

Aurora Health Care EMS Continuing Education 2nd Quarter 2011 Packet

ABDOMINAL TRAUMA

Blunt and penetrating abdominal trauma are major causes of morbidity and mortality in the United States, particularly because it can be very difficult to recognize clear symptoms early. In blunt force abdominal trauma, the spleen and liver are the most commonly injured organs, with a mortality rate of roughly 8.5%. Nearly three-quarters of all blunt abdominal trauma injuries involve vehicles. Almost two-thirds of injuries occur in males, with a peak incidence in patients between ages 14 and 30.

Penetrating abdominal trauma has a slightly higher mortality rate, depending on the mechanism of injury. It ranges up to about 12%, and is responsible for more than a third of urban trauma center admissions and 12% of rural trauma center admissions. Gunshot and stab wounds combine to cause 95% of penetrating abdominal injuries. Penetrating abdominal injuries have a significantly higher morbidity rate than blunt trauma, with the most serious morbidities arising from wound site infections and development of intra-abdominal abscesses.

Pediatric patients warrant special mention because their abdominal anatomy differs from adults. Fewer than 10% of pediatric injuries are considered abdominal trauma in nature; however, more than 80% of pediatric abdominal injuries are caused by blunt force trauma. Be suspicious of pediatric abdominal injuries, as many are caused by abuse. Due to the unique pediatric anatomy, discussed later in this article, organ injury rates differ from adults.

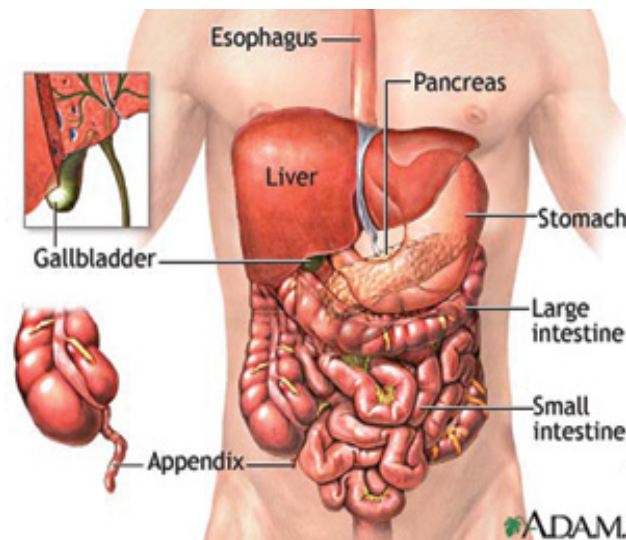
ANATOMIC REVIEW

The abdomen holds and protects major organs of the digestive, reproductive, genitourinary, vascular and endocrine systems, and can be defined as the space between the diaphragm pelvic bony structures on the superior and inferior aspects, respectively; the flanks along the lateral walls; the abdominal muscles anteriorly; and the vertebrae and back muscles along the posterior cavity wall.

Four regions divide the abdominal cavity. The intrathoracic region, which includes the spleen, stomach, diaphragm and a portion of the liver, runs from the base of the 12th ribs to the diaphragm. The ribs make complete assessment of this cavity difficult, but not impossible. Beginning at the superior aspects of the iliac crests, the pelvic abdominal region is the space within the pelvic bones and contains the bladder, rectum, small intestine and female reproductive system. Connective tissues separate out the

retroperitoneal region, which contains the kidneys, ureters, pancreas, aorta and inferior vena cava. Finally, the remaining space is the true abdominal region, which contains the large and small intestines, part of the liver, a gravid uterus, distended bladder and engorged stomach. The peritoneum is the connective tissue membrane holding in the contents of the true abdominal region. Traditionally, the true abdominal region is divided into four quadrants: right upper, right lower, left upper and left lower.

Organs are defined as either solid or hollow. Solid organs include the spleen, liver and pancreas, and generally bleed when injured. Hollow organs, including the stomach, intestines, bladder and gallbladder, spill their contents into the abdominal cavity (also called peritoneal cavity) when injured. With the exception of the gallbladder and bladder, hollow organs leak digestive enzymes and bacteria into the peritoneal cavity, which can lead to infections and peritonitis—inflammation of the peritoneum. The bladder and gallbladder do not contain acids, bacteria or digestive juices, thus do not produce infection as readily or peritonitis as rapidly.



Because the hollow organs within the abdomen expand and contract throughout digestion and waste production, many open spaces can be found throughout the abdominal cavities. These open spaces allow for organs such as the stomach and bladder to stretch and the intestines to contract and expand during peristalsis. Unfortunately, during trauma, these same open spaces allow for significant quantities of blood to collect in the abdominal regions before obvious physical signs appear.

Pediatric patients have many unique abdominal anatomical differences worth mentioning. There is significantly less protection, as the muscle walls are thinner and there is less fat. Ribs protecting the thoracic abdomen have an increased flexibility compared to adult ribs and, while this protects the ribs from damage, it more easily allows the ribs to injure the abdominal organs. Solid organs within the pediatric abdomen have a larger surface area relative to adult organs, thus a greater area is exposed for potential injury. The organ attachments are also more elastic, which increases the chances

of tearing and shearing injuries. In the pediatric patient, the bladder also extends to the umbilicus, increasing its chance for injury.

MECHANISMS OF INJURY

Traumatic injuries to the abdomen are defined as either blunt force or penetrating. Blunt force trauma occurs when an object strikes the abdomen or the abdomen strikes against an object. A common example of this occurs during an automobile accident. During blunt trauma, the abdominal organs can be injured at three distinct times. Initial injury can occur during a rapid change in organ momentum and speed. When organs or adjacent structures suddenly decelerate at different speeds (often due to connective tissues), shearing forces can result in organs tearing at their bases or at the juncture between two organs. Solid and hollow organs and the vasculature are all at risk for shearing forces. Next, organs can be crushed as a blunt object presses against them, or as organs are compressed against rigid structures in the body. The spleen, kidneys and liver are all particularly vulnerable to crushing. Finally, external compression from blunt trauma causes a rise of pressure inside an organ, particularly hollow organs. As a result, hollow organs rupture, spilling their contents into the abdominal cavity.

Penetrating trauma occurs when an object physically enters through the skin and wall of the abdominal cavity. The most common mechanism for penetrating trauma is gunfire, followed by stabbing. Other causes include impalement and animal bites. As an object enters the abdominal cavity, it injures the organs in two ways. First, the object physically damages organ tissues as it penetrates. While passing through organ tissue, the object sends a wave of pressure in all directions, stretching the organs, which can injure adjacent organs, not just the impacted organ. Organs stretch because of their elastic nature and can cause both a temporary and permanent cavity. The greater the speed of a penetrating object, the more kinetic energy is transmitted to the organs, increasing the chance for ricochet off bony objects and for fragmentation.

ASSESSMENT

During the care of any trauma patient, begin an initial assessment following the ABCDE mnemonic. An abdominal assessment becomes a key component of the secondary assessment and requires adequate time to complete thoroughly. However, it is imperative to not develop tunnel vision, looking for abdominal trauma findings and ignoring the remainder of the assessment. While evaluating the abdomen as part of the entire body, prioritize injuries in order of importance and severity.

Complete a thorough history and SAMPLE history while examining the patient. EMS is often the only reliable source for this information. Obtain as much information about the mechanism as possible without delaying transport. Key information for blunt force trauma includes: mechanism, time of injury, speed, location of impact, need for extrication and use of protective equipment. When managing penetrating trauma, determine: the object, distance traveled to the patient, speed, on-scene external blood loss and time of injury. The distance the object traveled to the patient is actually extremely

important, as the chance for serious injury decreases if the distance exceeds 10 feet (3 meters).

When completing a focused abdominal assessment, be organized, efficient and thorough. Initial abdominal examinations only identify injury about 65% of the time; repeated exams are needed when there is a high index of suspicion for abdominal trauma. When there are indicators of abdominal trauma (*Table 1*), repeat an abdominal exam as time permits to look for the most reliable signs of internal injuries: pain and tenderness, and peritoneal irritation. The most reliable sign of an intra-abdominal injury is shock without an otherwise identifiable cause.

Table 1: Indicators Suggestive of Abdominal Trauma

- Mechanism of injury consistent with abdominal compression
- Bent steering wheel
- Safety belt impressions
- Shock without an obvious cause
- Soft tissue injury to the lower thorax, back, flank or abdomen
- Significant tenderness on palpation or coughing
- Involuntary guarding

Begin an abdominal examination by exposing the entire abdomen from the nipple line to the groin. The standard sequence for an abdominal assessment is: inspection, auscultation, percussion and palpation.

Inspect the abdomen for abrasions, bruising, bleeding and other signs of external injury. Look for identifiable patterns like seat belt demarcation. Lap belt impression is a strong indicator of injury. Identify any patterns that indicate internal injury, such as lap or shoulder belt demarcation, or a steering wheel impression. Two bruising patterns worth noting are Cullen's sign and Grey-Turner's sign, both of which indicate retroperitoneal hemorrhage. While both appear late, they may be seen on longer transports. Cullen's sign is bruising around the umbilicus. Grey-Turner's sign is bruising along the flank and is indicative of blunt force hemorrhage, aortic leaking, and pancreas or kidney bleeding. Expose the genitalia to look for swelling, bruising and blood accumulation. The labia and scrotum are both locations where blood can easily and rapidly pool which indicates free blood in the abdominal and pelvic cavities. Protruding or exposed abdominal organs is an evisceration that ensures the need for surgery. Identify any impaled objects or entrance wounds from a penetrating object. When practical, estimate the depth. Do not routinely remove impaled objects from the abdomen. When incontinence is present, look for hematuria or blood in the urine. Its presence indicates bladder and/or kidney injury; however, the absence of hematuria is not a good indicator of the absence of abdominal injury. A recent study found that hematuria is only present in 60% of traumatic abdominal injuries.

Auscultation for bowel sounds is difficult in an emergency department, much less the back of a moving ambulance. Due to the length of time required, this skill is often

omitted during prehospital care. However, do listen carefully to lung sounds. On occasion, there may be bowel sounds in the thoracic cavity, which suggests a diaphragmatic rupture.

Percussion is an often underused prehospital assessment skill. Place one hand lightly against the patient's abdomen and tap the fingers of your other hand against the first. This triggers slight movement of the peritoneum. When there is peritoneal irritation, percussion causes tenderness.

Palpate the abdomen for masses, tenderness and deformity. There is a difference between pain, which is always present, and tenderness, which causes discomfort when pressure is applied. Palpate the inferior ribs. Rib pain or tenderness suggests fracture and indicates spleen injury on the left side and liver injury on the right. On the anterior abdomen, palpate each abdominal quadrant. A full or doughy sensation indicates free blood. Rigidity and guarding both present quickly following an injury with intestinal leakage and suggest developing peritonitis. Peritonitis tends to be diffuse across the entire abdomen. Isolated flank or upper quadrant rigidity and guarding can also be caused by inferior rib fractures. Pelvic fractures can cause isolated lower quadrant rigidity.

Palpate the pelvis for stability. Any abnormal bone movement is considered a positive finding for a pelvis fracture. Stop the pelvic assessment at that point and manage the fracture aggressively.

Remember, after completing an abdominal assessment, complete the rest of the secondary assessment and prioritize injuries in order of their severity and life-threat. Serious abdominal findings do not warrant ignoring the rest of the examination, as other equally or more life-threatening injuries may be discovered. Once all injuries have been identified, begin efficient management.

MANAGEMENT

The primary goal of trauma care remains airway stabilization, breathing protection, circulation support and cervical spine stabilization. Throughout the care of a patient experiencing major trauma, work to rapidly identify severe life-threatening conditions, including the potential for severe internal bleeding. This is a critical step in determining appropriate transport destinations, including bypassing the local hospital for a level 1 or 2 trauma center.

Whenever patients show evidence of major trauma, including abdominal trauma that may require surgical intervention, rapidly transport the patient directly to the highest level available trauma center. Patients are better off going to a more distant trauma center than directly to a local emergency department that will need to transfer them. Consider early activation of air medical transport whenever dispatch information or physical findings warrant transport directly to a trauma center. It may be in the patient's best interest to meet a helicopter down the road rather than transporting to a small rural emergency department. Most deaths from penetrating abdominal trauma occur secondary

to exsanguination. As soon as penetrating abdominal trauma is recognized, expedite transport to a trauma center.

Following the ABCDE mnemonic, begin routine trauma care with high-flow supplemental oxygen and secure the airway. Perform endotracheal intubation when necessary, utilizing rapid sequence intubation when authorized. Consider the use of oral and nasal pharyngeal airways as needed. At a minimum provide supplemental oxygen.

Provide cardiovascular hemodynamic support by establishing IV access and administering crystalloid fluids to prevent hypotension. When possible, establish IVs during transport rather than on scene. Avoid overly aggressive fluid resuscitation; provide fluid boluses to maintain a systolic blood pressure between 90-100 mmHg, or a mean arterial pressure of 65 mmHg. Blood pressures in this range maintain vital organ perfusion. Too much IV fluid can dilute the blood and actually worsen bleeding, and is particularly harmful in penetrating abdominal injuries.

ALS providers, when trained and authorized, should place a nasogastric or an oral-gastric (NG/OG) tube. Placing an NG/OG tube protects the intestines by emptying the stomach and permits stomach content evaluation for blood.

Impaled objects in the abdomen often tamponade internal hemorrhage, and removing them may trigger significant internal bleeding. Stabilize impaled objects in place with bulky dressings, remembering that any bump against the object moves the distal end in the organ and worsens damage. Only remove an impaled object in the abdomen when it cannot be secured or stabilized in place for transport and only after consultation with on-line medical direction.

Abdominal eviscerations are a surgical emergency. The protruding organ requires careful cleaning and evaluation prior to reinsertion. Do not attempt to reinsert the organs in the prehospital setting. Cover any protruding abdominal contents with a sterile dressing moistened with sterile saline and place an occlusive dressing over the top.

Open wounds left by penetrating objects likely need to be cleaned as well. When there is severe bleeding at the wound site, control it with well-aimed pressure directly on the bleeding source. Once bleeding is controlled, cover the wound with a sterile dressing.

Suspected pelvic fractures can rapidly produce massive internal hemorrhage. Don't wait for symptoms of shock to appear prior to management. Apply MAST pants or a pelvic binding wrap at the level of the greater trochanter.

Pain management is an essential component to good trauma care. Simple pain management techniques include oxygen administration, splinting, speaking in calm, reassuring voice, and placing the patient in his position of comfort. When spinal immobilization is required, flexing the patient's knees toward the chest helps relax the abdominal muscles. Consider administering analgesic drugs such as morphine sulfate or fentanyl. Both drugs are safe and effective analgesics and have a rapid onset.

Painful injuries often produce significant anxiety. Anxiolytics help to calm the patient, provide some amnesic effects and reduce the quantity of analgesia needed. Consider administering an anxiolytic like a benzodiazepine. Benzodiazepines work to reduce the action of GABA, a neurotransmitter in the brain, which provides central nervous depression, including the pain-sensing portions of the brain. Versed is often considered the sedative of choice for this, as it provides immediate effect and has a short half-life.

TRANSFER OF CARE

Upon arriving in the emergency department, deliver a clear and concise report stating the mechanism of injury, assessment findings, interventions, current vital signs and any hypotension. Make sure the ED staff is aware of all drugs given, the doses, and how much IV fluid was administered.

As part of the emergency department's assessment, the physician will likely select one of three tests to look for blood in the abdomen. The traditional test has been a diagnostic peritoneal lavage (DPL), with a needle inserted inferior to the umbilicus and introduced into the abdominal cavity where fluid is withdrawn and tested for blood. Any blood is considered a positive test and the patient is sent for surgery. The DPL is a very invasive procedure and is not frequently used.

Development of the FAST exam outdated the DPL. First used in 1996, the Focused Assessment with Sonography for Trauma (FAST) can detect as little as 30 mL of blood and looks at four different views of the abdominal cavity. Using ultrasound, the FAST exam looks at the pericardic, perihepatic, perisplenic and peripelvic spaces for the presence of fluid in the abdominal cavity. FAST is very accurate and can help eliminate unnecessary CT scans.

The gold standard in diagnosing solid organ injuries is the computed tomography, or CT, scan. Unlike the FAST exam, which can only identify the presence of blood, the CT scan identifies the bleeding source as well. Unfortunately, the CT scan is not available at all facilities, is very expensive to perform, and requires contrast dye administration.

Once physicians have completed their assessments and testing, they will determine who needs surgical intervention and who doesn't. Patients with deep penetrating injuries nearly always require surgery; small penetrating wounds that do not go through the muscle wall often do not require surgical care.

Trauma teams use these different tools to identify specific organ injuries and determine their best course of long-term care. EMS providers can benefit patients and improve their hospital care by identifying the mechanism of injury and looking for signs and symptoms specific to abdominal traumatic injuries.