Chapter Review Questions for the ATLS Student Course Manual

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Chapter 1 Initial Assessment and Management

A cast-cutter should be used to remove a trauma victim's helmet if there is evidence of a C-spine injury or if _____.

the patient experiences pain or paresthesias during an initial attempt to remove the helmet.

The "A" in ABCDE stands for ________.

Airway; however, always be cautious about and protect the cervical spine.

Any patient who is cool and tachycardic is considered to be ____ until proven otherwise.

in shock

The definition of tachycardia depends on the patient's age. What heart rate is considered tachycardic for infants, toddlers/preschoolers, school age/prepubescent, and adults?

- Infants > 160,
- toddlers/preschoolers > 140,
- school age/prepubescent > 120, and
- adults > 100

Compensatory mechanisms may preclude a measurable fall in systolic blood pressure until up to ____% of the patient's blood volume is lost.

30%

What is the trauma triad of death?

The trauma triad of death is the combination of hypothermia, coagulopathy, and acidosis. Severe hemorrhage in trauma diminishes oxygen delivery, and may lead to hypothermia. Hypothermia, in turn, can halt the coagulation cascade, which exacerbates the hemorrhage. Since tissues are hypoperfused, anaerobic metabolism increases, causing the release of lactic acid and other acidic compounds. Such an increase in acidity can reduce myocardial performance, further exacerbating tissue hypoperfusion. And so, the vicious cycle continues, ultimately ending in death ... unless someone trained in ATLS intervenes.

A patient may be abusive and belligerent because of _____, so don't just assume it's due to drugs, alcohol, or that he is a jerk.

hypoxia
Describe the Glasgow Coma Scale (GCS).

<table>
<thead>
<tr>
<th>ASSESSMENT AREA</th>
<th>SCORE</th>
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<tbody>
<tr>
<td><strong>Eye opening (E)</strong></td>
<td></td>
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<tr>
<td>Spontaneous</td>
<td>4</td>
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<td>To speech</td>
<td>3</td>
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<tr>
<td>To pain</td>
<td>2</td>
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<td>None</td>
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<td><strong>Verbal response (V)</strong></td>
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<td>Oriented</td>
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<td>Confused conversation</td>
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<td>Inappropriate words</td>
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<td>Incomprehensible sounds</td>
<td>2</td>
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<td>None</td>
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<td><strong>Best motor response (M)</strong></td>
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<tr>
<td>Obeys commands</td>
<td>6</td>
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<td>Localizes pain</td>
<td>5</td>
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<td>Flexion withdrawal to pain</td>
<td>4</td>
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<td>Abnormal flexion (decorticate)</td>
<td>3</td>
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<tr>
<td>Extension (decerebrate)</td>
<td>2</td>
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<tr>
<td>None (flaccid)</td>
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A patient opens her eyes only to painful stimuli, utters inappropriate words, and localizes pain. What is her GCS score?

E = 2
V = 3
M = 5
Therefore, GCS = 2+3+5 = 10

Patients with a GSC of less than ____ usually require intubation.

9
What information is in an “AMPLE” patient history?

A = Allergies
M = Medications
P = PMH/Pregnancy
L = Last meal
E = Events/Environment of injury

When is this done?
During the secondary survey.

You should assume that any patient with multisystem trauma and altered level of consciousness, or blunt injury above the clavicle, has what type of injury?
Cervical spine injury.

How can you clear the C-spine without imaging?
The C-spine can be cleared clinically if the patient:
- is awake, alert, and sober;
- has no distracting injuries;
- has no neurological deficits referable to the cervical spine;
- has no midline neck pain or tenderness on palpation; and
- can flex, extend, and laterally rotate his head to both sides without pain.

Otherwise, when would C-spine films be obtained?
During the secondary survey.

When should most images be obtained?
During the secondary survey. There are a small number of exceptions (see next question).

What imaging is done during the primary survey?
CXR and pelvis films (both AP views), and FAST scan.

What should you do for every female patient of childbearing age?
Pregnancy test.
What possible injuries would you suspect with a frontal impact automobile collision?

- Head trauma,
- cervical spine fracture,
- anterior flail chest,
- myocardial contusion,
- pulmonary contusion,
- pneumothorax,
- hemothorax,
- traumatic aortic disruption,
- fractured spleen and liver,
- posterior fracture/dislocation of hip and knee.

**Size of needle for needle cricothyroidotomy?**
- 12 gauge

**Size of needle for needle thoracentesis?**
- 14 gauge

**Size of needle for peripheral IV?**
- 16 gauge

**Size of needle for pericardiocentesis?**
- 18 gauge (spinal needle)
Chapter 2  **Airway and Ventilatory Management**

What two places would you look at on a patient if you suspected hypoxemia?
Lips and fingernail beds

**Can a patient breathe on his own after complete cervical cord transection?**
Yes, if the phrenic nerves (C3-C5) are spared (“C3, 4, 5 keep the diaphragm alive”). This will result in "abdominal" breathing. The intercostal muscles will be paralyzed though.

**The proper size ET tube for an infant is _____.**
The same size as the infant's nostril or littlefinger. (usually size 3 for neonates; 3.5 for infants)

**How do you calculate what size ET tube to use for children?**
Internal diameter = (age / 4) + 4 mm

**What size cuffed endotracheal tube do you use for an emergency cricothyroidotomy?**
5 or 6.

**Patients with tension pneumothorax and patients with cardiac tamponade may present with many of the same signs. What findings will you see with a tension pneumothorax that you will not see with tamponade?**
Absent breath sounds and hyperresonance to percussion over the affected hemithorax; and tracheal deviation away from the affected hemithorax.

**Immediate thoracic decompression is warranted for anyone with absent breath sounds, hyperresonance to percussion, tracheal deviation, _____. and _____.**
acute respiratory distress and subcutaneous emphysema
Chapter 3  Shock

The most effective method of restoring adequate cardiac output and end-organ perfusion is to restore venous return to normal by locating and stopping the source of _____, along with appropriate ____ repletion.

bleeding; volume

Any injured patient who is cool and has tachycardia is considered to be _____ _____ until proven otherwise.

in shock

Hypotension is caused by _____ until proven otherwise.

hypovolemia

Tachycardia is diagnosed when the heart rate is greater than ____ beats per minute (BPM) in infants, ____ BPM in preschool children, ____ BPM in children from school-age to puberty, and ____ BPM in adults.

160 BPM in an infant,
140 BPM in a preschool-aged child,
120 BPM in children from school age to puberty, and
100 BPM in adults.

Elderly patients may not exhibit tachycardia in response to hypovolemia because of limited cardiac response to catecholamines. Why else?

They may be on beta-blockers, or have a pacemaker.

When you don’t have a blood pressure, what are three things to look for when evaluating perfusion.

1. Level of consciousness (brain perfusion)
2. Skin color (ashen face and grey extremities)
3. Pulses (bilateral femoral – thready and rapid)

Which arm should you not place a pulse oximeter?

The arm with a blood pressure cuff attached.

Elderly patients have a limited ability to ____ to compensate for blood loss.

increase heart rate
Urinary catheters are good for assessing renal perfusion and volume status. List 5 signs of urethral injury that might prevent you from inserting one.
- Blood at urethral meatus,
- perineal ecchymosis,
- blood in scrotum,
- high-riding/non-palpable prostate, and
- pelvic fracture

The most common cause of shock in the injured trauma patient is ____.
- hemorrhage

Base deficit and/or ____ levels can be useful in determining the presence and severity of shock.
- lactate

Massive blood loss may produce ____ acute decrease in the hematocrit or hemoglobin concentration.
- only a minimal

Why might you want a Bair Hugger for a patient who smells of alcohol?
- Alcohol ingestion causes vasodilation, which can lead to hypothermia.

Vascular access must be obtained promptly. This is best accomplished by inserting two large-caliber (minimum of ____-gauge in an adult) peripheral intravenous catheters before placement of a central venous line is considered.
- 16-gauge

Resuscitation fluids should be warmed to 39 degrees Celsius (102.2°F). Can you use a microwave oven to do this?
- Yes, for crystalloids only (but not for blood products).

What things are you looking for when you perform a digital rectal exam (DRE) in a trauma patient?
- Blood, tears, high-riding prostate (in males), and sphincter tone.

Adult patients should maintain urine output of at least ____?
- Adults 0.5 mL/kg/hr (children 1.0 ml/kg/hr).
How does shock reduce the total volume of circulating blood?
Anaerobic metabolism --> insufficient ATP --> endoplasmic reticulum damage, then mitochondrial damage --> lysosomal rupture --> sodium and WATER enter cells (which swell and die) --> decreased intravascular volume

Which vasopressors should you use to treat hemorrhagic shock?

Approximately ____% of total blood volume is in the veins.
70%

What physical signs suggest pericardial tamponade?
Beck's Triad: JVD, muffled heart sounds, and hypotension (resistant to fluid therapy). Also likely is tachycardia.

Can isolated intracranial injuries cause neurogenic shock?
No.

How do you calculate total blood volume in an adult?
70 mL per kg ideal weight. E.g. a 70 kg person has about 5 liters of circulating blood (70 x 70 = 4,900 mL).

How do you calculate total blood volume in a child?
80-90 mL per kg ideal weight.

The blood volume of an obese person is calculated based on their ____ weight.
ideal

Fluid replacement should be guided by ____, not simply by the initial classification of hemorrhage (classes I-IV).
the patient's response to initial fluid therapy

How much blood volume is lost with class I hemorrhage?
Up to 15%. Donating 1 pint, or ~500 mL, of blood is about a 10% volume loss and would qualify as class I hemorrhage.
How do you treat a class I hemorrhage?
You don't (usually). Transcapillary refill and other compensatory mechanisms usually restore blood volume within 24 hours.

How much blood volume is lost with class II hemorrhage?
15-30% (750-1500 mL in a 70 kg adult).

How do you treat a class II hemorrhage?
Usually only with crystalloids.

Subtle CNS changes such as anxiety, fright, and hostility would be expected in a patient with a class ____ hemorrhage.
II

How much blood volume is lost with class III hemorrhage?
30-40% (2000 mL in a 70 kg adult).

A class ____ hemorrhage represents the smallest volume of blood loss that is consistently associated with a drop in systolic blood pressure.
III

A patient with inadequate perfusion, marked tachycardia and tachypnea, significant mental status change, and a measurable fall in systolic blood pressure likely has a class ____ hemorrhage.
III or IV. These patients almost always require a blood transfusion, which depends on their response to initial fluid resuscitation. The first priority is stopping the hemorrhage.

How much blood volume is lost with class IV hemorrhage?
More than 40%. Unless very aggressive measures are taken, the patient will die within minutes.

Loss of more than ____% of blood volume results in loss of consciousness.
50%

Up to ____ mL of blood loss is commonly associated with femur fractures.
1500 mL
Unexplained hypotension or cardiac dysrhythmias (usually bradycardia from excessive vagal stimulation) are often caused by ____, especially in children.

gastric distention

How much crystalloid should you give an adult as an initial fluid resuscitation bolus?
2 liters

How much crystalloid should you give a child as an initial fluid resuscitation bolus?
20 mL/kg (may repeat and give as much as 60 mL/kg). But, since children have a high reserve, they should get blood sooner rather than later.

Each mL of blood loss should be replaced with ____ mL of crystalloid, thus allowing for replacement of plasma volume lost to interstitial and intracellular spaces.
3 mL

"Blood on the floor and four more" is a memory aid for searching for occult blood loss where?
Chest; abdomen and pelvis; retroperitoneum; and thigh.

For children under 1 year of age, urinary output should be ____ mL/kg/hr.
2

Would patients in early hypovolemic shock be acidodic or alkalotic?
Alkalotic - respiratory alkalosis from tachypnea. Then metabolic acidosis from hypoxia ensues.

"Rapid responders," i.e. those whose vital signs return to normal (and stay there) after fluid resuscitation likely have had a class ____ hemorrhage.
I or II

"Transient responders" are associated with class ____ hemorrhage.
II or III
What is the differential diagnosis for "non-responders" following fluid resuscitation?
   Non-hemorrhagic causes, e.g. tension pneumothorax, pericardial tamponade, cardiac contusion, MI, acute gastric distention, neurogenic shock, etc.

Most patients receiving blood transfusions need calcium replacement. True or false?
   False.

How long can an intraosseous (IO) line be kept in?
   Intraosseous infusions should be limited to emergency resuscitation and should be discontinued as soon as other venous access is obtained.

How should you position the patient when inserting a subclavian or internal jugular line?
   Supine, trendelenburg (head down) at 15 degrees to distend the veins and prevent air embolism, and turn the head away from you (and only if the C-spine has been cleared).

Where is an incision for a saphenous vein cutdown made and how long should the incision be?
   The saphenous vein can be accessed approximately 1 cm anterior and 1 cm superior to the medial malleolus. Make a 2.5 cm transverse incision through the skin, taking care not to injure the vein.
Chapter 4  Thoracic Trauma

A patient arrives in the trauma bay intubated and there are absent breath sounds over the left hemithorax. Where should you place your decompression needle?

Trick question. This may not be a pneumothorax. For relatively stable intubated patients always suspect a right main stem bronchus intubation before attempting needle decompression.

Where would you insert a large caliber needle to decompress a tension pneumothorax?

Through the 2nd intercostal space in the midclavicular line of the affected hemithorax.

For an open pneumothorax (sucking chest wound), air passes preferentially through the chest wall defect (least resistance) if the diameter of the defect is at least $\frac{2}{3}$ the diameter of the trachea.

2/3

Flail chest results from multiple rib fractures. By definition, this would be ___ or more ribs, fractured in ___ or more places.

2 or more ribs fractured in 2 or more places

Flail chest is invariably accompanied by ___ which can interfere with blood oxygenation.

Pulmonary contusion - do not over-fluid resuscitate these patients.

Both tension pneumothorax and massive hemothorax are associated with decreased breath sounds on auscultation. You can tell which it is by _______.

Percussion - hyperresonant with pneumothorax; dull with hemothorax.

By definition, how much blood is in the chest cavity to call it a "massive hemothorax"?

1500 mL or 1/3 or more of the patient's total blood volume. Some also define it as continued blood loss of 200 mL/hr for 2-4 hours - but ATLS does not use this rate for any mandatory treatment decisions.

If a patient doesn't have JVD, does this mean a tension pneumothorax or pericardial tamponade is not present?

No, the patient may be hypovolemic.
What size chest tube might you use to evacuate a massive hemothorax?
#38 French - inserted at the 4th or 5th intercostalspace, just anterior to the midaxillary line.

What is Kussmaul's sign?
A rise in venous pressure with inspiration while breathing spontaneously. It is a true paradoxical venous pressure abnormality associated with cardiac tamponade.

How well do CPR compressions work on someone with a penetrating chest injury and hypovolemia?
"Closed heart massage" for cardiac arrest is ineffective in patients with hypovolemia. Patients with PENETRATING thoracic injuries who arrive pulseless but with myocardial electrical activity (PEA), may be candidates for a thoracotomy in the ED.

Are all patients with PEA who have sustained a thoracic injury candidates for an ED thoracotomy?
No - Only PEA with PENETRATING thoracic injuries are candidates for an ED thoracotomy.

An ED thoracotomy can allow you to do what?
Evacuate pericardial blood, cardiac massage, directly control hemorrhage, cross-clamp the descending aorta to slow blood loss below the diaphragm and increase perfusion to the heart and brain.

For a patient with a traumatic simple pneumothorax, what should you do BEFORE you start positive pressure ventilation or take them for surgery?
Insert a chest tube - positive pressure ventilation can turn a simple pneumothorax into a tension pneumothorax, so insert a chest tube first.

Should you evacuate a simple hemothorax if it is not causing any respiratory problems?
Yes - A simple hemothorax, if not evacuated, may result in a retained clotted hemothorax with lung entrapment; or, if infected, develop into an empyema.

A pneumothorax associated with a persistent large air leak after tube thoracostomy suggests a _______ injury.
tracheobronchial - Use bronchoscopy to confirm. You may need more than one chest tube before definitive operative management.
What radiographic findings are suggestive of traumatic aortic disruption?
- Widened mediastinum,
- Obliteration of aortic knob,
- Deviation of trachea to the right,
- Depression of left mainstem bronchus,
- Deviation of esophagus (NG tube) to right,
- Widened paratracheal stripe,
- Fracture of 1st or 2nd ribs, or scapula

A deceleration injury victim with a left pneumothorax or hemothorax, without rib fractures, in pain or shock out of proportion to the apparent injury, and has particulate matter in the chest tube, may have an esophageal rupture - a forceful blow causes expulsion of gastric contents into the esophagus, producing a linear tear in the lower esophagus allowing leakage into the mediastinum.

Fractures for the lower ribs (10-12) should increase suspicion for hepatic injury.

Why are upper torso, facial, and arm plethora with petechiae associated with crush injuries to the chest?
- Temporary compression of the superior vena cava

How does ATLS suggest you should review a chest radiograph?
- Trachea and bronchi, pleural spaces and parenchyma, mediastinum, diaphragm, bones, soft tissues, tubes and lines.

What types of penetrating chest wounds should alert the practitioner to the possible need for thoracotomy?
- Penetrating anterior chest wounds medial to the nipple line, and posterior wounds medial to the scapula because of potential damage to the great vessels, hilar structures, and the heart, with the associated potential for cardiac tamponade.

You should for. How would you perform pericardiocentesis?
- Obtain a 6 inch, 18 gauge needle. Puncture the skin 1-2 cm inferior to the left xiphohondral junction at a 45 degree angle to the skin and aim towards the top of the left scapula.

What is a good way to know if you've advanced your needle too far during pericardiocentesis and have entered ventricular muscle?
- ECG Changes - extreme ST-changes, widened QRS, PVCs, etc. Withdraw needle until ECG returns to baseline.
What should you do with your needle after you successfully evacuate blood during pericardiocentesis?

If possible, use the Seldinger technique to insert a 14 gauge flexible catheter. Close the stopcock and leave the catheter in place in case re-evacuation is needed. This is not a definitive treatment.
Chapter 5  **Abdominal and Pelvic Trauma**

Early consultation with a ____ is necessary whenever a patient with possible intraabdominal injuries is brought to the ED.

**surgeon**

**What are the indications for prompt laparotomy?**
- Free air, retroperitoneal air, or rupture of the hemidiaphragm.
- Peritonitis.
- Penetrating abdominal wound with hypotension.
- Blunt abdominal trauma with hypotension and a positive FAST or clinical evidence of intraperitoneal bleeding.
- Blunt or penetrating abdominal trauma with a positive DPL.
- Gunshot wound traversing the peritoneal cavity or visceral/vascular retroperitoneum.
- Evisceration.
- Bleeding from the stomach, rectum, or genitourinary tract from penetrating trauma.
- Contrast-enhanced CT that demonstrates ruptured gastrointestinal tract, intraperitoneal bladder injury, renal pedicle injury, or severe visceral parenchymal injury after blunt or penetrating trauma.

**What does FAST stand for?**
- Focused Assessment Sonography in Trauma

**FAST has a sensitivity, specificity, and accuracy in detecting intraabdominal fluid comparable to ____.

**DPL**

**What are the advantages of FAST?**
- Rapid, noninvasive, accurate, and inexpensive means of detecting intraabdominal fluid that can be repeated frequently.

**What are the four places you should look first when doing a FAST scan?**
- Mediastinum, hepatorenal fossa, splenorenal fossa, pouch of Douglas.

**Name two anatomical challenges that can interfere with doing a FAST scan?**
- Obesity and bowel gas (since fat and gas attenuate sound waves).

**What do you need to do BEFORE you do a DPL (other than getting instruments and materials together and surgically prepping, etc.)?**
- Decompress the bladder and decompress the stomach.
For patients with facial fractures or basilar skull fractures, gastric tubes should be inserted orally before doing a DPL.

What is "adequate" fluid return when getting DPL fluid back?
30%

DPL is considered to be 98% sensitive for detecting intraperitoneal bleeding.

DPL is indicated when a patient with multiple blunt injuries is hemodynamically unstable, especially when they have:
- Change in sensorium (brain injury, EtOH or drug intoxication, etc.),
- Change in sensation (spinal cord injury),
- Injury to adjacent structures (pelvis, lumbar spine),
- Lap-belt sign (from seatbelt), or
- If patient is going for long studies (CT, surgery, etc.).

What is the only ABSOLUTE contraindication to DPL?
An existing indication for laparotomy.

What are some RELATIVE contraindications to DPL?
Morbid obesity, advanced cirrhosis, pre-existing coagulopathy, and previous abdominal operations (adhesions).

When should you use an open supraumbilical approach for a DPL?
Pelvic fractures (don't want to enter a pelvic hematoma) and advanced pregnancy (don't want to damage uterus or fetus).

When performing a DPL, what INITIAL findings (not from lab) would mandate a laparotomy?
Free blood (>10 mL) or GI contents (vegetable fiber, bile, feces, etc.).

If you don't get gross blood upon initial DPL aspiration, what do you do next for an adult? For a child?
Adult: 1,000 mL warm isotonic crystalloid intraperitoneally.
Child: same, but 10 mL/kg.

What parameters would make a DPL positive?
- >100,000 red cells/mm³,
- 500 white cells/mm³, or
- Bacteria on gram stain.
List three methods of hemorrhage control.
Pelvic stabilization, laparotomy, angiographic embolization.

Your trauma patient needs an urgent laparotomy, can you take them to the CT scanner first to evaluate injuries?
No, if they need an emergent laparotomy, they are unstable - unstable patients should go to the OR, not the CT scanner.

What are some indications for laparotomy in patients with penetrating abdominal wounds?
Unstable, GSW, peritoneal irritation, fascial penetration.

What percentage of stab wounds to the anterior abdomen do not penetrate the peritoneum?
25-33%

Do you need to operate on everyone with an isolated solid organ injury?
No, not if they remain hemodynamically stable (of all patients who are initially thought to have an isolated solid organ injury, <5% will have hollow viscus injury as well).

Does an early, normal serum amylase level exclude major pancreatic trauma?
No.

Anterior/posterior forces cause _____ book pelvic fractures, and lateral forces cause _____ book fractures.
AP: open book;
lateral: closed book

Which is less likely to have a life-threatening hemorrhage: an open book or a closed book pelvic fracture?
Closed book - the pelvic volume is compressed, so there is less room for blood to extravasate.

Which are more common, open or closed book pelvic fractures?
Closed book: 60-70% (open book: 15-20%; vertical shear: 5-15%)

You need to do retrograde urethrography PRIOR to foley placement if there is _____.
inability to void,
unstable pelvic fracture,
blood at urethral meatus,
scrotal hematoma, perineal ecchymoses, or high-riding or mobile prostate.
Chapter 6  Head Trauma

Describe the Glasgow Coma Scale (GCS).

See page 2. You need to know how to determine a patient's GCS score quickly – know it inside out.

When calculating GCS and there is right/left asymmetry in the motor response - which one do you use?

The BEST response (better predictor than the worst response).

Ideally, you want to wait to perform a GCS on a person with SEVERE brain injury until what?

BP is normalized.

Patients with a GCS between 3 and 8 meet the accepted definition of "coma" or "____ brain injury."

severe

What are the GCS scores for "minor" and "moderate" brain injury?

Minor is 13-15,

Moderate is 9-12

What signs might you see if a patient has a basilar skull fracture?

Periorbital ecchymosis (raccoon eyes), retroauricular ecchymosis (battle sign), otorrhea, and rhinorrhea.

A fixed and dilated (blown) pupil in a patient with a traumatic injury is caused by compression of which nerve?

Superficial parasympathetic fibers of the oculomotor nerve (cranial nerve III).

What criteria may make admission necessary for a patient with minor brain injury?

focal neurological deficits,

abnormal CT (or no scan available),

penetrating head injury,

prolonged loss of consciousness,

worsening level of consciousness,

moderate to severe headache,
significant drug or alcohol intoxication,
skull fracture,
otorrhea,
rhinorrhea,
GCS remains < 15,
nobody at home to observe patient.

What is a "normal" ICP in the resting state?
10 mm Hg (pressures > 20, particularly if sustained, are associated with poor outcomes).

The Monro-Kellie Doctrine describes compensatory mechanisms to stabilize pressure inside the calvarium. What are the 2 main ones?
Venous Blood and CSF decrease in equal volumes. When this is exhausted, herniation can occur and brain perfusion will likely be inadequate.

Preventing hypercarbia is critical in patients who have sustained a _____ injury.

High levels of CO₂ will cause cerebral vasculature to _____.
dilate (to increase blood flow) - So you might want to hyperventilate patients with brain injuries.

Your patient has a dilated pupil and you want to give mannitol on the way to the OR. What is the dose?
0.25 - 1.0 g/kg IV rapid bolus.

What would you want to do if a patient with a minor brain injury failed to reach a GCS of 15 within 2 hours post-injury, had LOC >5min, is older than 65, had emesis x 2, or had retrograde amnesia >30 minutes?
Urgent head CT scan. Everything but the 30 min of retrograde amnesia makes him high risk for needing neurosurgical intervention.

What is the difference between retrograde amnesia and anterograde amnesia?
These are terms easily confused. Retrograde amnesia is the inability to recall events that occurred before the trauma. Anterograde amnesia is the loss of the ability to create new memories after the trauma.
What two things do you need to do first for everyone with a moderate brain injury (according to ATLS algorithm)?

1. Transfer to a facility capable of definitive neurosurgical care, and
2. Obtain a head CT scan (however, this should not delay patient transfer).

A FAST scan, DPL, or ex-lap should take priority over a CT scan if you cannot get the brain injured patient's sBP up to ____ mmHg.

100. If a patient has a systolic BP over 100 with evidence of intracranial mass (e.g. blown pupil, asymmetrical motor exam), then a CT would take priority.

A midline shift of greater than ____ often indicates the need for neurosurgical evacuation of the mass or blood.

5 mm

Cerebral perfusion pressure (CPP) is defined as mean arterial blood pressure minus ____.

intracranial pressure (CPP = MAP – ICP)

Hyperventilation will ____ ICP in a deteriorating patient with expanding intracranial hematoma until emergent craniotomy can be performed.

lower

In general, it is preferable to keep the PaCO\(_2\) at approximately ____ mm Hg, the low end of the normal range.

35 mm hg (4.7 kPa)

Brief periods of hyperventilation (PaCO\(_2\) of ____ to ____ mm Hg) may be necessary for acute neurologic deterioration.

25 to 30 mm Hg

Mannitol should not be given to patients with hypotension, because mannitol is a potent osmotic ____ and does not lower ICP in hypovolemia. This can further exacerbate hypotension and, therefore, cerebral ____.

diuretic; ischemia
Acute neurologic deterioration, such as the development of a dilated pupil, hemiparesis, or loss of consciousness, is a strong indication for administering mannitol, provided the patient is euvolemic. In this setting, a bolus of mannitol (1 g/kg) should be given rapidly (over 5 minutes).

Reasons for a patient with mild traumatic brain injury to return to the hospital include:

- Drowsiness or increasing difficulty in awakening patient,
- Nausea or vomiting,
- Convulsions,
- Severe headaches,
- Weakness or loss of feeling in the arm or leg,
- Confusion or strange behavior,
- One pupil much larger than the other,
- Peculiar movements of the eyes, double vision, or other visual disturbances,
- Very slow or very rapid pulse,
- Unusual breathing pattern, and
- Bleeding or watery drainage from the nose or ear.
Chapter 7  **Spine Trauma**

What are the possible mechanisms that can result in spine injuries?

Penetrating and blunt trauma, axial loading, flexion, extension, rotation, lateral bending, and distraction.

Can you clear the C-spine without imaging?

Yes. The C-spine can be cleared clinically if the patient:

- is awake, alert, and sober;
- has no neurological deficits referable to the cervical spine;
- has no distracting injuries;
- has no midline neck pain or tenderness on palpation; and
- can actively flex, extend, and laterally rotate his head to both sides without pain (never do this passively).

What are the indications for C-spine radiographs in a trauma patient?

Midline neck pain, tenderness on palpation, neurological deficits related to C-spine injuries, altered LOC, or intoxication.

Which views should be obtained?

Lateral, AP, and open-mouth odontoid views.

With the proper views of the C-spine, and a qualified radiologist, what is the sensitivity for finding an unstable cervical spine injury?

> 97% (CT with 3 mm slices > 99%).

Approximately ____% of patients with a cervical spine fracture have a second, noncontiguous vertebral column fracture.

10%

Cervical spine injury requires immobilization of the entire patient with:

- semirigid cervical collar,
- head immobilization,
- full-length backboard, and
- straps.
Attempts to align the spine for the purpose of immobilization on the backboard are not recommended if they _____.

cause pain

What is the most common type of C1 fracture?

Burst fracture (Jefferson fracture)

As long as the patient’s spine is ____, evaluation of the spine and exclusion of spinal injury may be safely deferred, especially in the presence of systemic instability, such as hypotension and respiratory inadequacy.

protected

In the presence of neurologic deficits, ____ or ____ is recommended to detect any soft tissue compressive lesion, such as a spinal epidural hematoma or a traumatized herniated disk.

MRI; CT myelography

Describe the muscle strength grading scale used in ATLS.

<table>
<thead>
<tr>
<th>SCORE</th>
<th>RESULTS OF EXAMINATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>Total paralysis</td>
</tr>
<tr>
<td>1</td>
<td>Palpable or visible contraction</td>
</tr>
<tr>
<td>2</td>
<td>Full range of motion with gravity eliminated</td>
</tr>
<tr>
<td>3</td>
<td>Full range of motion against gravity</td>
</tr>
<tr>
<td>4</td>
<td>Full range of motion, but less than normal strength</td>
</tr>
<tr>
<td>5</td>
<td>Normal Strength</td>
</tr>
<tr>
<td>NT</td>
<td>Not testable</td>
</tr>
</tbody>
</table>

A paralyzed patient who is allowed to lie on a hard board for more than ____ hours is at high risk for pressure ulcers.

2 hours

Partial or total loss of respiratory function may be seen in a patient with a cervical spine injury above _____.

C6
___ shock refers to the loss of muscle tone and loss of reflexes seen after spinal cord injury.

Spinal

What is neurogenic shock?
Spinal cord injury (SCI) --> loss of sympathetic tone --> vasodilation of blood vessels --> pooling of blood --> hypotension. SCI may also cause bradycardia or inhibit the tachycardic response to hypotension.

Neurogenic shock is rare in spinal cord injury below the level of ____.

T6

What is a major difference in a physical finding between hypovolemic shock and neurogenic shock?
Hypovolemic shock: usually tachycardic; neurogenic shock: usually bradycardic.

How do you treat neurogenic shock?
Judicious use of pressors and moderate fluid resuscitation. Too much fluid may result in fluid overload and pulmonary edema.

___ syndrome is characterized by a greater loss of strength in the upper extremities than in the lower extremities, with varying degrees of sensory loss.

Central cord

___ syndrome is characterized by paraplegia and a dissociated sensory loss with a loss of pain and temperature sensation. Dorsal column function (position, vibration, and deep pressure sense) is preserved.

Anterior cord

___ syndrome results from hemisection of the cord, usually as a result of a penetrating trauma. In its pure form, the syndrome consists of ipsilateral loss of motor function (corticospinal tract) and position sense (dorsal column), associated with contralateral loss of pain and temperature sensation (spinothalamic tract) beginning one to two levels below the level of the injury.

Brown-Séquard
Chapter 8  **Musculoskeletal Trauma**

In addition to “AMPLE,” what other aspects of the history are significant?
mechanism of injury, environment, preinjury status, and prehospital observations and treatment.

What are the four essential components of the physical assessment of MSK trauma?
Skin, neuromuscular function, circulatory status, and skeletal and ligamentous integrity.

Extremity injuries that are considered potentially life-threatening include ____ and ____.
major arterial hemorrhage; crush syndrome

A tourniquet may occasionally be used if hemorrhage is uncontrolled by direct ____ on the wound.
pressure

A properly applied tourniquet will ____ arterial flow.
Occlude (occluding only the venous system can actually increase hemorrhage)

When muscle is deprived of arterial blood, necrosis begins after about ____ hours.
6 hours

A fracture with an intrinsic tendency to displace after reduction is called ____.
unstable

The appropriate use of ____ significantly decreases the patient’s discomfort by controlling the amount of motion that occurs at the injured site.
splints

Should a leg be completely straight when splinting?
No, flexion of 10 degrees at the knee is recommended to lessen pressure on neurovascular structures.
If a fracture and an open wound exist in the same limb segment, the fracture is considered ____ until proven otherwise.

open

Patients with open fractures should be treated with ____ ____ as soon as possible.

intravenous antibiotics

Crush syndrome is also known as ____.

traumatic rhabdomyolysis

Explain crush syndrome?

Crush injury of a significant muscle mass (increase in CK) --> release of myoglobin --> may cause acute renal failure and disseminated intravascular coagulation (DIC). Other effects are metabolic acidosis, hyperkalemia, and hypocalcemia.

Myoglobin-induced renal failure may be prevented by intravascular fluid expansion and osmotic diuresis to maintain a high tubular volume and urine flow. It is recommended to maintain the patient’s urinary output at ____ until the myoglobinuria is cleared.

100 mL/hr

A doppler ankle-brachial index of less than ____ is indicative of impaired arterial flow in the lower extremities secondary to injury or peripheral vascular disease.

0.9

____ syndrome develops when the pressure within an osteofascial compartment causes ischemia and subsequent necrosis.

Compartment

Symptoms of compartment syndrome are:

Increasing pain out of proportion to the stimulus, palpable tenseness of the compartment, asymmetry of the muscle compartments, pain on passive stretch of the affected muscle, and altered sensation (e.g. paresthesia)
True or false: The absence of a palpable distal pulse may be relied upon to diagnose compartment syndrome.
False. The absence of a pulse is usually a late finding in compartment syndrome.

The end results of untreated compartment syndrome are:
muscle necrosis, neurologic deficit, ischemic contracture, infection, delayed healing of a fracture, and possible amputation.

By LOOKING at the patient, what findings might suggest a pelvic injury?
Leg-length discrepancy; hip rotation (usually external)

What is the procedure to salvage a body part that was traumatically amputated?
The amputated part should be thoroughly washed in isotonic solution (e.g. Ringer’s lactate) and wrapped in sterile gauze that has been soaked in aqueous penicillin (100,000 units in 50 mL of Ringer’s lactate). The amputated part is then wrapped in a similarly moistened sterile towel, placed in a plastic bag, and transported with the patient in an insulated cooling chest with crushed ice. Care must be taken not to freeze the amputated part.

What characteristics of wounds increase the risk for tetanus?
Significant contamination, contused or abraded, > 1 cm deep, due to burns or frostbite, due to high velocity missiles, and > 6 hours old.

In order to discover occult injuries not identified during the initial evaluation, it is imperative to repeatedly ____ the patient.
reevaluate
Chapter 9  Thermal Injuries

Inhalation injury necessitates ____ and transfer to a ____.
    intubation; burn center

A high index of suspicion for inhalation injury must be maintained, because patients may not display clinical evidence for up to ____ hours. By this time, edema may prevent non-surgical intubation.
    24

Circumferential burns of the neck can lead to swelling of the tissues around the airway; therefore, ____ is also indicated for these injuries.
    early intubation

Carbon monoxide has ____ times the affinity for hemoglobin as does oxygen.
    240

For patients with CO poisoning, the half-life of CO is ____ when breathing room air, and ____ when breathing 100% oxygen.
    4 hours on RA; 40 minutes on 100% O₂

Patients with CO levels less than ____% usually don’t have any physical symptoms.
    20%

Any patient with burns over more than ____% of the body surface requires fluid resuscitation.
    20%

The palmar surface of a patient’s hand represents approximately ____% of BSA.
    1%

Adult head body surface area (BSA) is ____%.
    9% (i.e. entire head, front and back is 9%)

Infant’s head BSA is ____%.
    18% (9% front, 9% back)
What is the main difference between adult and infant BSA determination for burns?
Entire head BSA for infant is 18%, whereas it is 9% for adults.

Chest BSA is ____%.
    18%

Back BSA is ____%.
    18%

Each arm BSA is ___%.
    9% (total - front and back)

Each leg BSA for an adult is ____%.
    18% (total - 9% front, 9% back)

Infant front or back of each leg BSA is___%.
    7% (total of each leg is 14%)

If you add up the BSAs of the head, chest, back, arms, and legs you get 99% of total BSA. What does the remaining 1% represent?
The perineum.

Partial or 2nd degree burns extend into the ____, whereas full thickness or 3rd degree burns extend ____.
    dermis; all the way through dermis into and even beyond the subcutaneous tissue.

How do you use the Parkland formula?
Volume of fluid in first 24 hrs = weight (kg) x % BSA burned x 4
Note: Give half of this in 8 hrs, then half over 16 hrs.
e.g.  70kg x 25 x 4 = 7 liters in 24 hours.
Note: Use “25,” not 0.25
Give 3.5 L in first 8 hrs, then 3.5 L in following 16 hrs.

Are prophylactic antibiotics advisable?
There is no indication for prophylactic antibiotics in the post-burn period.
Antibiotics should be reserved for the treatment of actual infections. Tetanus immunization, however, should be up-to-date.
Partial or full thickness burns of greater than ____% warrants transfer to a burn center.

10%

Referral to a burn center is indicated for:
Partial-thickness and full-thickness burns on greater than 10% BSA;
Partial-thickness and full-thickness burns involving the face, eyes, ears, hands, feet, genitalia, and perineum, as well as those that involve skin overlying major joints;
Full-thickness burns of any size in any age group;
Significant electrical burns, including lightning injury (significant volumes of tissue beneath the surface can be injured and result in rhabdomyolysis and acute renal failure and other complications);
Significant chemical burns;
Inhalation injury;
Burn injury in patients with pre-existing illness that could complicate treatment, prolong recovery, or affect mortality (e.g. diabetes);
Children with burn injuries who are seen in hospitals without qualified personnel or equipment to manage their care;
Burn injury in patients who will require special social, emotional, or long-term rehabilitative support, including cases involving suspected child maltreatment and neglect.

How is frostbite treated?
Place the injured part in circulating water at a constant 40°C (104°F) until pink color and perfusion return (usually within 20 to 30 minutes). Do not use dry heat since there is a significant risk of burning the skin.

Hypothermic patients are not pronounced dead until they are _____ and dead.

warm

Alkali burns are generally more serious than acid burns, because alkalis penetrate tissues more ____.
deeply
Chapter 10  Pediatric Trauma

What heart rate is considered tachycardic for infants, toddlers/preschoolers, and school age/prepubescent children?
   Infants > 160,
   toddlers/preschoolers > 140,
   school age/prepubescent > 120.

What are you thinking if a child has broken ribs?
   Massive force and highly likely organ damage. Since children's ribs are very pliable, a great amount of force is required to break them. There is often underlying organ damage without broken ribs.

How should you insert an OPA (Guedel) in a child?
   Use tongue blade depressor and insert gently without turning – otherwise there is great risk for trauma and resultant hemorrhage. Do not do the 180 degree rotation manoeuvre.

The normal systolic BP in children can be estimated by what formula?
   90 mm Hg + (age x 2)

How do you estimate a child’s total circulating volume?
   80 mL/kg

When shock in a child is suspected, how much fluid do you give?
   20 mL/kg warm crystalloid. May need to repeat up to 3 times (total of 60 mL/kg), then consider blood products.

Optimal UOP for infants is ___ mL/kg/hr.
   2 mL/kg/hr (1.5 mL/kg/hr for younger children, and 1.0 mL/kg/hr for older children).

What would you see in an infant that would make you suspect severe brain injury in spite of normal level of consciousness?
   Bulging fontanelles.
Chapter 11  Geriatric Trauma

___ are the most common mechanism of injury encountered in older adults seen in trauma centers, and are the most common cause of unintentional injury and death among the elderly.

Falls

Elderly patients have a limited ability to ____ to compensate for blood loss.

increase heart rate

What is a possible mistake about a blood pressure of 120/80 in a 87 year-old man?

Assuming that normal blood pressure means euvolemia. Many geriatric patients have uncontrolled hypertension, and if their usual BP is 180/100, then 120/80 is relative HYPOtension for them.

Frequent use of medications, including ____ and ____, complicate assessment and management.

beta blockers; anticoagulants (also calcium channel blockers, diuretics, NSAIDs, corticosteriods, hypoglycemics, psychotropics, etc.)

Rapid screening for ____ and subsequent correction of coagulation parameters may improve outcomes.

anticoagulant use

Why would geriatric patients be more susceptible to intracranial hemorrhage when there is increased space around a shrinking brain to protect them from contusion?

Atrophic brains --> stretching of the parasagital bridging veins, making them more prone to rupture upon impact.

How well do geriatric patients do with non-operative management of abdominal injuries compared to younger people?

Not as well – the risks of non-operative management are often worse than the risks of surgery.
Chapter 12  **Trauma in Pregnancy and Intimate Partner Violence**

Plasma volume increases during pregnancy, what happens to hematocrit?  
It decreases due to dilution by plasma (a hematocrit of 31-35% is normal in pregnancy).

**What would you think of a WBC of 15,000 in a pregnant woman?**  
Normal. It can go up to 25,000 during labor.

**A PaCO\(_2\) of 35 to 40 in a pregnant patient may indicate what?**  
Impending respiratory failure. PaCO\(_2\) is usually around 30 due to hyperventilation due to increased levels of progesterone.

Pregnancy results in a ____ fall in systolic and diastolic blood pressures during the second trimester.  
5 to 15 mm Hg. Blood pressure returns to near-normal levels at term.

**What should you always assume about a pregnant patient’s stomach?**  
That it is always full. Gastric emptying time increases during pregnancy. Early NG tube placement is recommended.

**What is the time-frame for administering Rhogam?**  
Within 72 hours of the injury.

**True or False: All Rh negative pregnant trauma patients should be administered Rhogam?**  
False. Rhogam is not necessary if the injury is remote from the uterus (e.g. distal extremity injury only).

**When worn correctly, seat belts reduce fatalities by ____%.*  
65-70%, with a 10-fold reduction in serious injury.
An abrupt decrease in maternal intravascular volume can result in a profound increase in uterine vascular ____ , reducing fetal ____ despite reasonably normal maternal vital signs.

resistance; oxygenation

Admission to hospital is mandatory in the presence of:

- vaginal bleeding,
- leakage of amniotic fluid
- pain or cramping,
- evidence of hypovolemia,
- uterine irritability,
- changes in fetal heart tones

In the supine position, vena cava compression can decrease cardiac output by ____ % because of decreased venous return from the lower extremities.

30%

The uterus should be displaced manually to the ____ side to relieve pressure on the inferior vena cava.

left

If the patient requires immobilization in a supine position, the patient or spine board can be log rolled ____ degrees to the ____.

15 degrees; left

Indicators that suggest the presence of intimate partner violence include:

- Injuries inconsistent with the stated history;
- diminished self-image, depression, or suicide attempts;
- self-abuse;
- frequent ED or office visits;
- symptoms suggestive of substance abuse;
- self-blame for injuries; and
- partner insists on being present for the interview.
Chapter 13  **Transfer to Definitive Care**

Patients whose injuries **exceed** an institution’s capabilities for definitive care should be identified and transferred early.

The **ATLS** course is designed to train clinicians to be proficient in assessing, stabilizing, and preparing trauma patients for definitive care.

Patient outcome is directly related to the **time** elapsed between injury and properly delivered definitive care.

____ studies that delay transfer should not be obtained.

The referring doctor and receiving doctor should communicate **directly** (not through intermediaries)

Transfer personnel should be **adequately skilled** to administer the required patient care en route.