

Abdominal Gunshot Wounds

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Continuing Education Activity

An abdominal gunshot wound is a multisystemic, traumatic injury that commonly causes high morbidity and mortality. Practitioners should recognize that emergent surgical evaluation is warranted when hemodynamic instability persists and evidence of peritonitis is present. This will lead to improved recognition of potential abnormalities which, in turn, will dictate treatment strategies and improve patient outcomes. This review highlights the role of the interprofessional team in the evaluation and treatment of this emergency situation.

Objectives:

- Outline the clinical presentation of a patient with an abdominal gunshot wound.
- Describe the evaluation in an abdominal gunshot wound.
- Review the management in an abdominal gunshot wound.

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Introduction

Traumatic injuries to the abdomen can result from a wide range of etiologies and can lead to life-threatening injuries, multi-organ system dysfunction, and death. Gunshot wounds in the abdominal region can range from minor wounds to severe traumatic injuries depending on the anatomical structures the bullet penetrates.[1] While the leading cause of blunt abdominal trauma-related deaths in the United States in adults ages 15 to 24 is due to motor vehicle collisions, abdominal gunshot wounds account for up to 90 percent of the mortality associated with penetrating abdominal injuries.[2]

The most common cause of a penetrating abdominal injury is a stab wound or gunshot wound. In gunshot wounds, due to the high-intensity kinetic energy of the bullet, the pathway is often unpredictable in nature as well as the internal organs that may be affected. The most common organs injured are the small and large bowel at 50% and 40%, respectively. Also, the liver and intraabdominal vasculature are oftentimes injured as well at 40% and 30% involvement, respectively. Although direct abdominal trauma may be caused by a penetrating bullet, there may be shrapnel or fragmentation from the bullets that can disperse into the intra-abdominal cavity also causing injury.

Etiology

Penetrating trauma due to gunshot results from a firearm and can lead to multisystem organ injury, shock, and infection. A projectile from a firearm will enter the skin and layers of tissue and inflict damage to anything in its

pathway. This may include soft tissue structures only but may also include damage to bone, vasculature, and internal organs. A penetrating gunshot abdominal injury can result in the foreign object remaining in soft tissue compartments or finding an exit pathway out of the body. If the projectile enters the body, it is considered a penetrating injury. If there is an exit wound that accompanies the entry wound, this may be considered a perforating abdominal wound. Many abdominal gunshot wounds result in penetrating trauma.[3]

A mainstay of care for a potentially penetrating gunshot wound to the abdomen is emergency evaluation and often emergency surgical consultation is required to rule out acute abdomen, prevent exsanguination, and decrease the likelihood of developing peritonitis and sepsis.

In addition to the physical exam, an emergency assessment may include a FAST (Focused Assessment with Sonography in Trauma) to rule out hemoperitoneum.[4] Health care professionals may choose to order X-rays and other rapid imaging to quickly identify the location of the foreign object or bullet and plan early goal-directed management. In an emergency setting, many patients with abdominal gunshot wounds may be taken immediately to surgery for diagnostic evaluation and treatment of injuries.

Epidemiology

Firearm-related deaths are the third leading cause of trauma-related deaths in the United States today. In an average week, 645 people lose their lives to firearm violence and 1565 more are treated in an emergency department for a firearm-related injury.[5] Firearm homicide is the second leading cause of injury death among youth 10 to 24 years of age. Firearm suicide is the third leading cause of injury death for persons aged 35 years and older, after drug overdoses and motor vehicle crashes. Overall, firearm injuries are ranked among the 5 leading causes of death for people ages 1 to 64 in the United States.[6] In a study completed from 2010 to 2012, almost half of all firearm deaths in the United States occurred in the South and were lowest in the Northeast region. Internationally, war-inflicted countries have increased the incidence of gunshot abdominal injury due to more firearms being available.

Racial disparities in firearm-related homicide and suicide do exist. The homicide rate is 7 fold higher in Black males than any other demographic. Also, it is notable that non-Hispanic whites and non-Hispanic American Indian/Alaskan natives account for the majority of suicides related to firearms. Young adults between the ages of 25 and 34 years have the highest rate of fatal firearm injury and approximately 90% of patients are males. The male age group of 20–24 years old is notably the most affected by firearm injury. Males disproportionately bear the burden of firearm mortality, accounting for 86% of all victims of firearm death.

Pathophysiology

Abdominal gunshot wounds can result in severe traumatic internal injury. This includes multisystem organ injury, hemoperitoneum, and life-threatening internal bleeding. Since bullet trajectory is often unpredictable, penetrating abdominal injury can be potentially catastrophic if there is significant vascular injury. Knowledge of ballistics, the science of the motion of projectiles in flight, may help in determining characteristics of injuries that might be expected from a given gunshot wound.

History and Physical

The history of a penetrating abdominal trauma during the initial presentation of the patient to the emergency department is crucial to providing clues to the pattern of injury. Taking a detailed and thorough history of the patient may guide potential management. Personnel such as paramedics, police officers, or fire rescue who may have arrived at the scene of the injury may be utilized as sources of essential history regarding the etiology of the injury. This is especially important if the patient has altered mental status and is unable to relay the history of the incident. It is

beneficial to gather information regarding the events surrounding the injury, including the environment, people involved, allergies, medications, and past medical history of the patient. Information about the caliber of the weapon, the number of shots heard, and any other extenuating circumstances may provide additional valuable information. Additionally, efforts should be made to ensure provider safety by hospital security and law enforcement until the circumstances of the injury are fully understood.

Physical exam following the ABCs of trauma is essential. Because the presentation is often not straightforward, the exact diagnosis can be difficult. Besides pain, the patient may present with bleeding per rectum, unstable vital signs, and the presence of peritonitis. The physical exam may reveal wounds, ecchymosis, abdominal distention, absent bowel sounds, and tenderness to palpation. If peritonitis is present, abdominal rigidity, guarding, and rebound tenderness may be present. Early and serial monitoring of vital signs can be helpful to determine shock either at presentation or developing during the evaluation. A comprehensive external exam looking for wounds is an essential part of the evaluation of a patient with an abdominal gunshot wound.

Evaluation

The evaluation of any trauma patient begins with evaluating the airway, assessing the breathing, and managing the circulation. The diagnosis of intra-abdominal injury following penetrating trauma depends primarily on the initial presentation and hemodynamic status of the patient. If hemodynamic stability can be established, in the absence of peritonitis, a computed tomography (CT) scan is a feasible option. This scan is able to detect intraperitoneal free fluid, solid organ damage, and active serosanguinous extravasation if present. If the patient is potentially hemodynamically unstable and rapidly deteriorating, the ideal initial radiologic assessment is the Extended Focused Assessment with Sonography for Trauma (EFAST). This EFAST exam is a point of care ultrasound for critically ill patients. It is a comprehensive tool that specifically targets the detection of hemorrhage in the spaces of the abdomen. With experience, trained health care professionals learn to quickly assess and identify pathologic states in pleural, peritoneal, and pericardial cavities of the body. Indications for an EFAST ultrasound include blunt or penetrating trauma to the torso where there is a suspicion of intraperitoneal hemorrhage, pericardial tamponade, and hemothorax.[7]

Components of the extended focused assessment with sonography for trauma (EFAST) ultrasound

1. Right upper quadrant (RUQ) - when evaluating this region, the evaluator must consider that if the hemorrhage is present within the peritoneum, is most commonly found within the RUQ. The anatomical structures found within a right upper quadrant include:

- Inferior pole of the right kidney
- Subphrenic space (between diaphragm and liver)
- Hepatorenal space (between liver and kidney, also known as Morrison's pouch)
- Pleural space

2. Left upper quadrant (LUQ) - the anatomical structures visualized in the LUQ space, also known as the peri-splenic space, include:

- Inferior pole of the left kidney
- Subphrenic space
- Splenorenal space

- Pleural space
3. Suprapubic space - the anatomical structures visualized in the suprapubic space vary based on gender:
 - Pouch of Douglas (females)
 - Rectovesicle space (males)
 4. Subcostal space - visualize the pericardium and evaluate for hemopericardium.
 5. Pulmonary - visualize the space surrounding the lung for pneumothorax or hemothorax

It is essential to note in patients that have penetrating abdominal gunshot wounds and peritonitis and/or hemodynamic instability, the mainstay is an operative intervention, and this operative intervention should not be delayed to obtain diagnostic testing.

Treatment / Management

Treatment of patients with abdominal gunshot injury begins with the initial contact of personnel who arrive at the scene of injury, such as paramedics. In penetrating abdominal injury due to a gunshot wound, initial treatment can be paramount for the prognosis and survival of the victim. The most important task for the initial assessment is to assess the airway, breathing, and circulation of the patient and stop the bleeding. Once a clear airway is established, the cervical spine must be protected if indicated by the mechanism of injury. Assessment of breath sounds is essential as the location of the wound on the abdomen does not rule out injuries to structures outside of the abdomen. Efforts to obtain hemostasis before arriving at the emergency room may entail pressure on the wound. Depending on materials available, gauze, shirts, towels, and any other fabrics can be applied with pressure to aid in coagulation. A tourniquet may be utilized if a professional can apply to the area affected, but this is less likely with abdominal gunshot wounds than extremity wounds. If, when assessing vital signs, the patient is no longer breathing or loses pulses, the protocol of CPR should be initiated immediately. For patients with hemodynamic instability, aggressive fluid resuscitation should be initiated, and blood should be typed and screened. O negative blood should be made ready for an emergency transfusion, with it being the lower risk of causing serious adverse transfusion reactions.[8] Massive transfusion protocol, where available, may be initiated in the hemodynamically unstable patient.

All patients with abdominal gunshot wounds who have signs of peritoneal hemorrhage, peritonitis, active bleeding, or deteriorating clinical signs must immediately undergo diagnostic and potentially therapeutic laparotomy.[9] Non-surgical treatment is much less invasive but must depend on the discretion of the evaluating healthcare professional based on clinical and radiologic evidence. Timely surgical evaluation or transfer to a facility with surgical capability is often necessary. Some pharmacologic considerations may include tetanus prophylaxis, broad-spectrum antibiotics, analgesics, and anxiolytics.[10]

Once hemodynamic stability has been achieved, it is imperative that abdominal gunshot wound patients be closely monitored for any signs of vital sign changes. Medical professionals should also perform a serial physical examination, and blood analysis to trend hemodynamic features return to baseline.

Differential Diagnosis

The initial differential should include an evaluation to determine if the injury is penetrating or non-penetrating. For penetrating injuries, one must include a differential diagnosis that includes a gunshot wound, a stab wound, or another mechanism of penetrating injury. History of the event may be helpful when attempting to narrow the differential diagnosis for penetrating abdominal injury.

Prognosis

The prognostic success of early goal-directed management of abdominal gunshot wounds is of most importance. Still, it is mainly based on the severity and extent of the injury and the time of presentation to the hospital. The usual management of abdominal gunshot wounds involves supportive measures such as hemostasis techniques, blood transfusions, cardiopulmonary support, and surgical attention to injured intraperitoneal structures damaged structures and an attempt to remove foreign objects.[11] Timely surgical intervention may influence mortality and morbidity. Unfortunately, the mortality from abdominal gunshot wounds remains very high. The reason is that the severity of the gunshot wound may vary due to bullet caliber, the trajectory of the object in the body cavity, and energy transfer into the destruction of the penetrating structures.

A study was published on trauma patients in Philadelphia who experienced penetrating trauma due to penetrating stab wound or gunshot wounds to analyze mortality rates between 2003 and 2007 of patients entering the Philadelphia hospitals. This study reports that of the 4,122 patients taken to eight Level I and Level II adult trauma centers, 2,961 were transported by EMS and 1,161 by the police, and carried an overall mortality rate was 27.4 percent. In this study, about 77.9% of these victims endured gunshot wounds, and about 22.1% endured wounds due to stabbing. Approximately one-third of patients with gunshot wounds expired, and approximately 7.7% died of complications due to stab wounds.[12]

Complications

- Exsanguination
- Inadequate resuscitation
- Airway collapse
- Peritonitis
- Intra-abdominal sepsis
- Fistula formation
- Wound dehiscence
- Hematoma
- Scarring
- Infection
- Death

Postoperative and Rehabilitation Care

Postoperative care is directed by the injuries identified at the time of operation. Analgesia is a necessary component of postoperative care. Early consideration of enteral nutrition is also important when feasible. Deep vein thrombosis prophylaxis is another consideration in the postoperative abdominal gunshot wound patient.

Consultations

The following consultations are required:

- Emergency medicine

- General surgery
- Trauma surgery
- Radiology
- Anesthesia
- Forensic pathology

Pearls and Other Issues

Mortality rates have substantially decreased in the last two decades as trauma centers have streamlined the approach to diagnosis and management. However, abdominal gunshot wounds are, unfortunately, still extremely common in the US. Healthcare professionals have the opportunity to emphasize safe practices regarding firearms. As part of the society as a collective unit, the healthcare system can be intentional with patients and families in society to emphasize prevention and decreased violence regarding weapons such as firearms. Educational messages such as the danger of firearms and how they should be safely used and stored can be promoted.

Enhancing Healthcare Team Outcomes

The mortality rate from abdominal gunshot wounds remains high due to the high-velocity, penetrating abdominal trauma, and potential shock from damage to organs and intraperitoneal vascular extravasation. Most of the overall mortality due to the injury is in the first 24 hours of insult.

Review Questions

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