Learning Objectives

- Identify mechanisms of injury associated with abdominal trauma.
- Describe mechanisms of injury, signs and symptoms, and complications associated with abdominal solid organ, hollow organ, retroperitoneal organ, and pelvic organ injuries.
Learning Objectives

• Outline the significance of injury to intra-abdominal vascular structures.
• Describe the prehospital assessment priorities for the patient suspected of having an abdominal injury.
• Outline the prehospital care of the patient with abdominal trauma.

Review of Abdominal Anatomy

• Organs in abdomen include
  – Intestines
  – Kidneys
  – Liver
  – Gallbladder
  – Pancreas
  – Spleen
  – Stomach

• Abdomen has many vascular structures
  – Abdominal aorta
  – Superior and inferior mesenteric arteries
  – Renal artery
  – Splenic artery
  – Hepatic artery
  – Iliac arteries
  – Hepatic portal system
  – Inferior vena cavae
Review of Abdominal Anatomy

- All abdominal organs and vascular structures are susceptible to injury
  - Quick recognition of injury, emergency care, and rapid transport for definitive care can tremendously alter morbidity and mortality
Mechanisms of Abdominal Injury

• Abdominal injury may result from blunt or penetrating trauma
  – Regardless of organ injured, management usually is limited to
    • Securing airway with spinal precautions
    • Providing ventilatory support
    • Providing wound management
    • Managing shock with fluid replacement and application of pneumatic antishock garment (PASG) (per protocol)
    • Rapidly transporting

• Be aware of kinematics and mechanism of injury when evaluating patient with abdominal trauma
• Examples
  – In motor vehicle collision, note
    • Extent of damage to car
    • Patient’s location within car
    • Whether patient struck steering wheel or dash
    • Whether personal restraints were used properly

Blunt Trauma

• Blunt trauma to abdominal organs usually is caused by compression or shearing forces
  – Compression forces
    • May cause abdominal organs to be crushed between solid objects
Blunt Trauma

• Blunt trauma to abdominal organs usually is caused by compression or shearing forces
  – Shearing forces
    • May cause tear or rupture of solid organs or blood vessels
    • Occurs when tissues are stretched at their points of attachment
    • Severity of injury usually related to degree and duration of force applied
    • Related to type of abdominal structure injured (fluid filled, gas filled, solid, or hollow)

Blunt Trauma

• May be caused by
  – Motor vehicle and motorcycle collisions
  • Including injuries that result from use of personal restraints
  – Pedestrian injuries
  – Falls
  – Assults
  – Blast injuries
  – Automobile is major cause of blunt abdominal trauma
    • Automobile–automobile and automobile–pedestrian crashes have been cited as causes in 50 to 75 percent of cases
    • Blows to abdomen in about 15 percent of cases
    • Falls in 6 to 9 percent of cases
Why are young children more susceptible to abdominal organ injury than adults?

Penetrating Trauma

- May result from stab wounds, gunshot wounds, or impalement
  - Major complication is hemorrhage from major vessel or solid organ
  - Amount of internal bleeding is related to
    - Which and how many blood vessels are injured
    - Vascularity of solid organ

Penetrating Trauma

- May cause perforation of segment of bowel
- Injuries caused by penetrating trauma do not have as high mortality rate as those caused by blunt trauma
  - Because injuries from blunt trauma are more difficult to diagnose
  - Often accompanied by injury to multiple organ systems
Specific Abdominal Injuries

- May be classified as
  - Solid organ
  - Hollow organ
  - Retroperitoneal organ
  - Pelvic organ
  - Vascular injury
Solid Organ Injury

- Usually results in rapid and significant blood loss
  - Two solid organs most often injured are liver and spleen
  - Both are primary sources of life-threatening hemorrhage

When will shock associated with injury to the liver or spleen develop?

Liver

- Largest organ in abdominal cavity
  - Because of its location, often is injured by trauma to 8th to 12th ribs on right side of body
  - Also is often injured by trauma to upper central part of abdomen
  - Injury should be suspected in any patient with
    - Steering wheel injury
    - Lap belt injury
    - History of epigastric trauma
Liver

• After injury to liver, blood and bile escape into peritoneal cavity
  – Results in signs and symptoms of shock and peritoneal irritation
    • Abdominal pain
    • Tenderness
    • Rigidity

Liver

• Second most commonly injured intra-abdominal organ (spleen is first)
  – Damaged in about 15 to 20 percent of blunt abdominal trauma
  – Damaged in about 37 percent of cases of penetrating trauma
  – Mortality rate for liver injury is 10 percent

Spleen

• Lies in upper left quadrant of abdomen
  – Slightly protected by organs that surround it medially and anteriorly
  – Protected by lower portion of rib cage
  – Injury to spleen often associated with other intra-abdominal injuries
  – Splenic injury should be suspected in motor vehicle crashes and in falls or sports injuries involving an impact to lower left chest or flank or to upper left abdomen
Spleen

- About 40 percent of patients with splenic injuries have no symptoms
  - May complain of pain in left shoulder (Kehr sign)
  - Referred pain that occurs as result of irritation of adjacent diaphragm by splenic hematoma or hemoperitoneum
    - Pain in left shoulder, left upper abdomen, or generalized abdominal
  - Damaged in about 25 percent of cases of blunt abdominal trauma
  - Damaged in about 7 percent of cases of penetrating trauma

Hollow Organ Injury

- Injuries to hollow organs of abdomen may result in
  - Sepsis
  - Wound infection
  - Abscess formation, particularly if trauma to intestine remains undiagnosed for extended period
  - With injuries to solid organs, hemorrhage is major cause of symptoms
  - Injury to hollow organs results in symptoms from spillage of their contents (results in peritonitis)

Stomach

- Because of its protected location in abdomen, stomach is not often injured by blunt trauma
  - Penetrating trauma may cause gastric transection or laceration
    - Patients may show signs of peritonitis rather quickly as result of leakage of acidic gastric contents
    - Diagnosis of injury to stomach usually is confirmed during surgery or when nasogastric drainage returns blood
    - Damaged in about 1 percent of cases of blunt abdominal trauma
    - Damaged in about 10 to 15 percent of cases of penetrating trauma
Colon and Small Intestine

- More likely to be injured as result of penetrating trauma than blunt trauma
  - Large and small bowel also may be injured by compression forces in high-speed motor vehicle crashes
  - May sustain deceleration injuries associated with wearing of personal restraints

Colon and Small Intestine

- Considerable force is required to cause injury to colon or small intestine
  - Other injuries usually are present
  - Peritoneal contamination with bacteria is common problem
  - With blunt abdominal trauma, colon is damaged in about 2 to 5 percent of cases and small intestine in about 5 to 15 percent of cases
  - With gunshot wounds, colon is damaged in about 25 percent of cases and 5 percent of stab wounds
  - Small intestine is damaged in about 26 percent of cases

Retroperitoneal Organ Injury

- Injury may occur as a result of blunt or penetrating trauma to
  - Anterior abdomen
  - Posterior abdomen (particularly flank area)
  - Thoracic spine
Retroperitoneal Organ Injury

- Hemorrhage within retroperitoneal area may be massive
  - Most result from pelvic or lumbar fractures
  - Retroperitoneal structures are damaged in about 9 percent of cases of blunt abdominal injuries and in about 11 percent of cases of penetrating trauma

Kidneys

- Solid organs that lie in retroperitoneal space
  - May be injured by abdominal trauma
  - Trauma may cause contusion as well as lacerations and fractures to organ
  - Can result in hemorrhage, extravasation of urine, or both
  - Contusions usually are self-limiting
    - Usually heal with bed rest and forced fluids
  - Organ fractures and lacerations are more severe
    - May require surgical repair, depending on which part of kidney is damaged
Ureters

- Hollow organs that are rarely injured by blunt trauma
  - Flexible structure
  - When injury occurs, usually is result of penetrating abdominal or flank

Pancreas

- Solid organ that lies within retroperitoneal space
  - Injury is rare
  - When it occurs, usually caused by compressive or penetrating forces on upper left quadrant
    - Steering wheel and bicycle handlebar impalement
  - More often is injured by penetrating trauma (particularly firearms) than by blunt trauma
What functions of the pancreas may be disrupted after injury? What might be the effects of spillage of pancreatic juices into the abdominal cavity?

Duodenum

- Lies across lumbar spine
  - Seldom injured due to location in retroperitoneal area, near pancreas
  - When great force from blunt trauma or penetrating injury occurs, may be crushed or lacerated
    - Injury usually associated with concurrent pancreatic trauma
    - Confirmed through surgery
Pelvic Organ Injury
• Usually results from motor vehicle crashes that cause pelvic fractures
  – Other, less frequent causes of pelvic organ injury are
    • Penetrating trauma
    • Straddle-type injuries from falls
    • Pedestrian injuries
    • Some sexual acts

Pelvic Organ Injury
• Pelvis supports and protects multiple organ systems
  – Risk of associated injury is high
    • Most common associated injuries are those to urinary bladder and urethra
    • Fractures of pelvis often associated with severe retroperitoneal hemorrhage
    • Mortality rate for pelvic fractures ranges from 6.4 to 19 percent
Urinary Bladder

- Hollow organ that may be ruptured by
- Blunt trauma
- Penetrating trauma
- Pelvic fracture

Urinary Bladder

- Rupture more likely if bladder is distended at time of injury
  - With rupture, integrity of peritoneum may be disrupted
  - Urine may enter peritoneal cavity
  - Bladder injury should be suspected in inebriated patients that suffer trauma to lower abdomen
    - Gross hematuria (blood in urine) may be present
    - Patient may complain of being unable to void
    - Urinary bladder and surrounding structures are damaged in about 6 percent of cases of abdominal trauma

Urethra

- Tear in urethra occurs more often in men than in women
  - Usually occurs as result of blunt trauma associated with pelvic fracture
  - Patient may complain of abdominal pain and of being unable to urinate
  - Blood at meatus indicates urethral injury
  - Passage of indwelling urinary catheter is contraindicated
Vascular Structure Injuries

- Injuries to arterial and venous vessels in abdomen can be life-threatening because of their potential for massive hemorrhage
  - Usually are caused by penetrating trauma
  - May also be result of compression or deceleration forces on abdomen
  - Injury usually marked by hypovolemia
  - In some cases, vascular injuries are associated with palpable abdominal mass

Vascular Structure Injuries

- Injuries to arterial and venous vessels in abdomen can be life-threatening because of their potential for massive hemorrhage
  - Major vessels most often injured
    - Aorta
    - Inferior vena cava
    - Renal, mesenteric, iliac arteries and veins
  - Injury to major vessels in abdomen has high mortality rate
  - Immediate surgical repair often required

How can you attempt to manage profound shock from massive vascular injury associated with a severe pelvic fracture?
Assessment of Abdominal Trauma

- Most significant sign is unexplained shock
  - Mechanism of injury and classic presentation of hypovolemia are important indicators
  - Other signs and symptoms that should alert to possibility of severe abdominal trauma are abdominal wall injuries and
    - Obvious bleeding
    - Pain and abdominal tenderness or guarding
    - Abdominal rigidity and distention
    - Evisceration
    - Rib fractures
    - Pelvic fractures

Assessment of Abdominal Trauma

- Absence of signs and symptoms does not rule out an abdominal injury
  - Maintain high degree of suspicion based on mechanism of injury
Focused History

- Should be obtained from patient or reliable source
- Historical facts that may be important
  - Events prior to injury
  - Alcohol or other drug use
  - Underlying medical problems
    - Diabetes
    - Cardiovascular disease
    - Respiratory disease
    - Seizure disorder
  - Medication use
  - Drug allergies
Abdominal Trauma Management

- Emergency care
  - Usually limited to two courses of action
    - Stabilizing patient’s condition
    - Rapidly transporting patient to a hospital for physician evaluation and surgical repair of injury

Abdominal Trauma Management

- Most important components of on-scene care
  - Thorough scene survey to identify forces involved in abdominal trauma
  - Rapid evaluation of patient and mechanism of injury
  - Airway maintenance with spinal precautions
  - Administration of high-concentration O₂ (≥85 percent)
  - Ventilatory support as needed
  - Reduction of hemorrhage by application of pressure
  - Fluid replacement with volume expanders
  - Use of a PASG (per protocol)
  - Cardiac monitoring

Abdominal Trauma Management

- O₂ saturation should be maintained at or above 90 percent
  - Goal of fluid resuscitation for patient with abdominal injury and hypotension is to maintain systolic BP between 80 and 90 mm Hg (mean arterial pressure of 60 to 65 mm Hg)
  - Aggressive fluid replacement can reinitiate bleeding in abdomen from sites that had stopped bleeding from blood clots and hypotension
    - Strive to balance perfusion to vital organs without restoring BP to normal limits
Abdominal Trauma Management

- En route to hospital, full physical examination and ongoing assessment can be performed
  - Vital sign assessment (and reassessment)
  - Inspection, percussion, palpation of abdomen
  - Auscultation of abdomen for presence of bowel sounds can establish baseline measurement for hospital personnel
  - Assessment is difficult and time-consuming in prehospital setting and should never delay patient transport

Summary

- Blunt trauma to abdominal organs usually results from compression or shearing forces
- Penetrating injury may result from stab wounds, gunshot wounds, or impaled objects

Summary

- Two solid organs most commonly injured are liver and spleen
  - Both organs are primary sources of death from hemorrhage
  - Injuries to hollow abdominal organs may result in sepsis, wound infection, and abscess formation
- Injury to retroperitoneal organs (kidneys, ureters, pancreas, duodenum) may cause massive hemorrhage
Summary

• Injury to pelvic organs (bladder, urethra) usually results from motor vehicle crashes that produce pelvic fractures.
• Injuries to abdominal vascular structures may be life threatening.
  – Due to their potential for massive hemorrhage.

Summary

• Most significant sign of severe abdominal trauma is presence of unexplained shock.
• Emergency care of patients with abdominal trauma usually is limited to two courses of action.
  – Stabilize patient.
  – Rapidly transport patient to hospital for surgery to repair injury.

Questions?