



Abdominal Trauma

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Objectives

Upon completion of this module, you should be able to:

1. Diagnose, resuscitate, stabilize and manage abdominal trauma patients;
2. Identify common pathophysiologic conditions in abdominal trauma patients;
3. Describe the components of a primary survey in an abdominal trauma patient;
Generate a differential diagnosis of potential traumatic injuries based on history, mechanism, and physical exam;
4. List commonly utilized imaging modalities in abdominal trauma;
5. Discuss the eventual disposition of abdominal trauma patients based on their diagnosis;
6. Appreciate the necessity for emergent surgical intervention in certain abdominal trauma conditions.

Introduction

Abdominal trauma is seen quite often in the Emergency Department where it can take the shape of blunt or penetrating mechanisms occasionally a combination of both. Blunt abdominal trauma (BAT) is frequently encountered in the form of motor vehicle accidents (75%), followed by falls and direct abdominal impact¹. Three kinds of forces are seen with BAT: shearing forces, that occur due to rapid deceleration causing tearing at fixed points of attachments. Crushing forces, that cause intra-abdominal contents to be crushed between anterior abdominal wall and posterior ribs and vertebrae; and external compression which is the sudden and rapid rise in intra-abdominal pressure leading to rupture of viscous organs.²

Penetrating abdominal trauma (PAT) is on the rise with increasing gang violence. There are two main kinds of PAT: Stab Wounds (SW) and Gun Shot Wounds (GSW). SWs are more common than GSWs, however have a lesser mortality compared to GSW. The higher energy transfer and missile trajectory and multiple bullet fragments from GSW leads to increased mortality and morbidity.

Abdominal Trauma presentations are complex in that they can present with polytrauma resulting in imminently life threatening injuries, distracting injuries and altered mental status, that makes the diagnosis of abdominal traumatic injuries more challenging.

Initial Actions and Primary Survey

Abdominal Trauma can present in multiple ways. They can be brought by Emergency Medical Transport, in which case they are typically boarded and collared. They can also on occasion be brought by private vehicle, in which case the prudent plan of action is to apply a C Spine collar and proceed in accordance with ATLS guidelines. Of note, occult cervical spine injury is unlikely in patients with penetrating trauma. Unless there is a deficit or concerning mechanism (blunt trauma combined with penetrating trauma), a cervical collar is rarely necessary and may hinder treatment in penetrating trauma victims.

All trauma patients must be managed in accordance with Advanced Trauma Life Support (ATLS) algorithms³:

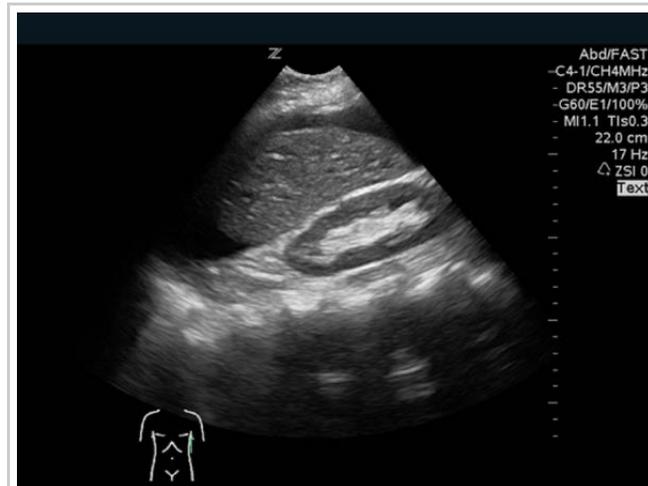
- A (Airway with c-spine protection): Is the patient speaking in full sentences?
- B (Breathing and Ventilation): Is the breathing labored? Bilateral symmetric breath sounds and chest rise?
 - O2 – Nasal cannula, Face Mask
- C (Circulation with hemorrhage control): Pulses present and symmetric? Skin appearance (cold clammy, warm well perfused)
 - IV – 2 large bore (minimum 18 Gauge) Antecubital IV
 - Monitor: Place patient on monitor.
- D (Disability): GCS scale? Moving all extremities?
- E (Exposure/Environmental Control): Completely expose the patient. Rectal tone? Gross blood per rectum?



(https://cdemcurriculum.files.wordpress.com/2015/06/abd_trauma_01.png)

Figure 1: Normal FAST exam window showing the liver and the spleen in a view of the right upper quadrant. Images courtesy of Dr. David Bahner, MD, Associate Professor of Emergency Medicine, The Ohio State University Department of Emergency Medicine.

If patient's primary survey is intact, the adjuncts to the primary survey and resuscitation begins. The adjuncts to the primary survey include any of the following as necessary: EKG, ABG, chest Xray, pelvis xray, urinary catheter, eFAST exam, and/or DPL. Bedside sonography should be used to perform an eFAST exam (figure 1). In the setting of hypotension, free fluid on the eFAST exam suggests hemoperitoneum, necessitating emergent surgical intervention (see figure 2) [2].



(https://cdemcurriculum.files.wordpress.com/2015/06/abd_trauma_02.png)

Figure 2: Positive FAST image of LUQ courtesy of David Bahner MD, RDMS

Details of the abdominal trauma mechanism are crucial. For motor vehicle accidents (MVAs) speed of collision, position of colliding car to each other, position of patient in the car, seatbelt use, extent of car damage (intrusion, wind shield damage, difficulty of extrication, air bag deployment) are important elements to elicit. With respect to falls, height of fall is very important. With respect to gun shot wounds, kind of gun, distance from the shooter, number of shots heard are all relevant. For stab wounds, it is prudent to obtain information on kind of weapon used.

The Secondary Survey

Following the primary survey, the secondary survey must be performed. The secondary survey is the complete history and physical examination. This is completed after the primary survey and vital functions are returning to normal.

Start by taking an “AMPLE” history. The abdomen should be examined by inspection, auscultation, palpation, and percussion. Abdominal exam should detail exit and entry wounds, number of wounds, any evisceration, ecchymosis and deformities. The perineum, rectum and genitalia should all be examined at this point. A rectal exam can alert the provider for a high riding prostate, lack of rectal tone, or heme-positive stools.

When assessing a trauma victim, it is important to be aware of distracting injuries and the presence of altered mental status or intoxication. These factors may contribute to an unreliable physical exam. The most important way to make your physical exam reliable is to perform it serially, noting important changes as the patient is reexamined [3].

Presentation

Abdominal trauma patients can present in multiple ways ranging from frank shock to hemodynamic instability to completely stable vitals to polytrauma. Alteration of mental status can be seen which makes the diagnosis of abdominal trauma very challenging. Patients can also present in traumatic arrest due to massive abdominal trauma.

Penetrating injuries are easier to detect. Hemodynamically stable patient often complain of abdominal tenderness, and their exams can reveal peritoneal signs. Of the penetrating injuries GSW are notoriously deceptive for reasons mentioned previously.

Blunt abdominal trauma injuries are notoriously harder to detect and patients often present with generalized abdominal tenderness. Nausea and vomiting can sometimes occur.

Injuries Seen in Abdominal Trauma

Solid and hollow organ injury can occur in abdominal trauma. With blunt trauma splenic rupture is the most common injury followed by liver lacerations. Bladder rupture can also be encountered. Intestinal injuries although less common can definitely occur. Blunt abdominal trauma can also lead to diaphragmatic rupture especially on the left side. Patients with diaphragmatic injuries present with vague complaints sometimes weeks after initial accident. Blunt aortic injuries especially from deceleration injury can also occur however majority of these patients die from traumatic transection of the aorta at the scene of the accident. In the minority who survive, judicious BP control and emergent operative intervention is indicated. Pelvic fracture is another common injury seen in blunt abdominal trauma. Depending on the kind of pelvic fracture, pelvic blood vessels can shear leading to retroperitoneal bleeding.

With GSWs small intestine and colonic injuries are most common whereas with SWs, liver injuries are predominant. Penetrating injuries however can result in trauma to any organ system within the abdomen and occasionally the chest depending on the trajectory of the bullet/knife. Penetrating thoraco-abdominal injuries can occasionally result in traumatic arrest (see Table 1).

Table 1: Most Commonly Injured Organs (from most common at top)

GSW	STAB WOUND
Small Bowel	Liver
Colon	Small Bowel
Liver	Diaphragm
Vasculature	Colon

Diagnostic Testing

The bedside sonogram has become standard of care when evaluating patients with BAT. Free fluid in Morrison's pouch is pathognomonic for hemo-peritoneum, requiring emergent surgical intervention (figure 3). Although bedside sonography is also used for evaluation of PAT, its utility is limited especially for the retroperitoneal organs.



(https://cdemcurriculum.files.wordpress.com/2015/06/abd_trauma_03.png)

Figure 3: Positive FAST image of RUQ courtesy of

David Bahner MD, RDMS

Diagnostic Peritoneal Lavage (DPL) has been largely replaced by bedside sonography, however it is occasionally used in patients too unstable to be transported to CT in whom hollow viscous injury or solid organ injury is suspected. A DPL is considered positive if there is aspiration of 10 mL of gross blood or gastrointestinal contents, or the presence $>100,000$ RBC/mm³, >500 WBC/mm³, or vegetable matter in the liter of saline infused. All of these findings are indications for laparotomy. Some advantages of DPL include ease to learn, time-efficiency in experienced hands, can be performed at the bedside, and is highly specific. The downsides are that many practitioners are inexperienced, it is difficult in uncooperative patients or patients with large body habitus, it does not evaluate the retroperitoneum, and it can result in a high non-therapeutic laparotomy rate. [3]

For stable patients the cornerstone of diagnosis is the CT Scan with IV contrast. CT scan of the abdomen has improved sensitivity and specificity in diagnosing solid and hollow viscous injury. Retroperitoneal organs can be easily visualized with CT Scans. The pros of CT scan include the ability to detect intraperitoneal fluid and free air in the abdomen and to assess the solid organs, hollow viscous, retroperitoneum, vasculature, and diaphragm. The cons include reader-dependency, the patient has to leave the trauma bay to have it done, the use of ionizing radiation, and availability in some hospitals 4

With respect to blood work, apart from basic labs, type and screen (or when appropriate type and cross) should be sent. Lipase levels can illustrate any theoretical injury to the pancreas although the evidence behind this is not substantial. Urinalysis should be sent to check for signs of hematuria, as this can indicate injury to the genitourinary system. A urine pregnancy test should be obtained in all women of child-bearing age.

Treatment

In patients with known abdominal trauma, antibiotics should be started in the ED, tetanus should be updated. Blood should be transfused as needed, keeping in mind principles of permissive hypotension. Permissive hypotension means avoiding aggressive crystalloid resuscitation of trauma patients, in favor of blood product resuscitation to a specific defined Mean Arterial Pressure (MAP) of 65. The thought is that any increases in BP or excessive crystalloid administration further exacerbates the lethal trauma triad : coagulopathy, acidosis, and hypothermia which all eventually beget each other and cause the patient to spiral towards death.5.

Although simple grade I and II spleen and liver lacerations can often be managed with conservative management and blood transfusions, complicated lacerations grade IV and above often require surgical intervention. Intestinal and colonic injuries typically require surgical intervention (exploratory laparotomies). Pelvic fractures with concurrent pelvic vessel injury warrant a stat interventional radiology consult for emergent arterial embolization. Traumatic Aortic Injuries, warrant judicious blood pressure control, and emergent surgical intervention.

Traumatic arrest due to penetrating thoracoabdominal injuries can be managed with an ED thoracotomy followed by emergent operative intervention. Massive transfusion protocols should be activated. There is no place for ED thoracotomy for blunt thoraco-abdominal injuries.

Disposition

Anyone with identifiable injuries on US, CT scan, or DPL should be admitted to the hospital or transferred to a trauma center for further inpatient monitoring and care. Patients with no injuries on diagnostic evaluation and continued abdominal pain should be admitted for observation and serial abdominal exams. Patients with no injuries who have a benign physical exam can be safely discharged to home with good instructions on what to return for.

Pearls and Pitfalls

- Abdominal trauma patients present with deceptively unimpressive physical exams
- Details of mechanism of injury should be elicited in order to appropriately manage said patients
- GSW penetrating trauma has a much higher morbidity and mortality compared to SW
- Bedside sonography is increasingly useful for diagnosis of hemoperitoneum in BAT. The presence of free fluid in Morrison's pouch is pathognomonic for hemo-peritoneum.
- Although blunt thoraco-abdominal trauma patients are no longer candidates for ED thoracotomies, select penetrating thoraco-abdominal trauma patients are candidates for ED thoracotomies

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