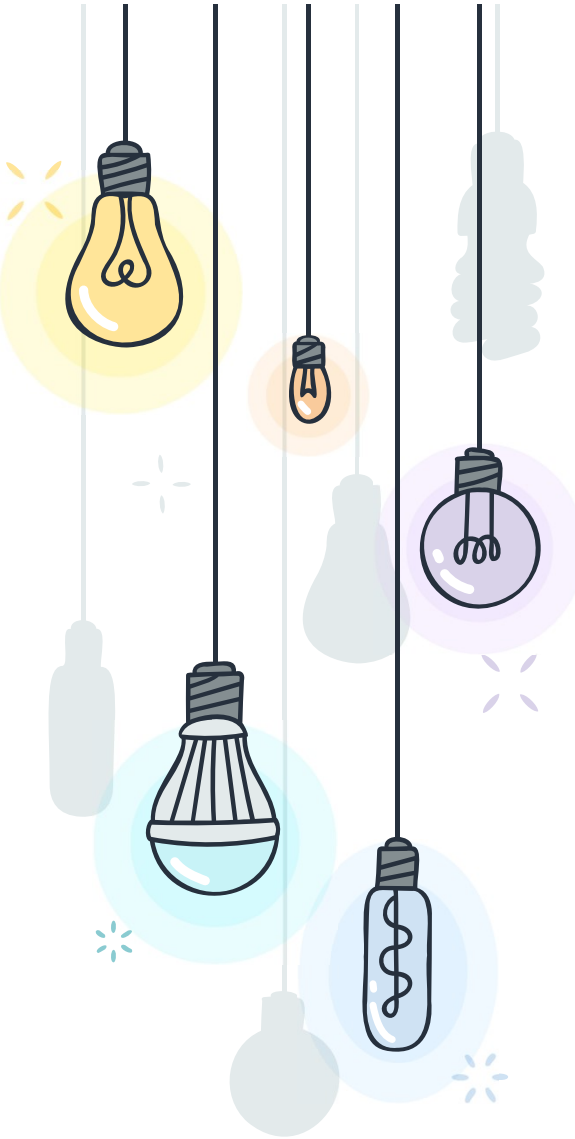


Primary survey:

A:airway maintenance with cervical spine protection
B:breathing and ventilation
C:circulation with hemorrhage control
D:disability
E:exposure




Patient with multiple traumatic injuries presents to the emergency department
Activate trauma alert/team
Initiate primary survey
A B C D E



UP TO ۵ MINUTES

Mobilize trauma resource

Cervical spine
Vital sign

Airway

Obstruction
Direct airway injury

Breathing

Tension pneumothorax
Massive hemothorax
Open pneumothorax
Flail chest

Circulation

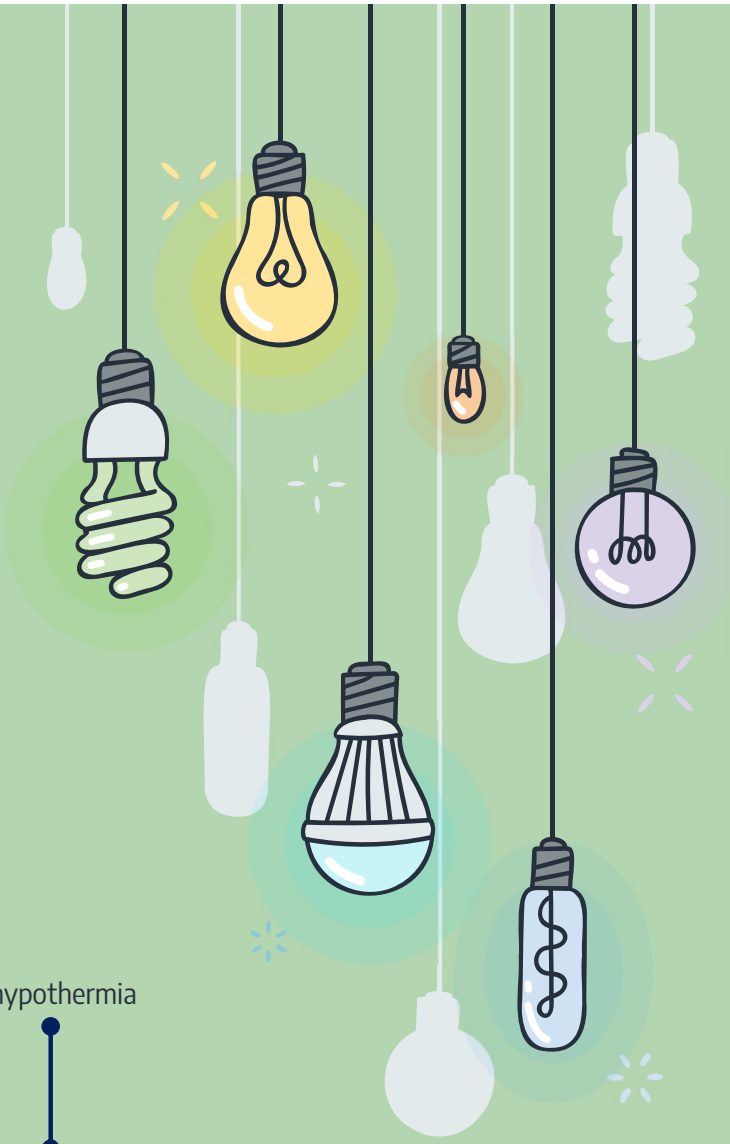
Absent circulation
External hemorrhage
Signs of shock
Cardiac tamponade
Pelvic fracture

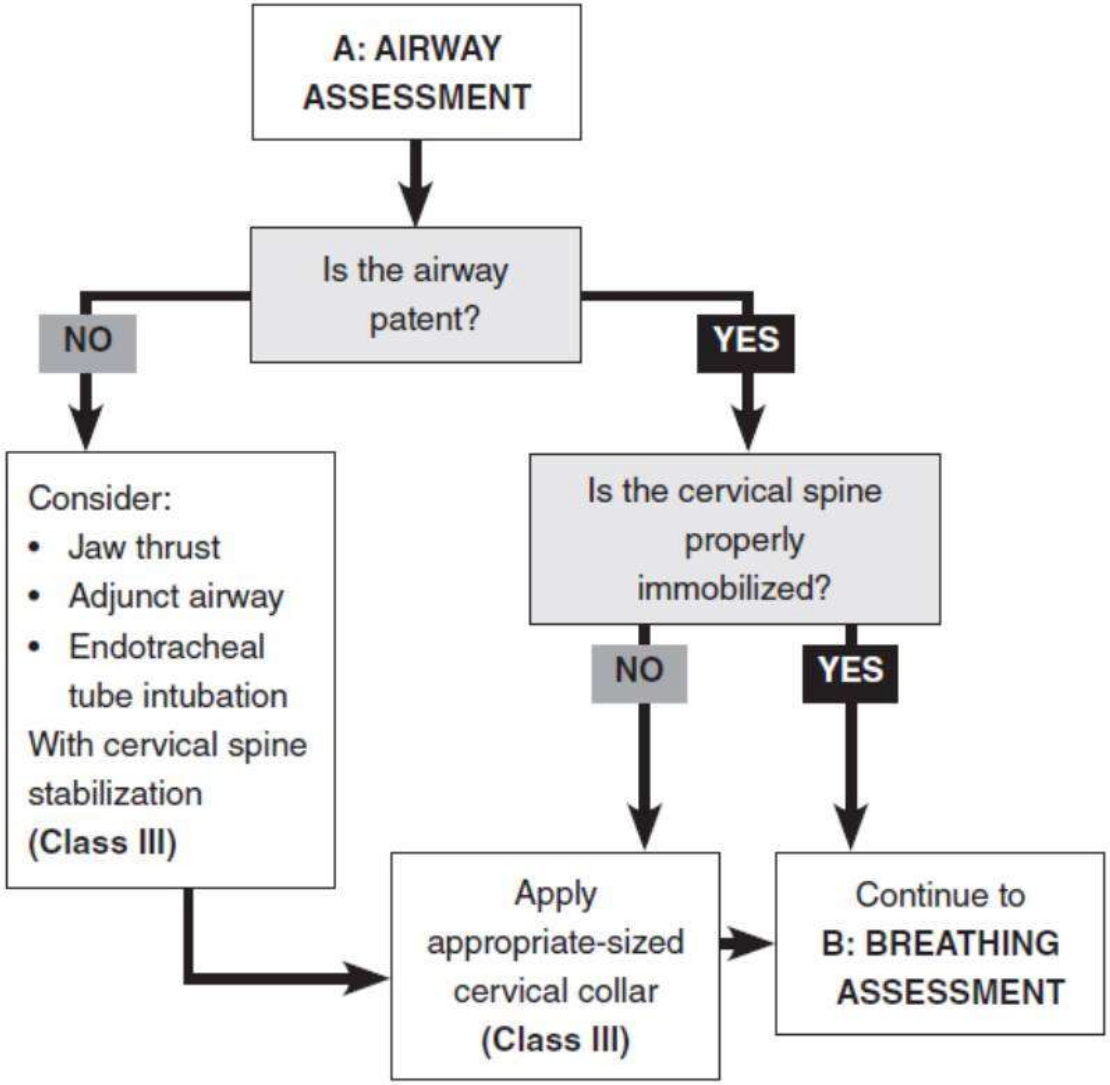
GCS
Pupillary response
Spinal cord injury
Impeding herniation

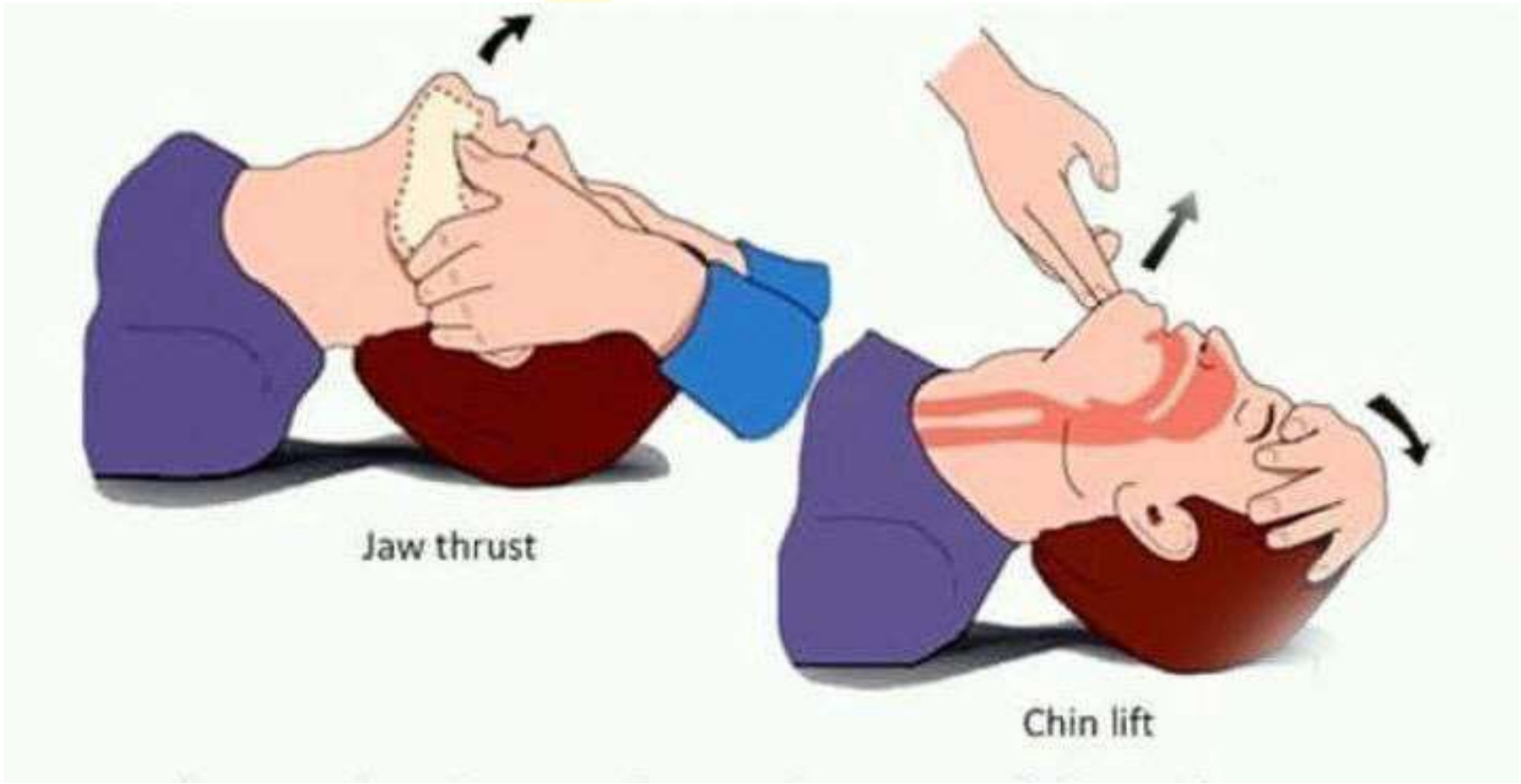
Disability

hypothermia

Exposure




A: AIRWAY ASSESSMENT
Is the airway patent?
NO
YES
Consider:
• Jaw thrust
• Adjunct airway
• Endotracheal tube intubation
With cervical spine stabilization
(Class III)
Is the cervical spine properly immobilized?
NO
YES
Apply appropriate-sized cervical collar
(Class III)
Continue to
B: BREATHING ASSESSMENT


Jaw thrust
Chin lift

UP TO ٥ MINUTES

Mobilize trauma resource

Cervical spine
Vital sign

Airway

Obstruction
Direct airway injury

Breathing

Tension pneumothorax
Massive hemothorax
Open pneumothorax
Flail chest

Circulation

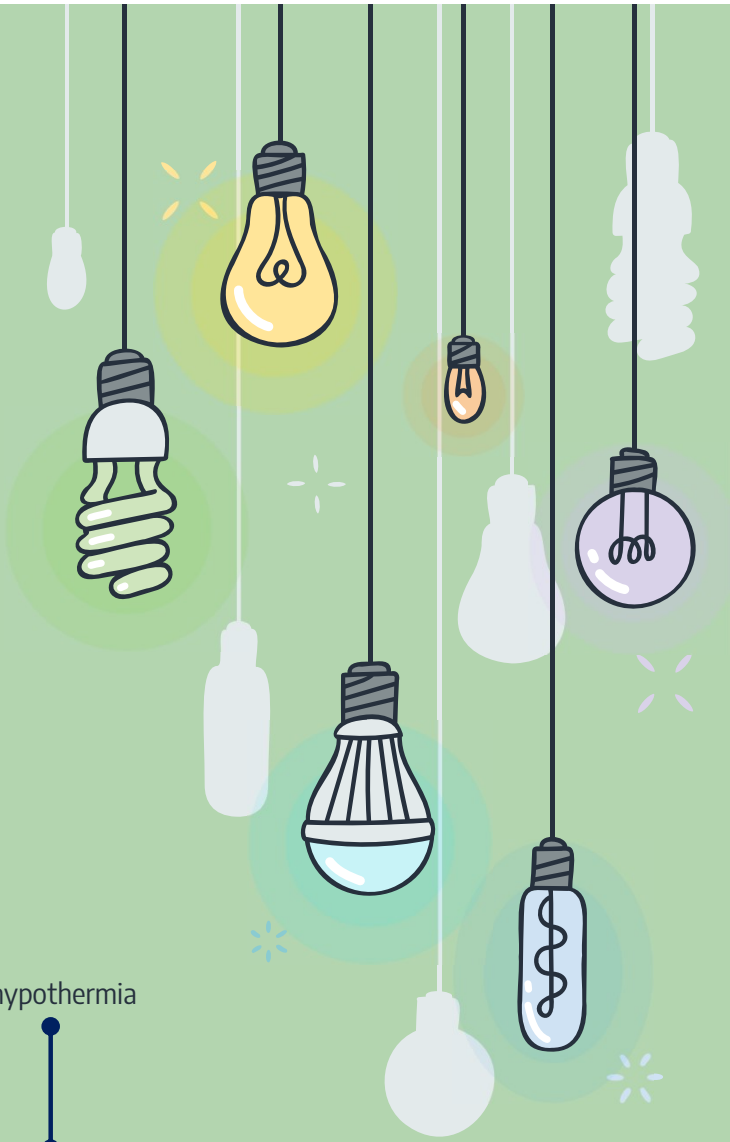
Absent circulation
External hemorrhage
Signs of shock
Cardiac tamponade
Pelvic fracture

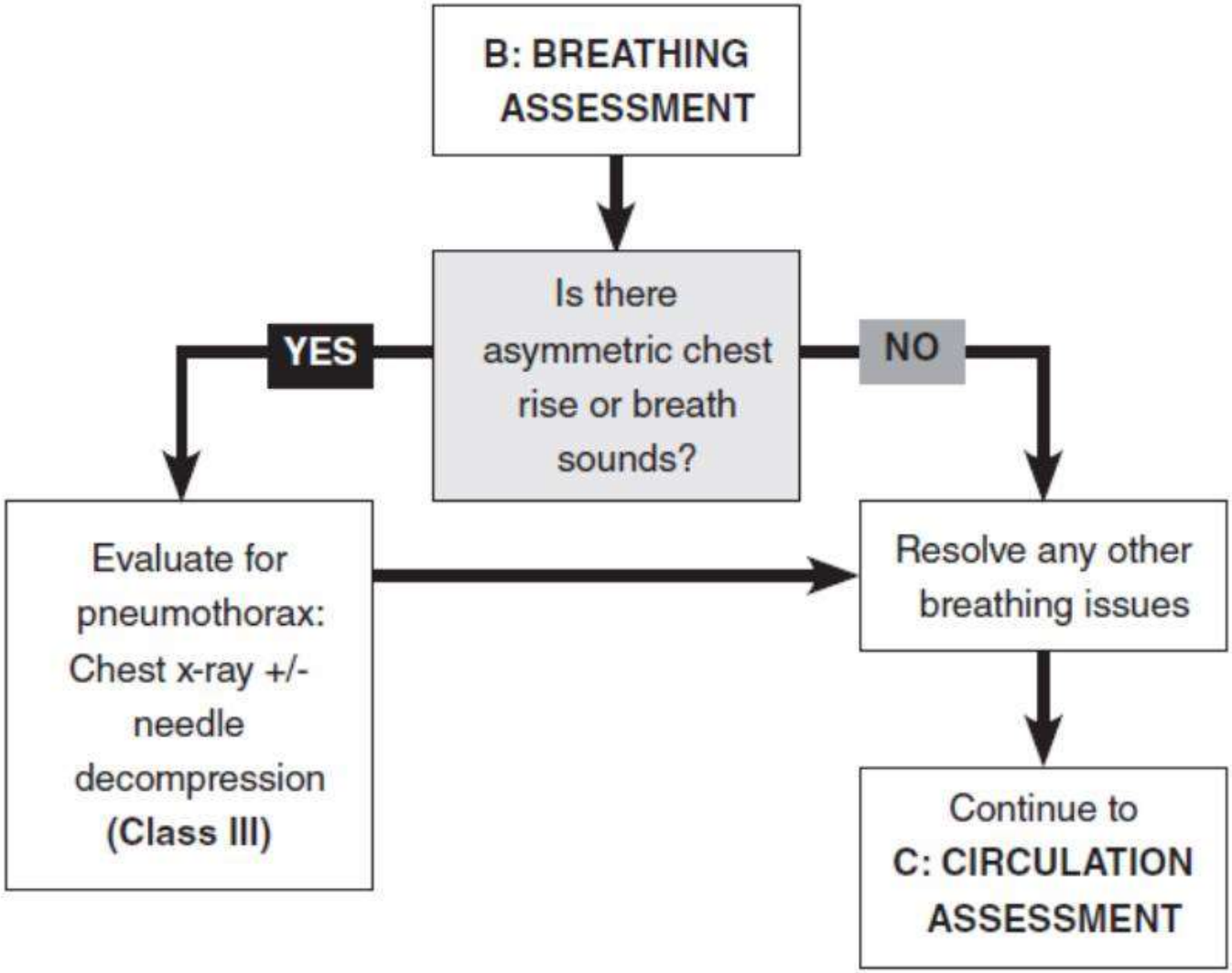
Disability

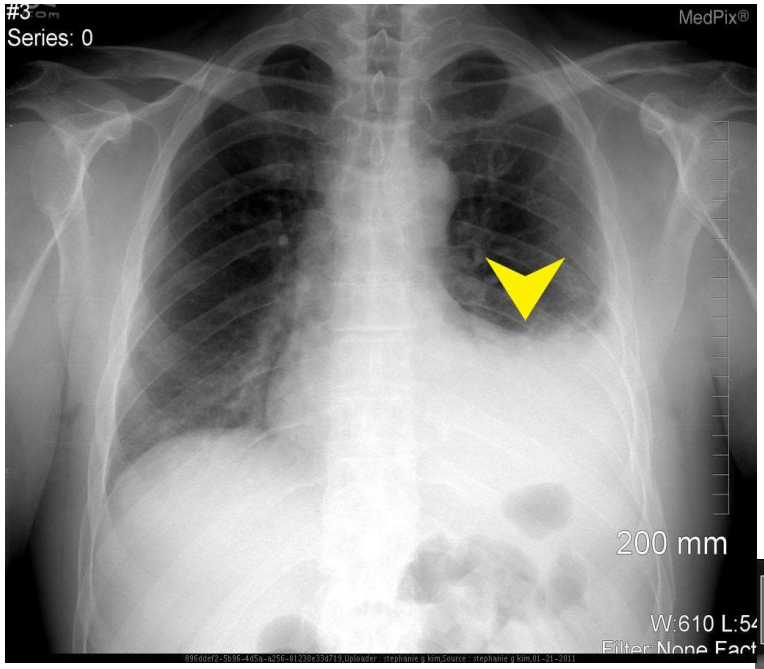
GCS
Pupillary response
Spinal cord injury
Impeding herniation

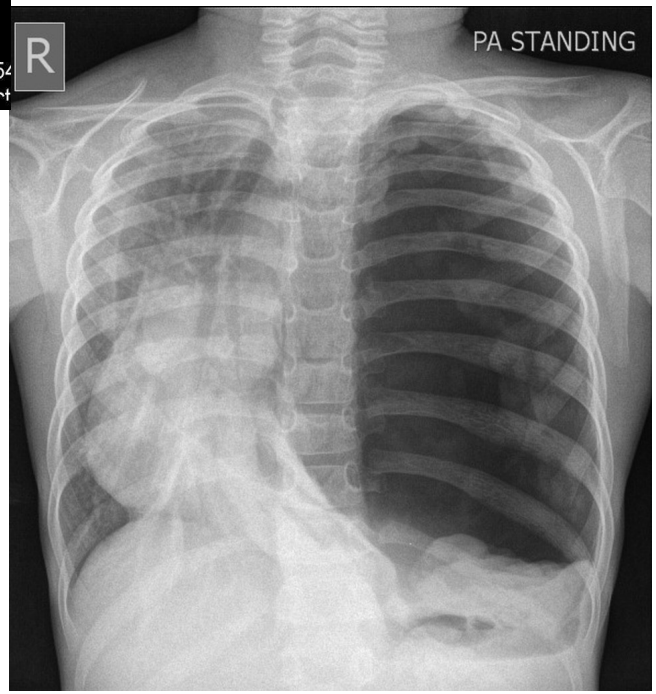
Exposure

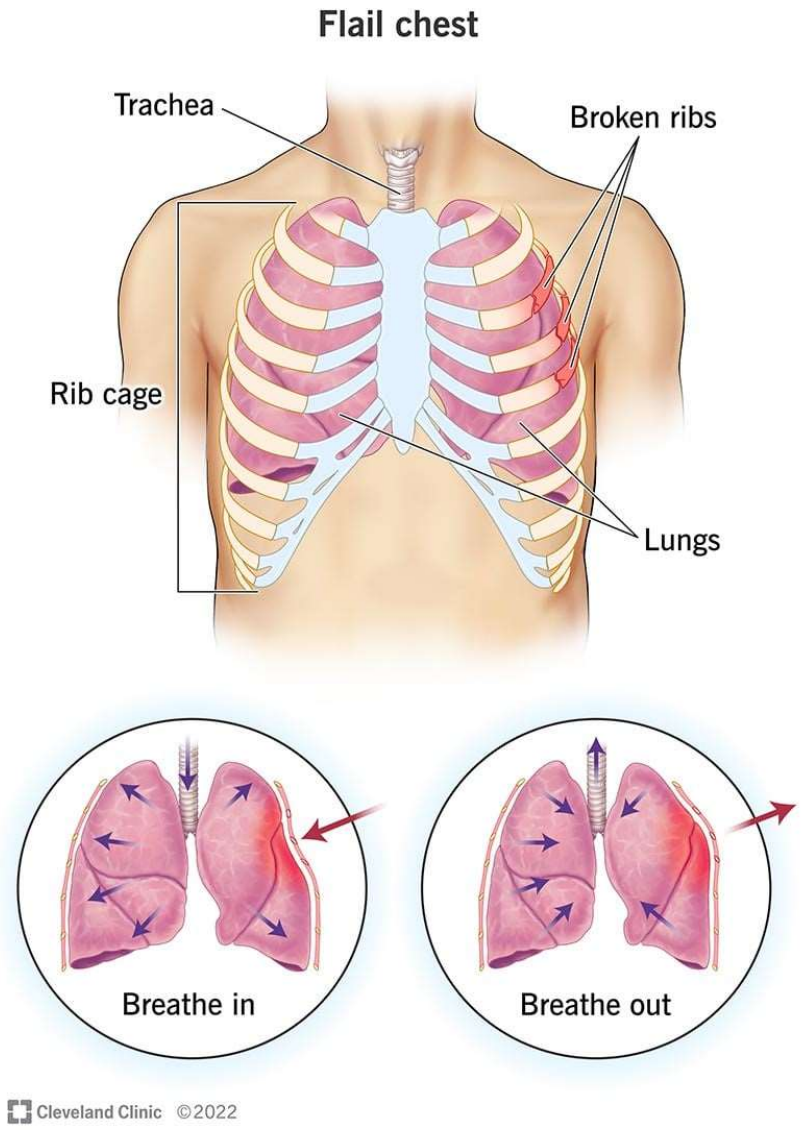
hypothermia




B: BREATHING ASSESSMENT
Is there asymmetric chest rise or breath sounds?
YES
NO
Evaluate for pneumothorax: Chest x-ray +/- needle decompression (Class III)
Resolve any other breathing issues
Continue to C: CIRCULATION ASSESSMENT

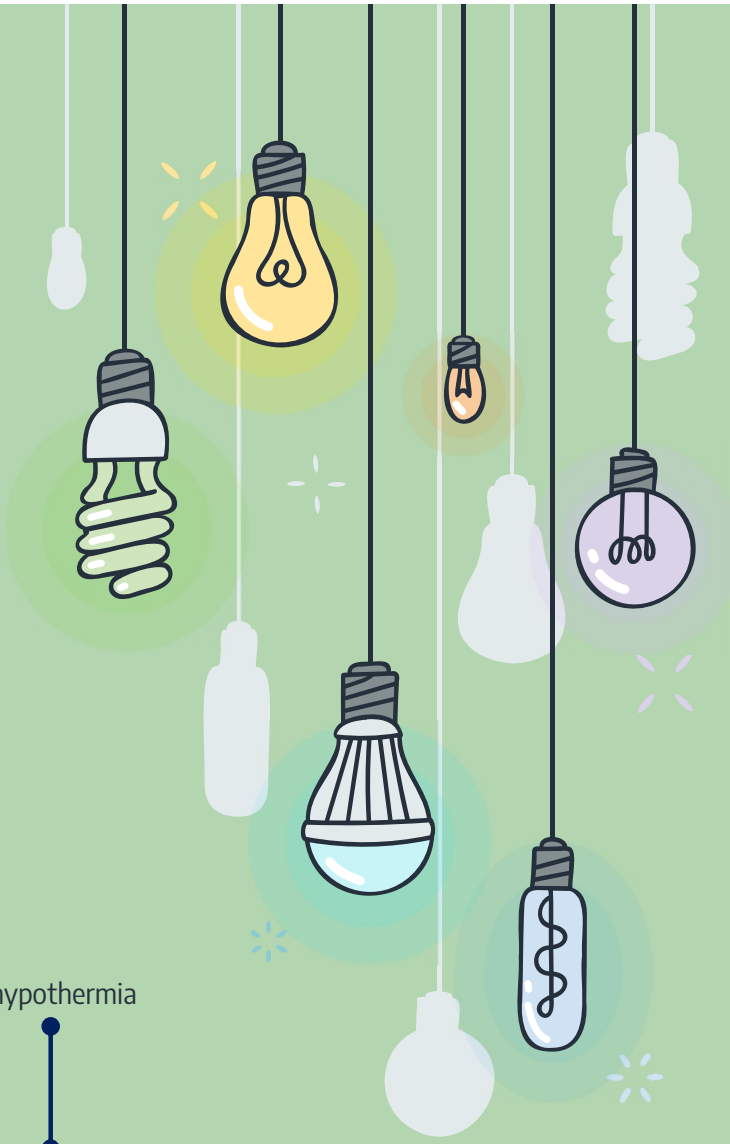

#3
Series: 0
MedPix®
200 mm

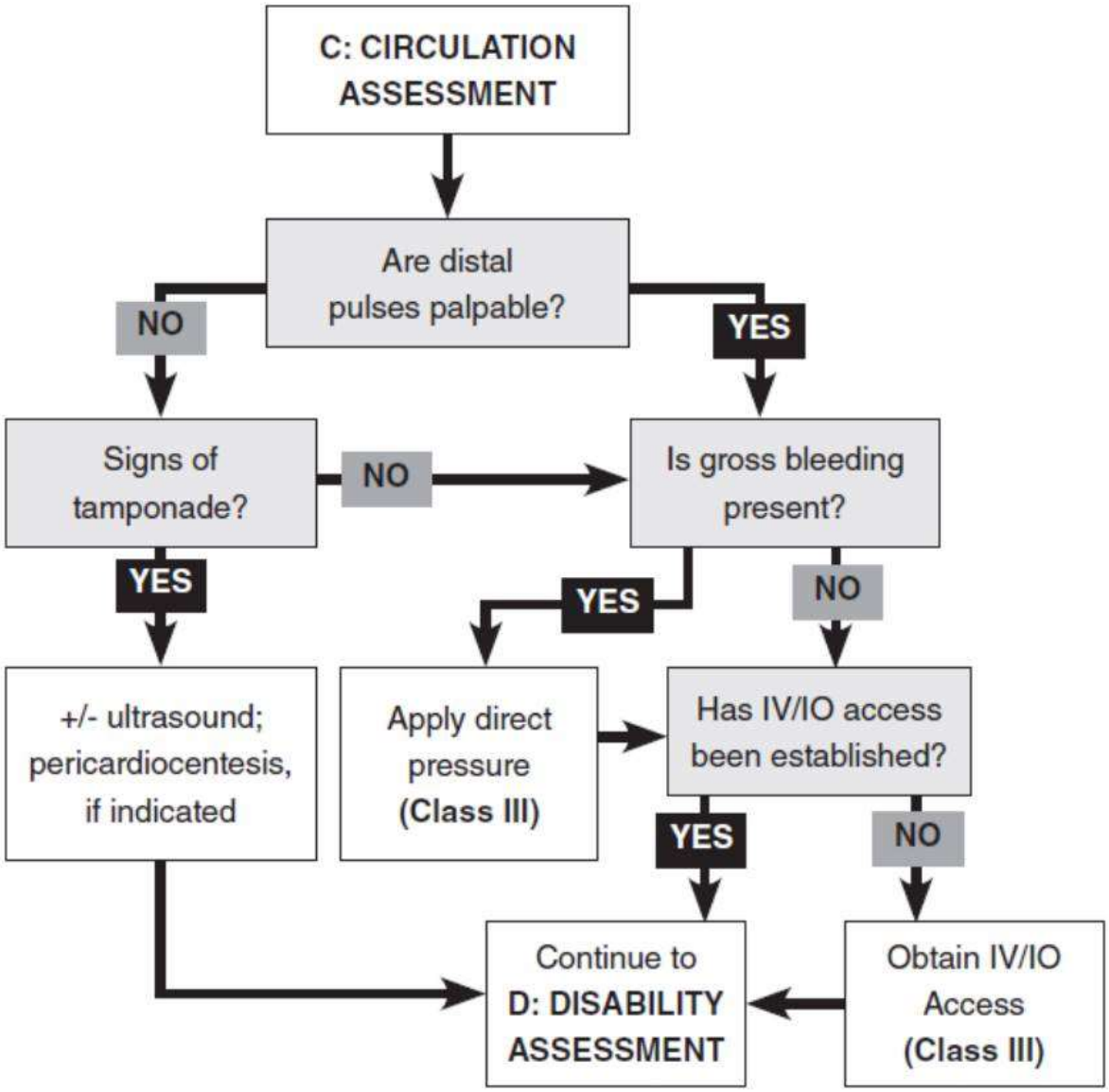

R
PA STANDING

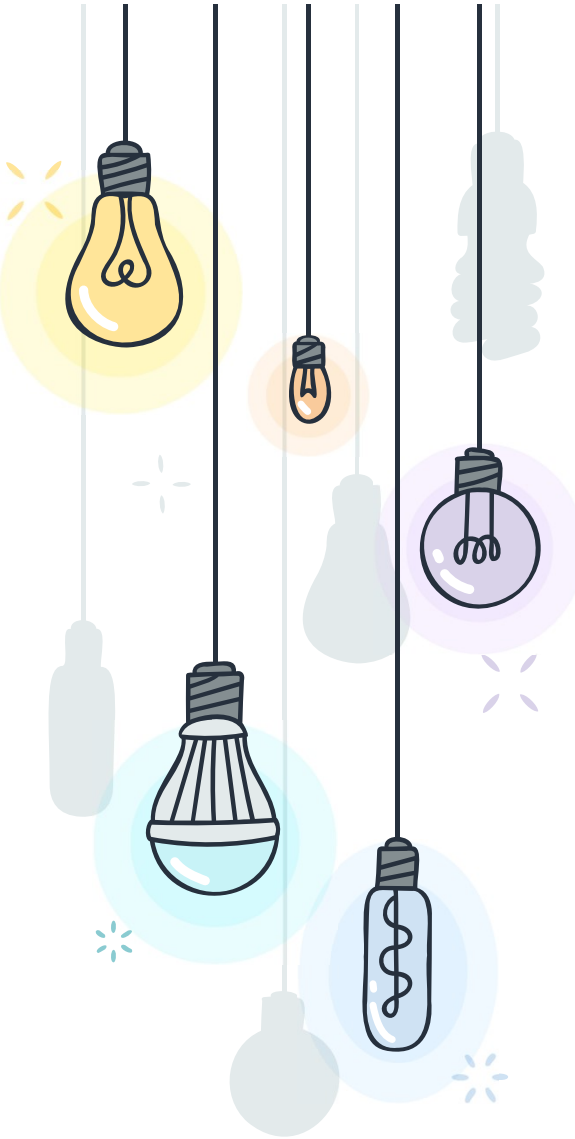

Flail chest
Trachea
Broken ribs
Rib cage
Lungs
Breathe in
Breathe out
Cleveland Clinic ©2022

UP TO ٥ MINUTES

- Mobilize trauma resource
  - Cervical spine
  - Vital sign
- Airway
  - Obstruction
  - Direct airway injury
- Breathing
  - Tension pneumothorax
  - Massive hemothorax
  - Open pneumothorax
  - Flail chest
- Circulation
  - **Absent circulation**
  - **External hemorrhage**
  - **Signs of shock**
  - **Cardiac tamponade**
  - **Pelvic fracture**
- Disability
  - GCS
  - Pupillary response
  - Spinal cord injury
  - Impeding herniation
- Exposure
  - hypothermia




C: CIRCULATION ASSESSMENT
Are distal pulses palpable?
NO
YES
Signs of tamponade?
NO
Is gross bleeding present?
YES
YES
NO
+/- ultrasound; pericardiocentesis, if indicated
Apply direct pressure (Class III)
Has IV/IO access been established?
YES
NO
Continue to D: DISABILITY ASSESSMENT
Obtain IV/IO Access (Class III)



UP TO ٥ MINUTES

Mobilize trauma resource

Cervical spine
Vital sign

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Circulation

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GCS
Pupillary response
Spinal cord injury
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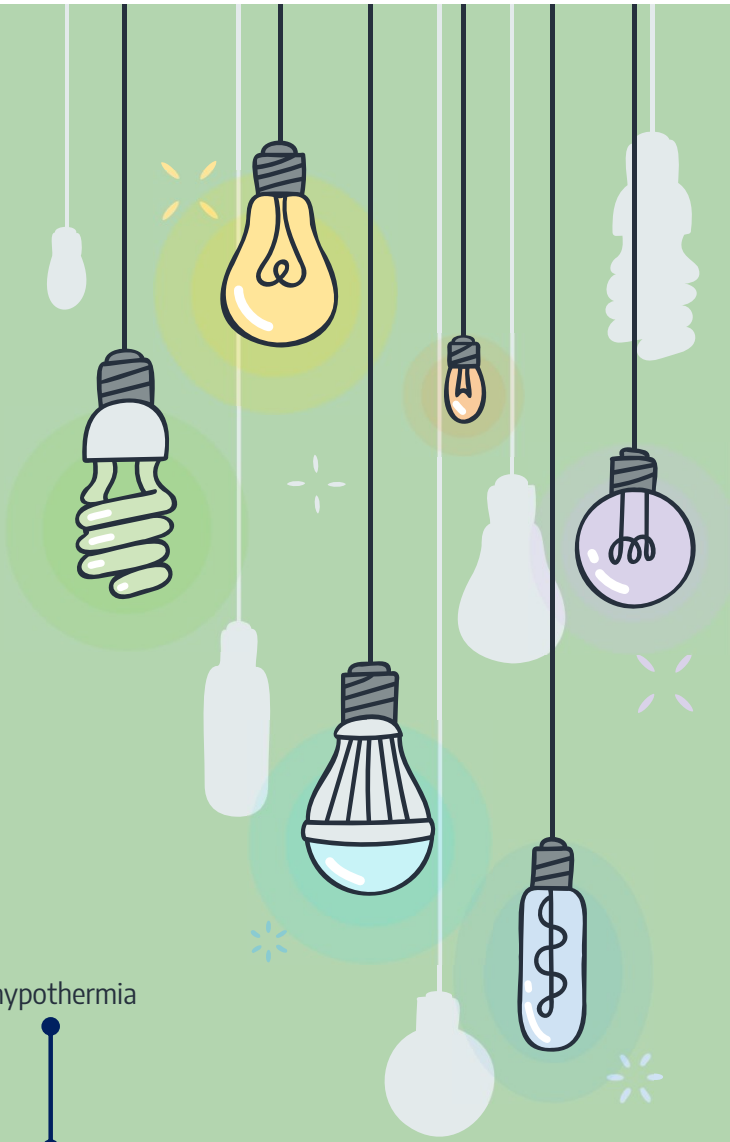
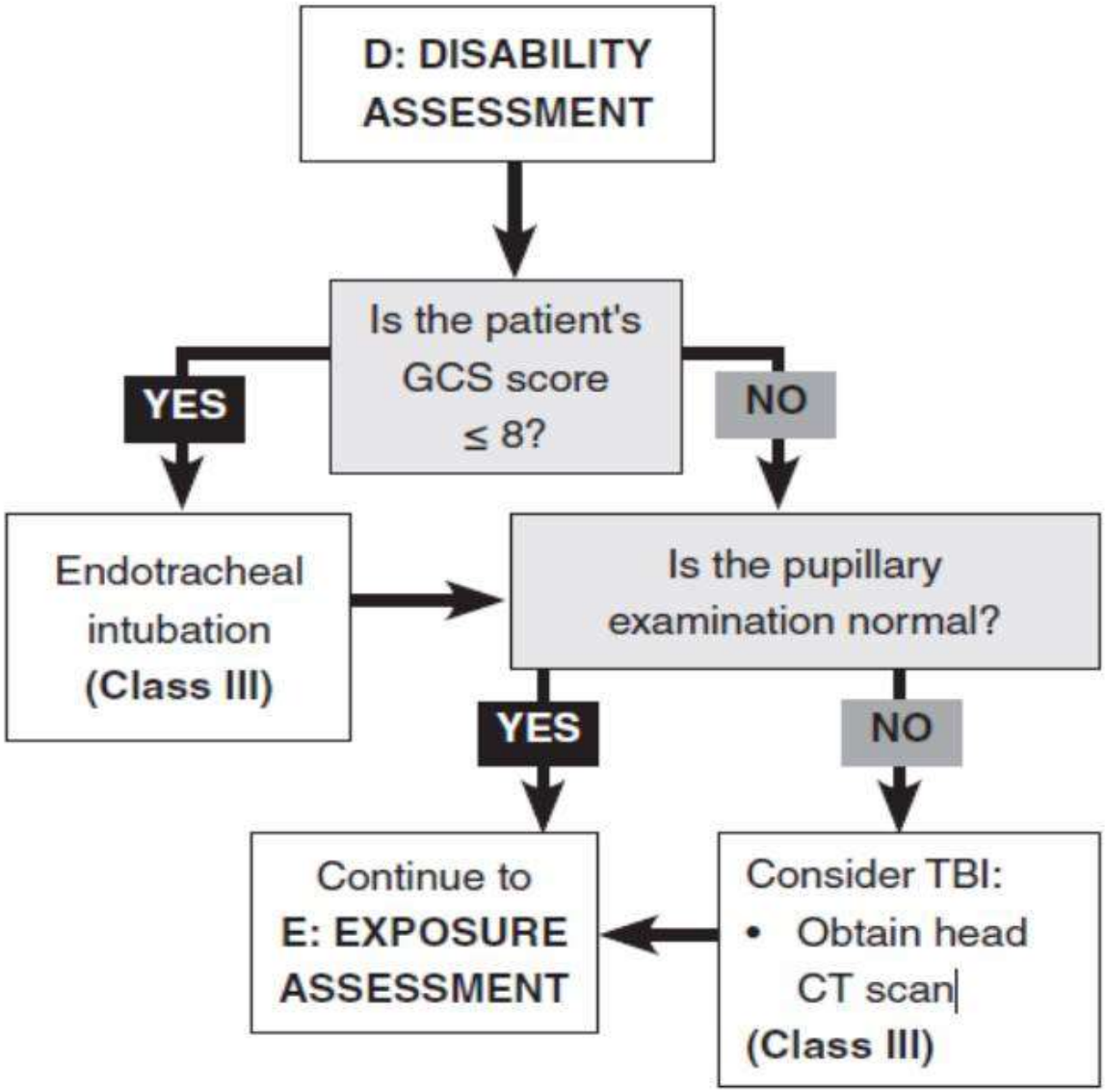
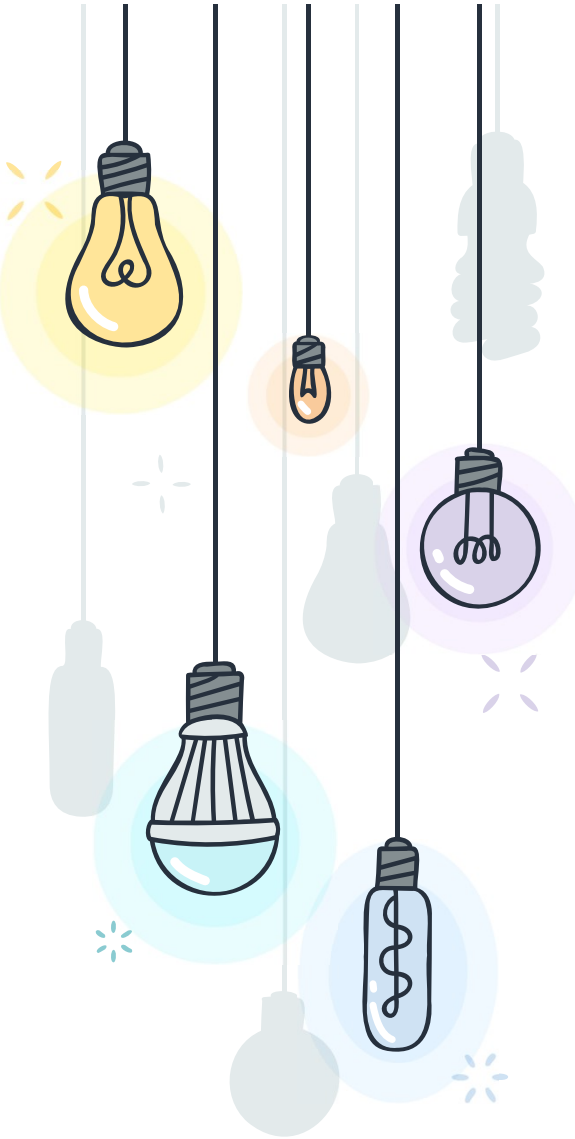
Disability

hypothermia

Exposure




D: DISABILITY ASSESSMENT
Is the patient's GCS score ≤ 8?
YES
NO
Endotracheal intubation (Class III)
Is the pupillary examination normal?
YES
NO
Continue to E: EXPOSURE ASSESSMENT
Consider TBI:
• Obtain head CT scan
(Class III)



PEDIATRIC GLASGOW COMA SCALE:

EYE OPENING		*VERBAL RESPONSE*		*MOTOR RESPONSE*	
Age : > 2yrs ≤ 2 yrs		**Age : >2 yrs ≤ 2 yrs**		**Age : > 2 yrs ≤ 2 yrs**	
Spontaneous **4** Spontaneous		Oriented **5** Coos, babbles		Obeys commands **6** Normal, spontaneous	
To voice **3** To speech		Confused **4** Irritable, cries		Localizes pain **5** Withdraws to touch	
To pain **2** To pain		Inappropriate **3** Cries to pain		Withdraws to pain **4** Withdraws to pain	
None **1** None		Incomprehensible **2** Moans to pain		Flexion to pain **3** Abnormal flexion	
		None **1** None		Extension to pain **2** Abnormal extension	
				None **1** None	
Eye opening = _____		Verbal = _____		Motor =____	

TOTAL = _____/ 15

UP TO ٥ MINUTES

Mobilize trauma resource

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Vital sign

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Disability

GCS
Pupillary response
Spinal cord injury
Impeding herniation

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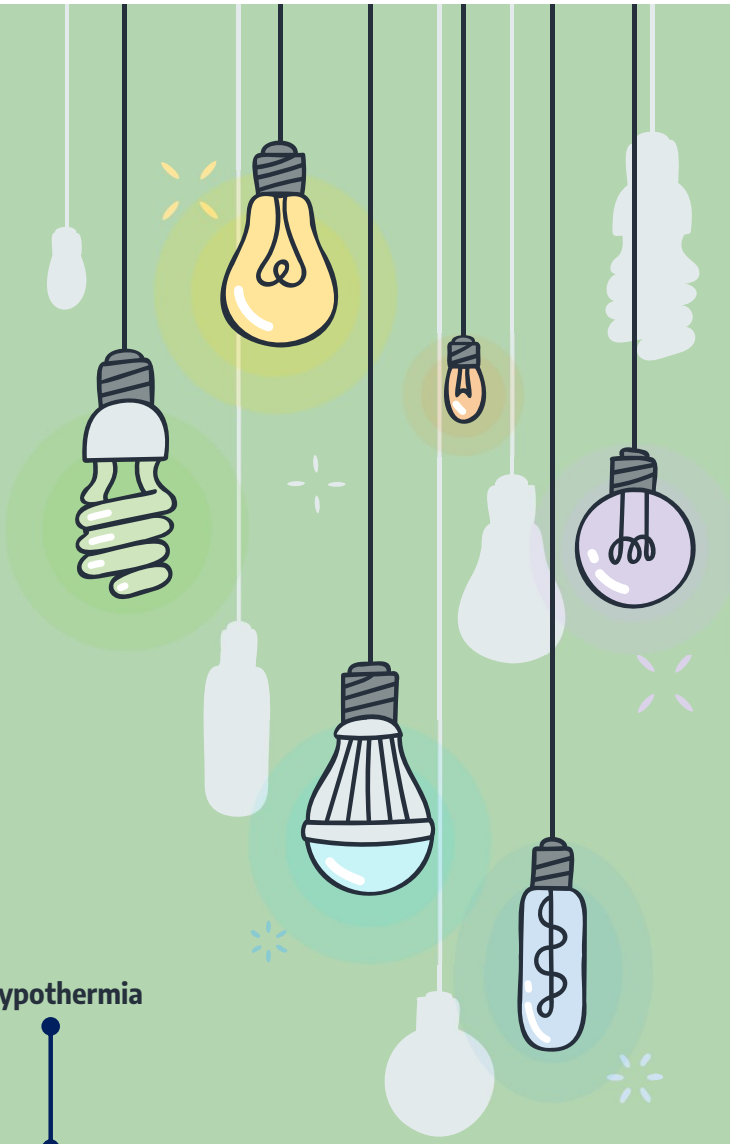
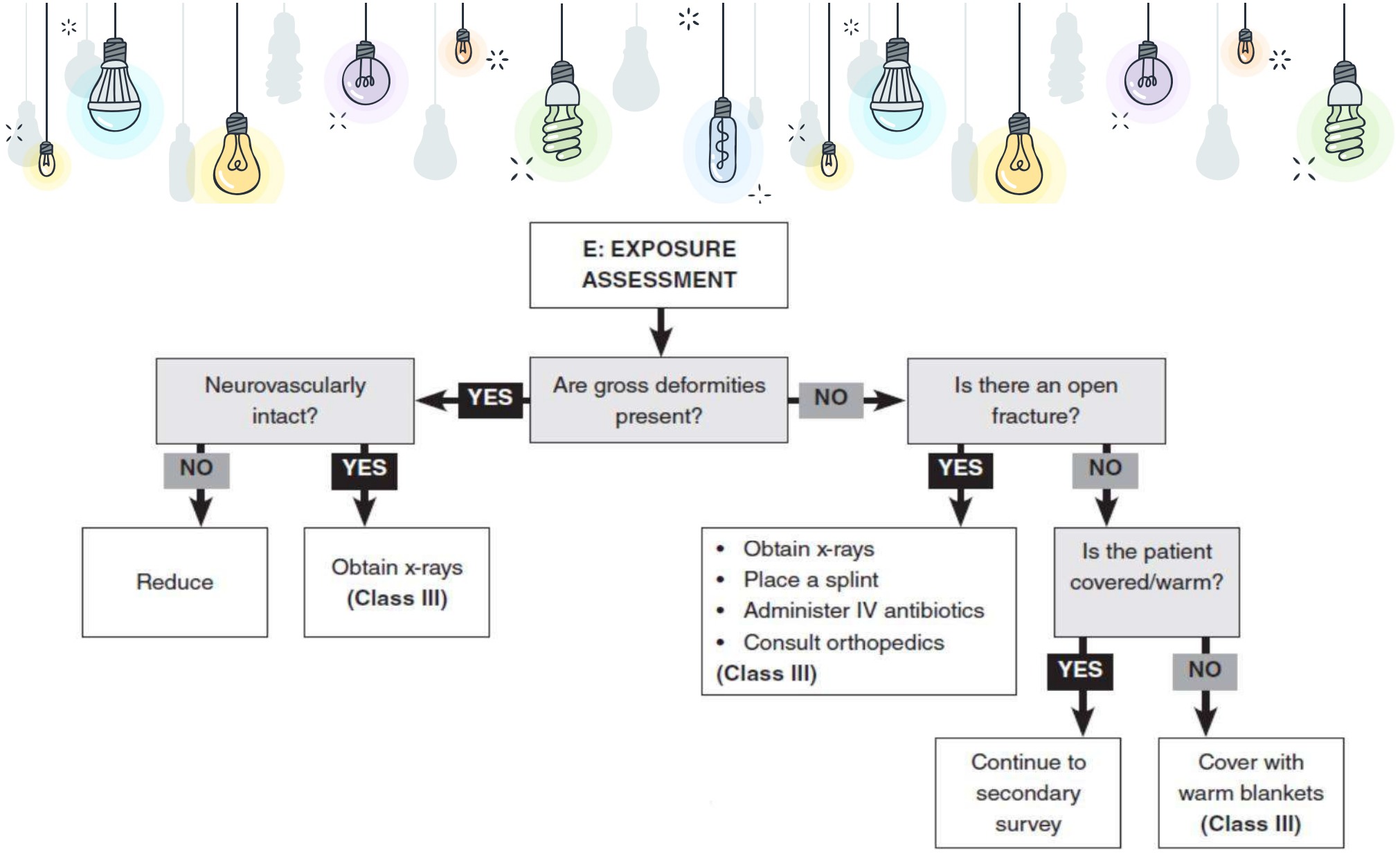
hypothermia




E: EXPOSURE ASSESSMENT
Are gross deformities present?
YES
Neurovascularly intact?
NO
Reduce
YES
Obtain x-rays (Class III)
NO
Is there an open fracture?
YES
• Obtain x-rays
• Place a splint
• Administer IV antibiotics
• Consult orthopedics
(Class III)
NO
Is the patient covered/warm?
YES
Continue to secondary survey
NO
Cover with warm blankets (Class III)

٥ UP TO ١٥ MINUTES

Repeat VS every ٥ min

Continue care of A,B,C,D

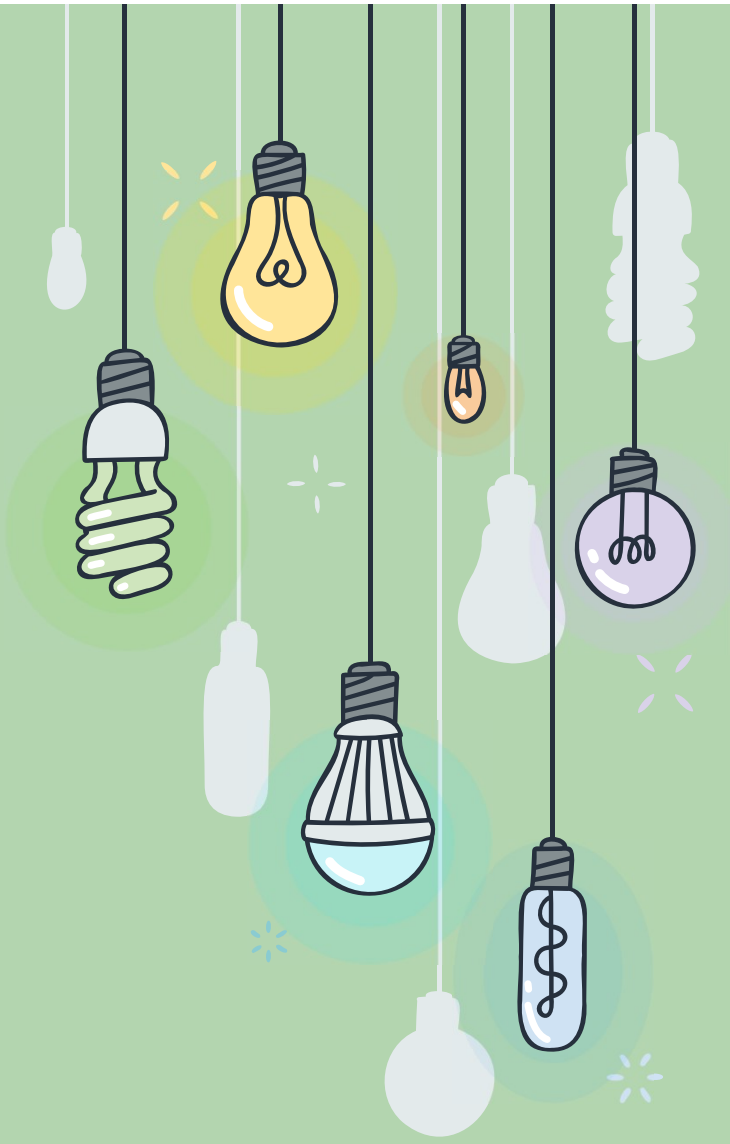
Reassess response to intervention

intubated patient

Monitor end tidal CO_2
Blood gas
Gastric tube

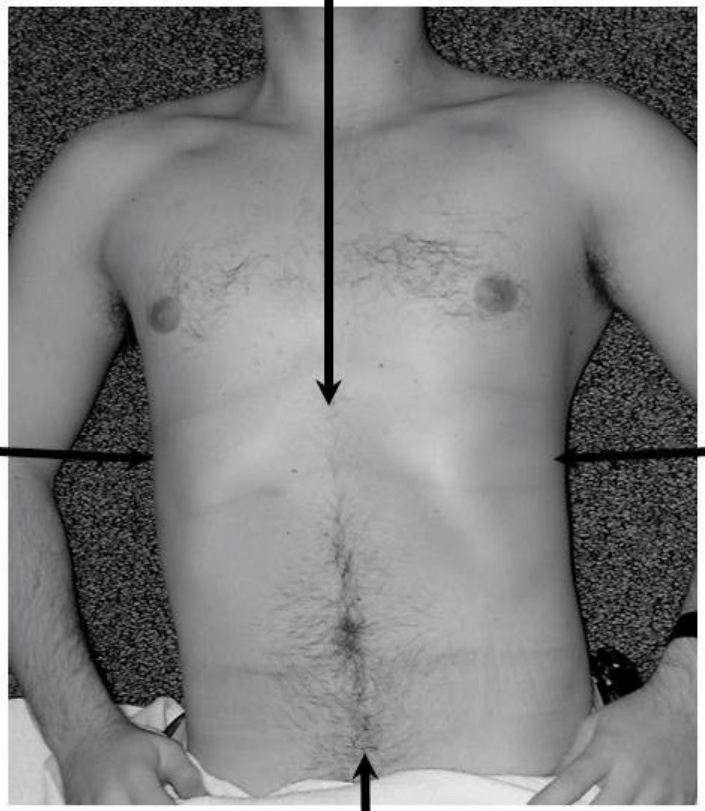
Persistently hypotensive

FAST



Subxyphoid
1 Space: Pericardial

Right Upper Quadrant
4 Spaces:
1. Pleural
2. Subphrenic
3. Hepatorenal (Morison's pouch)
4. Inferior pole kidney

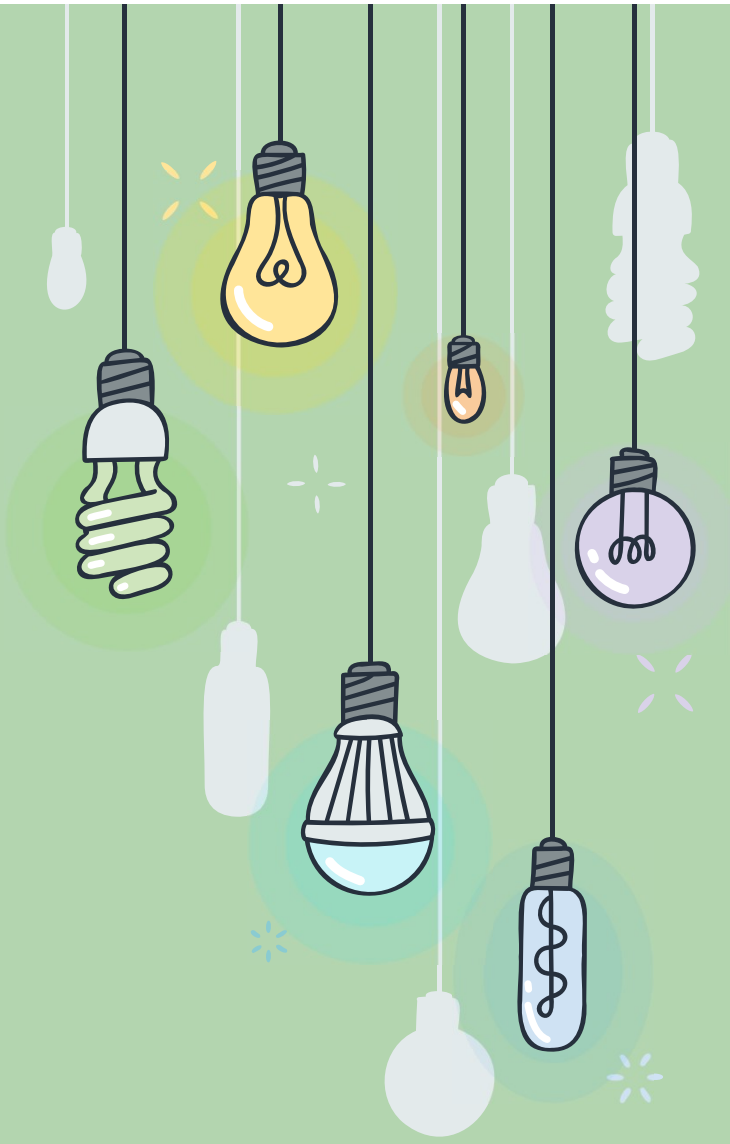


Left Upper Quadrant
4 Spaces:
1. Pleural
2. Subphrenic
3. Splenorenal
4. Inferior pole kidney

Suprapubic
1 Space: Retrovesicular recess/pouch of Douglas

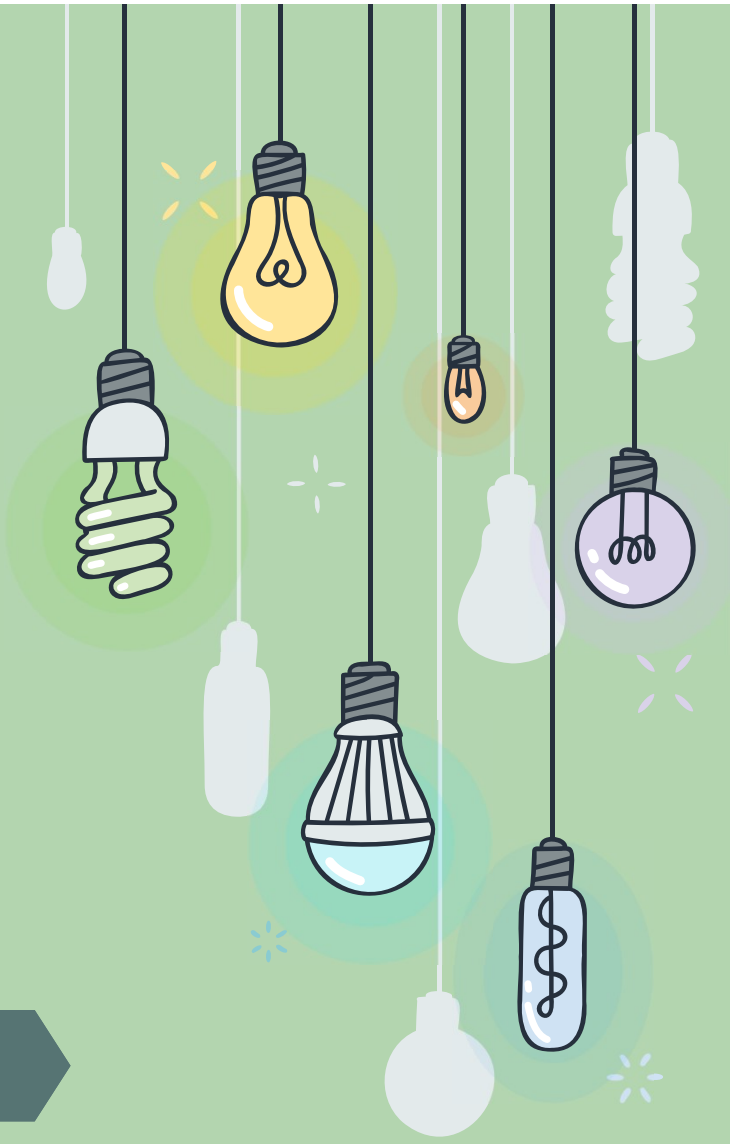
١٥ UP TO ٢٠ MINUTES

- Reassess response to intervention
  - Care of A,B,C,D
- Reassess GCS
  - Logroll and remove spine board
- Examine head,neck,...
  - Analgesia
  - Urinary catheter(if not contraindicated)
- Radiographs
  - Operative management if needed



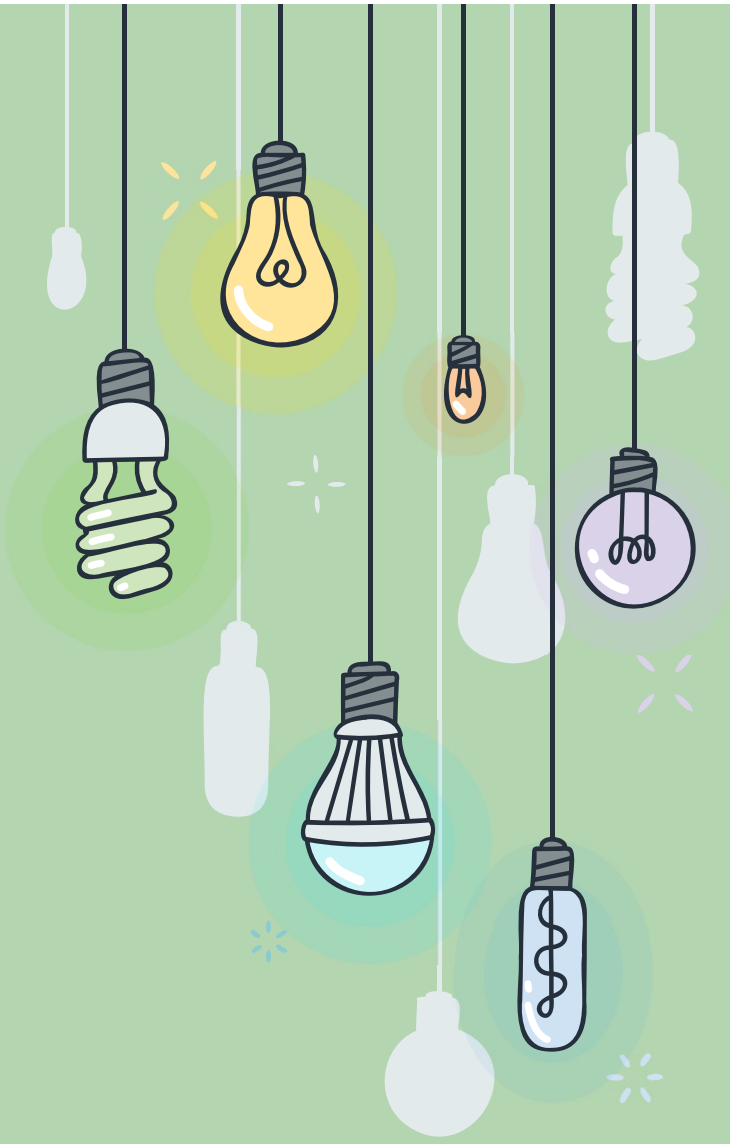
٢٠ UP TO ٦٠ MINUTES

- Reassess response to intervention
  - Analgesia
  - Splint fracture
- Reassess GCS
  - Update tetanus immunization if needed
- Examine head,neck,... (secondary survey)
  - Antibiotics if needed
- Lab data
- CT if needed



Secondary survey(head trauma):

- GCS evaluation
- Brain CT scan
- ICP evaluation



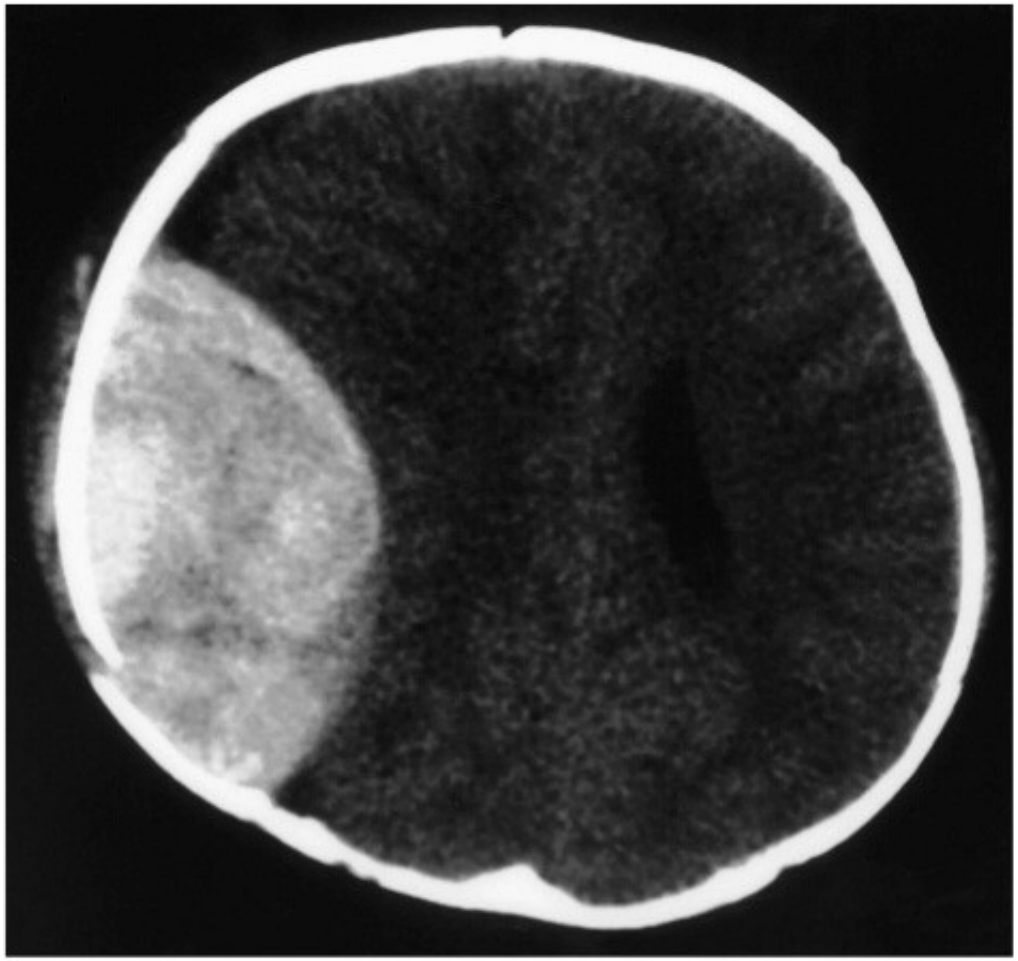


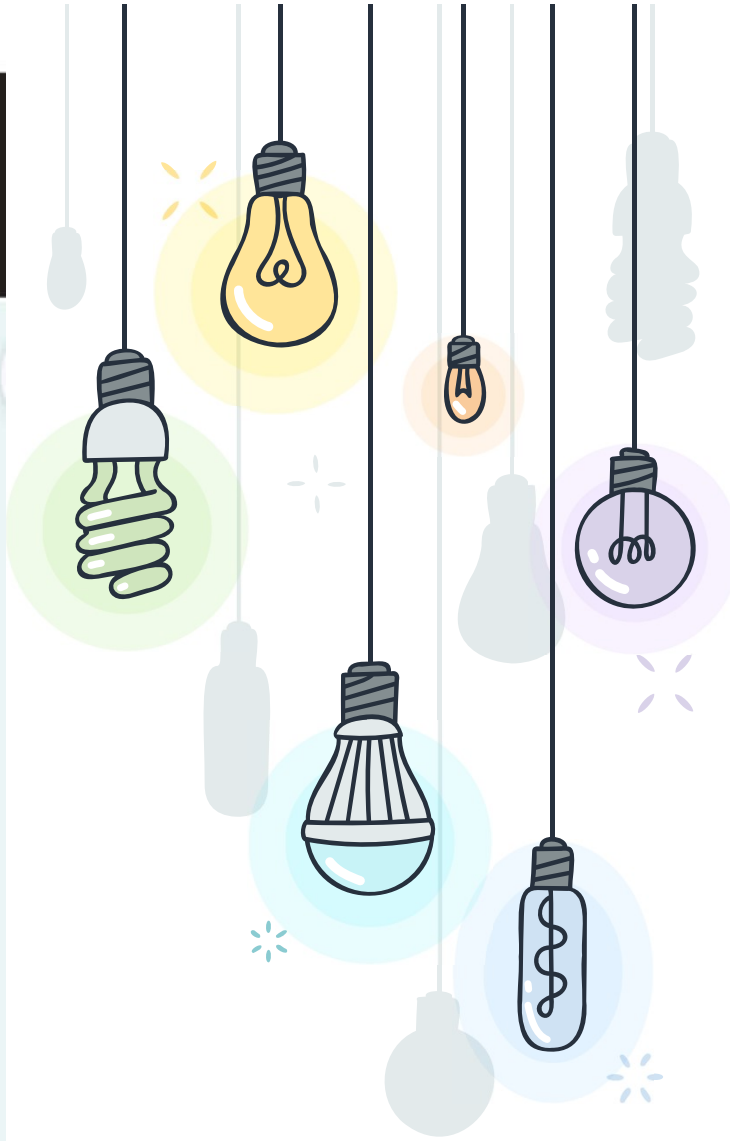
Table 82.7	Prediction Rule for Identification of Children at Very Low Risk of Clinically Important Brain Injuries After Head Trauma

*Children <2 yr old are at very low risk of clinically important traumatic brain injury if they have **none** of the following:*

- Severe mechanism of injury
- History of LOC >5 sec
- GCS ≤14 or other signs of altered mental status
- Not acting normally per parent
- Palpable skull fracture
- Occipital/parietal/temporal scalp hematoma

*Children 2-18 yr old are at very low risk of clinically important traumatic brain injury if they have **none** of the following:*

- Severe mechanism of injury
- History of LOC
- History of vomiting
- GCS ≤14 or other signs of altered mental status
- Severe headache in the ED
- Signs of basilar skull fracture



Secondary survey(Spinal cord injury):

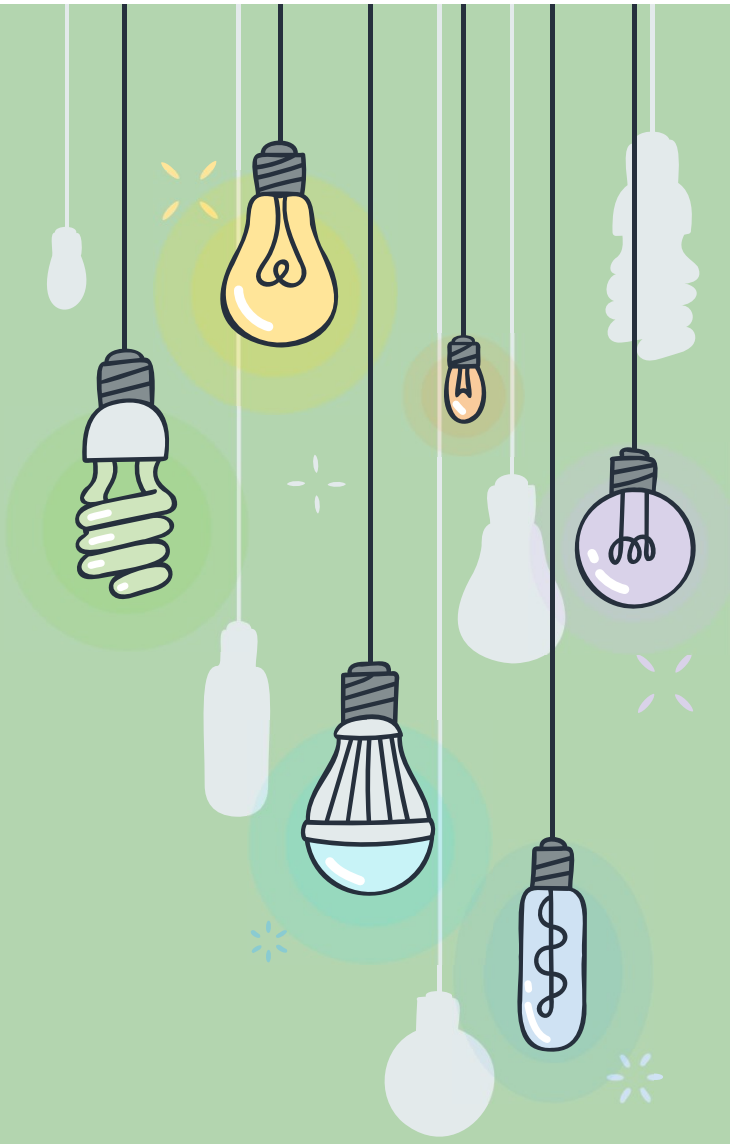
- **GCS evaluation**
- **SCIWORA**

Spinal cord injury without radiographic abnormality

Consider MRI

- **NEXUS criteria**

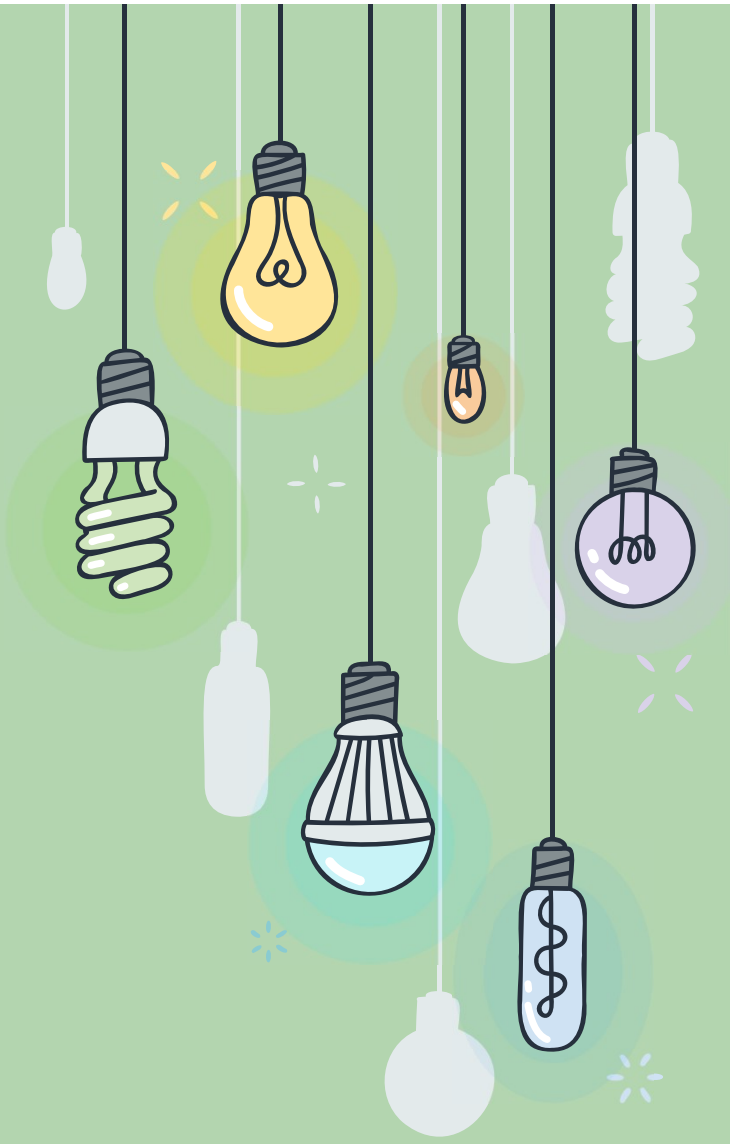
Focal neurologic deficit present
Midline spinal tenderness present
Altered level of consciousness present
Intoxication present
Distracting injury present



Secondary survey(CHEST):

- **Lung contusion**

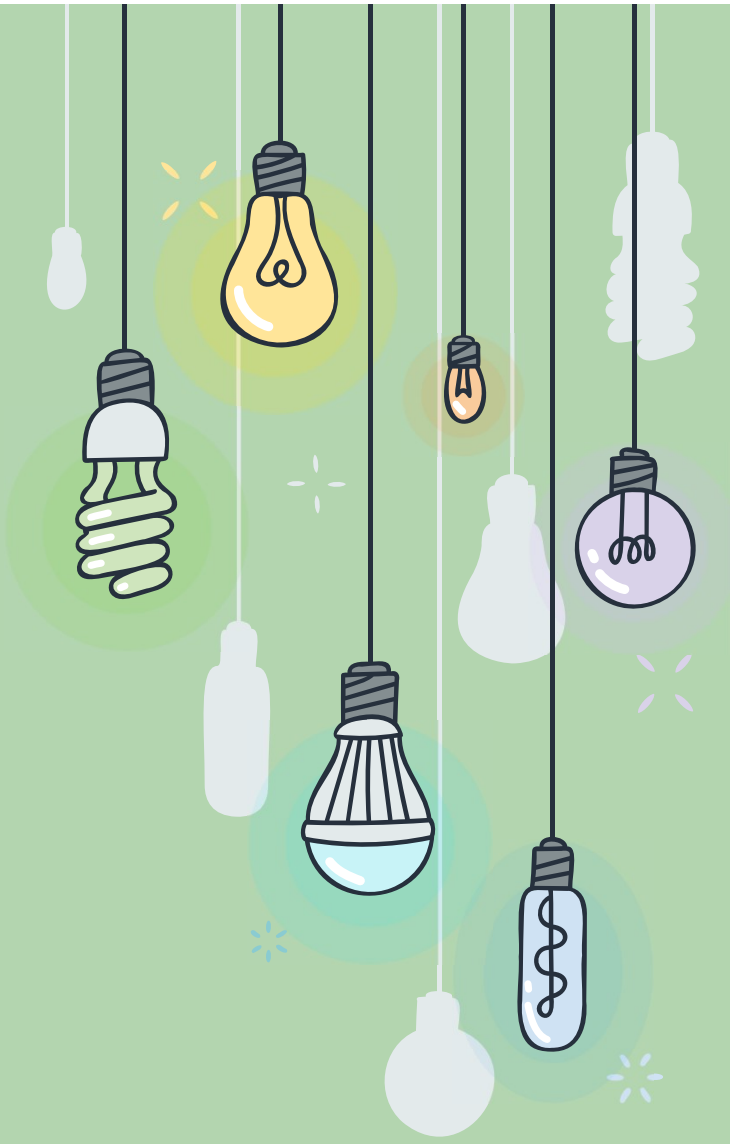
- **Ribs fracture**



Secondary survey(ABDOMEN):

- **Penetrating trauma:** GI , liver , vessels
- **Blunt trauma:** kidney , spleen , pancreas and duodenum

- **Consider CT and FAST**



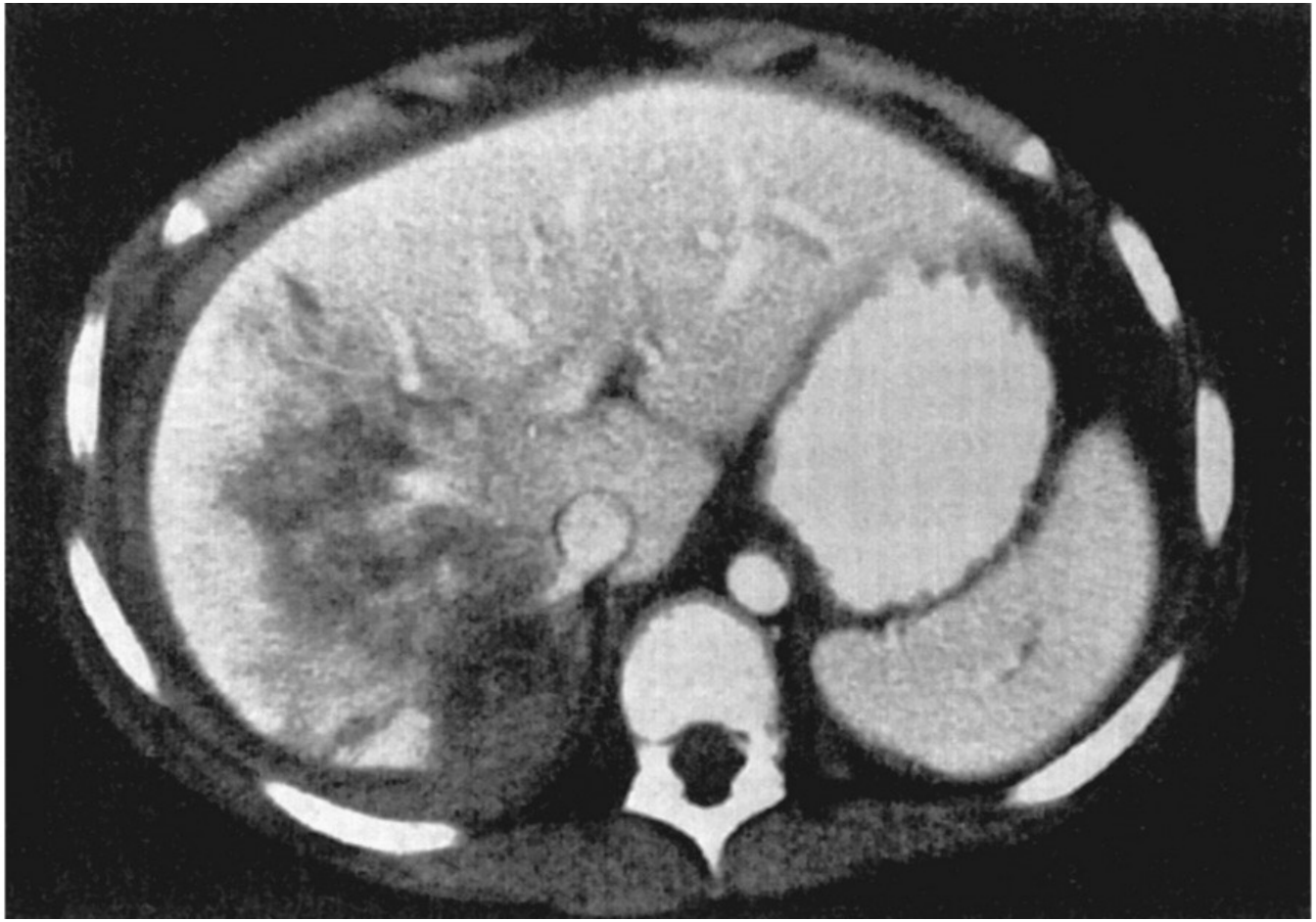
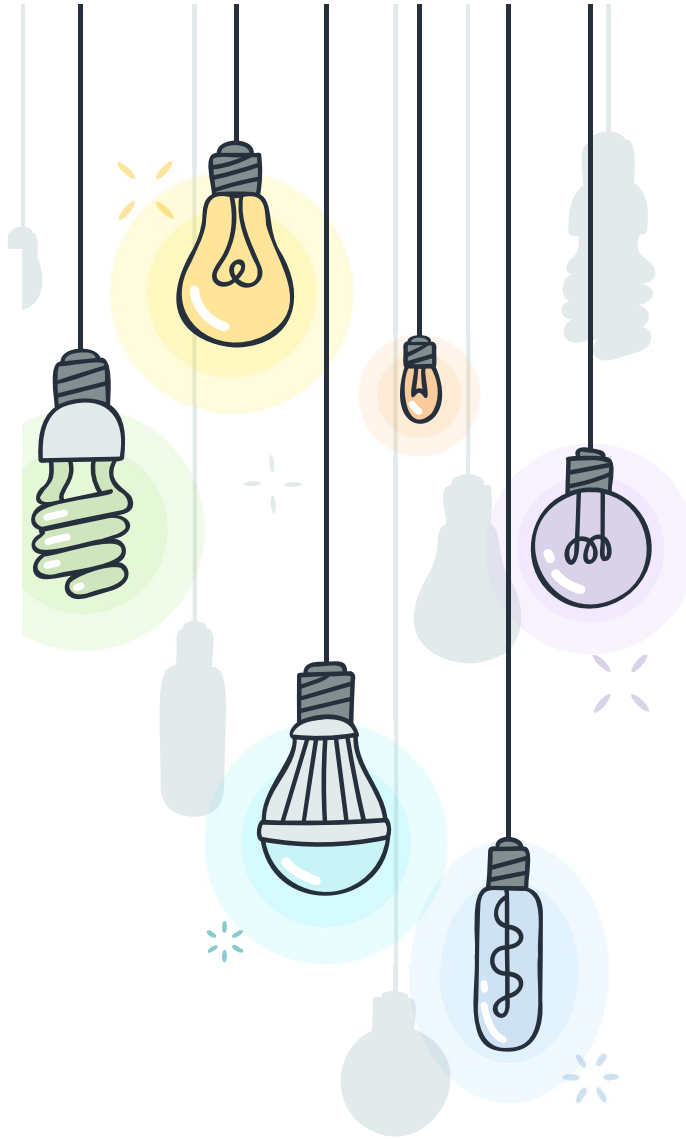


Table 82.8	Prediction Rule for Identification of Children at Very Low Risk of Clinically Important Intraabdominal Injuries After Blunt Trauma

*If **none** of the following is present, the patient is at very low risk for clinically significant intraabdominal injury:*

Glasgow Coma Scale score <14
Vomiting
Evidence of thoracic wall trauma
Decreased breath sounds
Evidence of abdominal wall trauma or seatbelt sign
Abdominal pain
Abdominal tenderness



Secondary survey(pelvic):

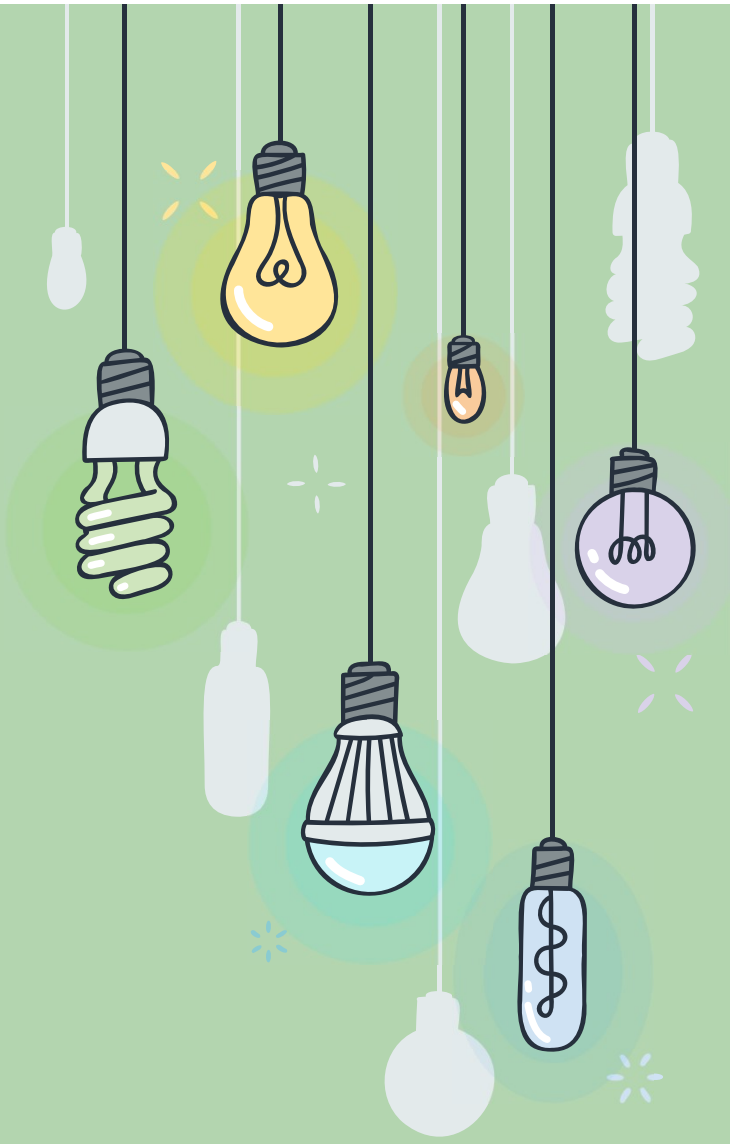
- **Pelvic fracture**

Compression distraction maneuver

External fixation

- **Prediction rule for identification of children at very low risk of pelvic fracture:(non of the following is present)**

GCS<١۴
Abdominal tenderness
Pelvic tenderness
Gross hematuria
High risk trauma
equimosis



Compression

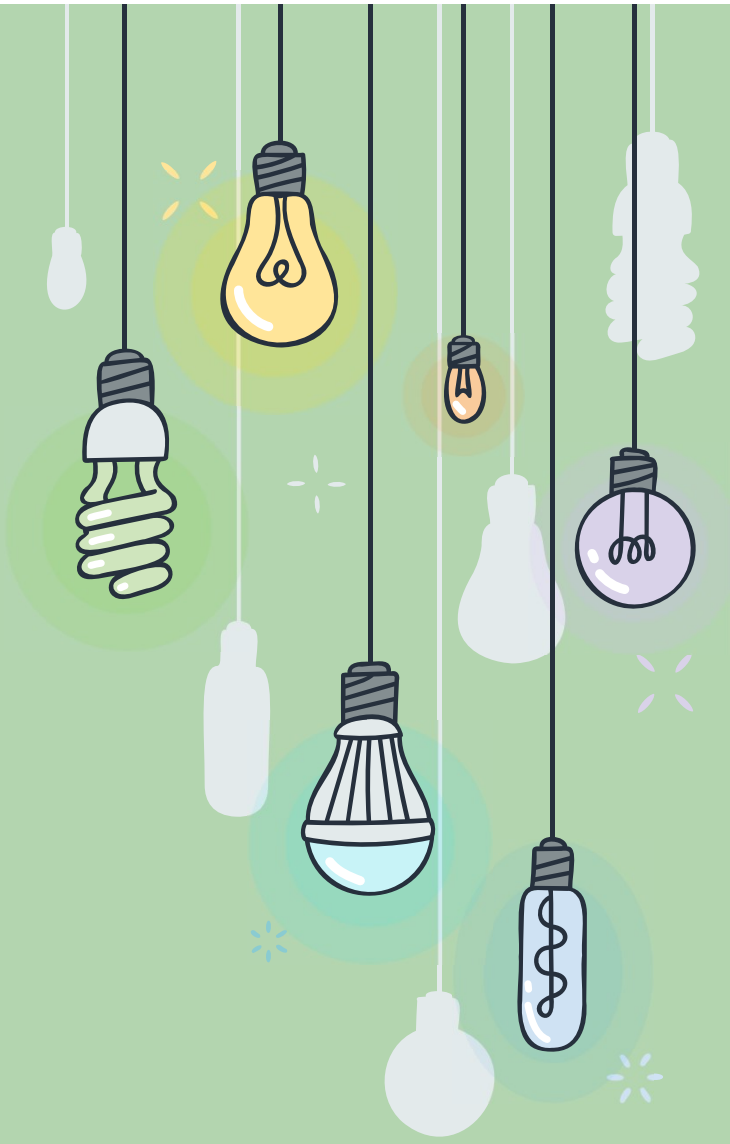
Distraction

Secondary survey(GU):

- Labial or scrotal equimosis
- Meatal bleeding
- Pelvic fracture

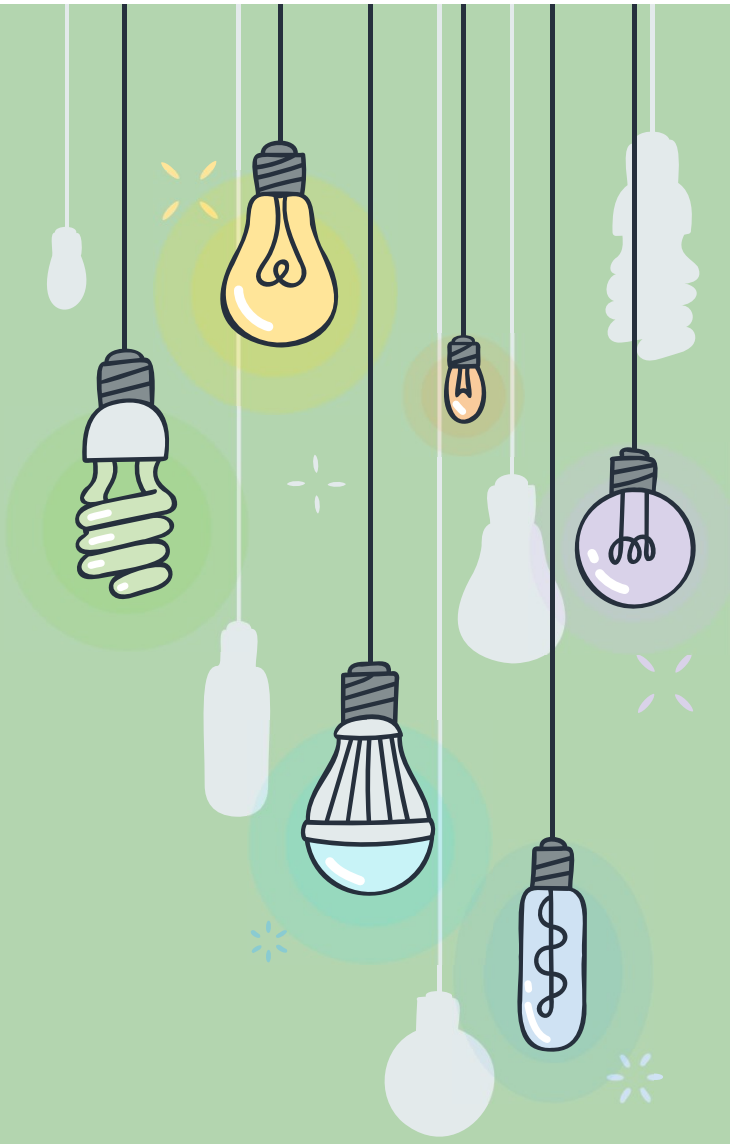
Retrograde cystograohy or CT for abdomen and pelvic

Contraindicated for urinary catheterization

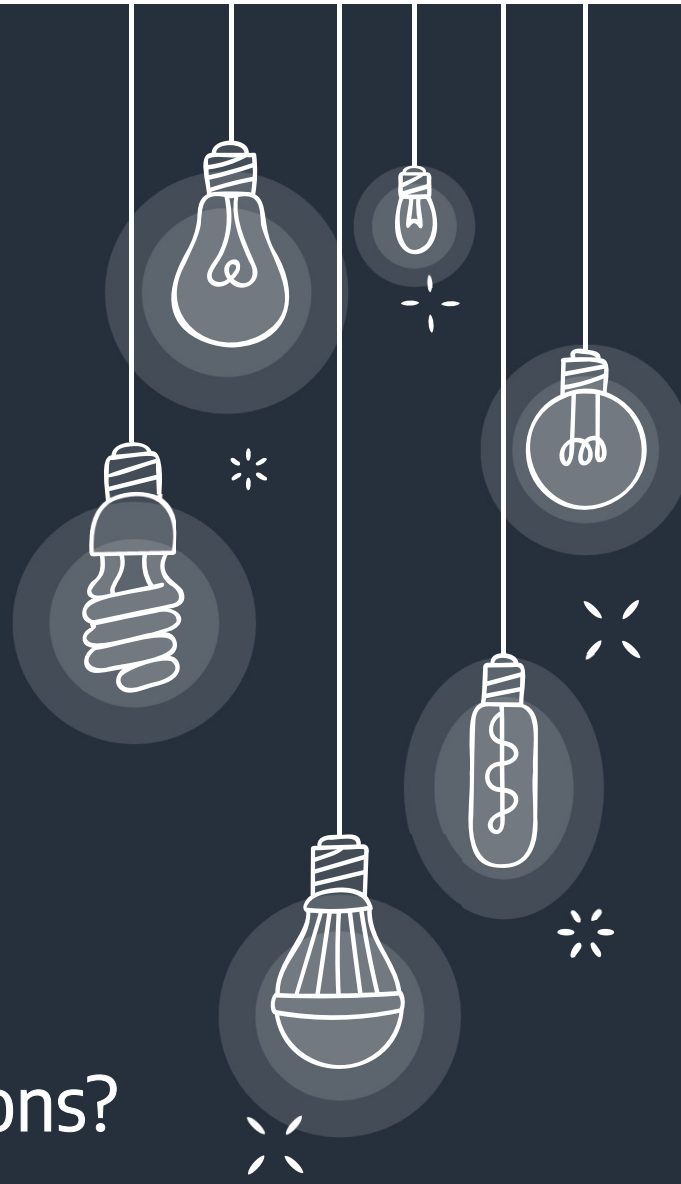


Secondary survey(extremities):

- **fractures**
- **wounds**



Thanks for your attention



Any questions?