

Nonoperative management of penetrating abdominal trauma

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Penetrating abdominal trauma is prevalent in most urban settings in the United States; for instance, 25% of trauma cases in Los Angeles are penetrating. Selective nonoperative management is practiced routinely for blunt abdominal trauma, but in most institutions laparotomy is still considered the standard of care for abdominal gunshot wounds. The traditional treatment of these injuries has been exploratory laparotomy for all gunshot wounds to the abdomen and for all stab wounds where peritoneal violation has been proven.

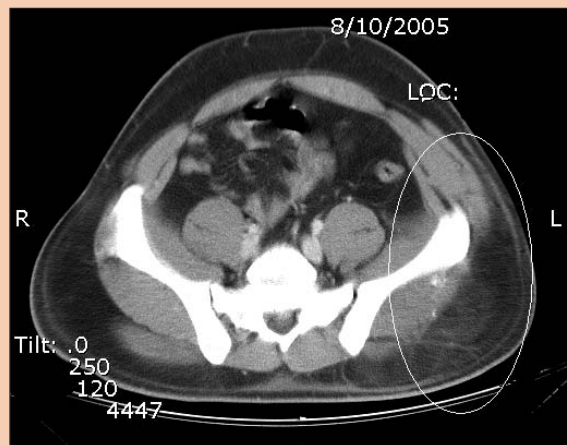
Nonoperative versus surgical management

The implementation of selective nonoperative management of penetrating abdominal trauma can decrease the rate of unnecessary laparotomy and thus avoid the complications associated with nontherapeutic surgery. In addition, it significantly shortens hospital length of stay, resulting in cost savings.¹ One reason cited for aggressive surgical management has been the high incidence of intra-abdominal injuries in cases of penetrating trauma, previously reported to be as high as 98%.² However, the studies reporting this number do not distinguish between therapeutic and nontherapeutic laparotomies, making it difficult to accurately assess which cases could have been managed without surgery.^{2,3} In addition, other studies have found the incidence to be only about 70% to 80%, leaving 20% to 30% of cases that can be managed nonoperatively.⁴⁻⁷

Clinicians have been hesitant to move to nonoperative management because many consider negative exploratory laparotomy to be a harmless procedure. However, it is not without complications. Any surgery involves exposure to anesthesia, whose risks include idiosyncratic reactions and aspiration; other risks of surgery are bleeding, infection, iatrogenic injuries, and

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FIGURE 1



CT shows the bullet track to be extraperitoneal despite gunshot wounds in the left lower quadrant and left flank.

possible future adhesions, as well as the costs of the OR and postoperative hospital stay.^{6,8}

Our experience

At the Los Angeles County and University of Southern California Medical Center (LAC+USC), a level I trauma center, we admit a large number of patients with abdominal gunshot wounds and abdominal stab wounds. We have adopted a policy of selective nonoperative management for both stab wounds and gunshot wounds to the anterior and posterior abdomen. The anterior abdomen is defined as the area between the midaxillary lines laterally, the nipples superiorly, and the pubic symphysis inferiorly. The posterior abdomen is defined as the posterior area between midaxillary lines laterally, the tips of the scapula superiorly, and the gluteal folds inferiorly.¹ We practice selective observation for patients who have no clinical evidence of peritonitis or severe bleeding. Contraindications to selective nonoperative management include hemodynamic instability and peritonitis; we also exclude from nonoperative management patients

with unreliable findings on physical examination because of head injury or spinal cord injury and those who are undergoing general anesthesia for another procedure.

Studies conducted at our institution have found that with this policy, approximately 50% of stab wounds to the anterior abdomen, 85% of stab wounds to the posterior abdomen, and 25% to 30% of gunshot wounds to the anterior abdomen can be managed nonoperatively.⁹ Up to 30% of stab wounds with proven peritoneal penetration do not involve significant abdominal injury.^{10,11} Radiographic tests, CT, and focused abdominal sonography for trauma (FAST) can be useful adjuncts in patients selected for nonoperative management. CT is used to assess the bullet trajectory and proximity to important structures. We use the above modalities routinely in evaluating penetrating abdominal trauma.

Our trauma center is staffed for 24-hour in-house coverage, with an attending trauma surgeon and a team consisting of a senior resident, a junior resident, a PA, an intern, and trauma nurses. Our protocol is not likely to be as effective in a setting that cannot provide frequent close monitoring of patients and an immediate ability to provide operative management should the need arise (see the algorithm, page 54). PAs are an integral part of the trauma team, participating in all aspects of patient care. We are in the emergency department (ED) as part of the resuscitation effort and are often with the patient during CT. We perform serial examinations on patients selected for nonoperative management and are in close communication with the entire trauma team.

Patient selection

Our policy of selective nonoperative management means that patients with penetrating abdominal wounds are managed based on individual signs and symptoms if evaluation is possible. Any patient with a penetrating abdominal wound and signs of peritonitis or hemodynamic instability undergoes surgery immediately.

Signs of peritonitis are diffuse abdominal tenderness, guarding, and rebound tenderness. Patients also undergo FAST as part of their initial evaluation; however, a positive result does not always necessitate taking the patient to surgery. The decision is still made solely on the presence of hemodynamic instability or peritonitis. Patients who do not initially show these signs and symptoms and can undergo evaluation are selected for nonoperative management.

The observation period

Diagnosics All patients who do not have any of the exclusion criteria are managed by observation and,

FIGURE 2



This patient sustained a gunshot wound to the left lower quadrant, with a second wound to the left posterior lower quadrant.

often, radiographic evaluation with CT.¹² Patients have CT with fine cuts through the bullet holes as marked with a paper clip or other metallic object to better assess the bullet trajectory and its proximity to vital structures (see Figure 1). After CT, patients are admitted to a closely monitored observation unit with a low nurse-to-patient ratio for at least 12 to 24 hours. This unit is a specific trauma-observation area, with higher acuity than a standard ward. All patients remain in this unit for nonoperative observation during the time when treatment failure could potentially occur.

Laboratory tests Upon arrival in the observation unit, each patient undergoes baseline laboratory testing: CBC; basic metabolic panel (BMP), which includes serum sodium, potassium, chloride, carbon dioxide (CO₂), BUN, creatinine, and glucose; prothrombin time/international normalized ratio; partial thromboplastin time; liver function tests; and urinalysis. The patient also has a history and physical examination performed and vital signs recorded. The patient is then observed closely, with vital signs recorded frequently.

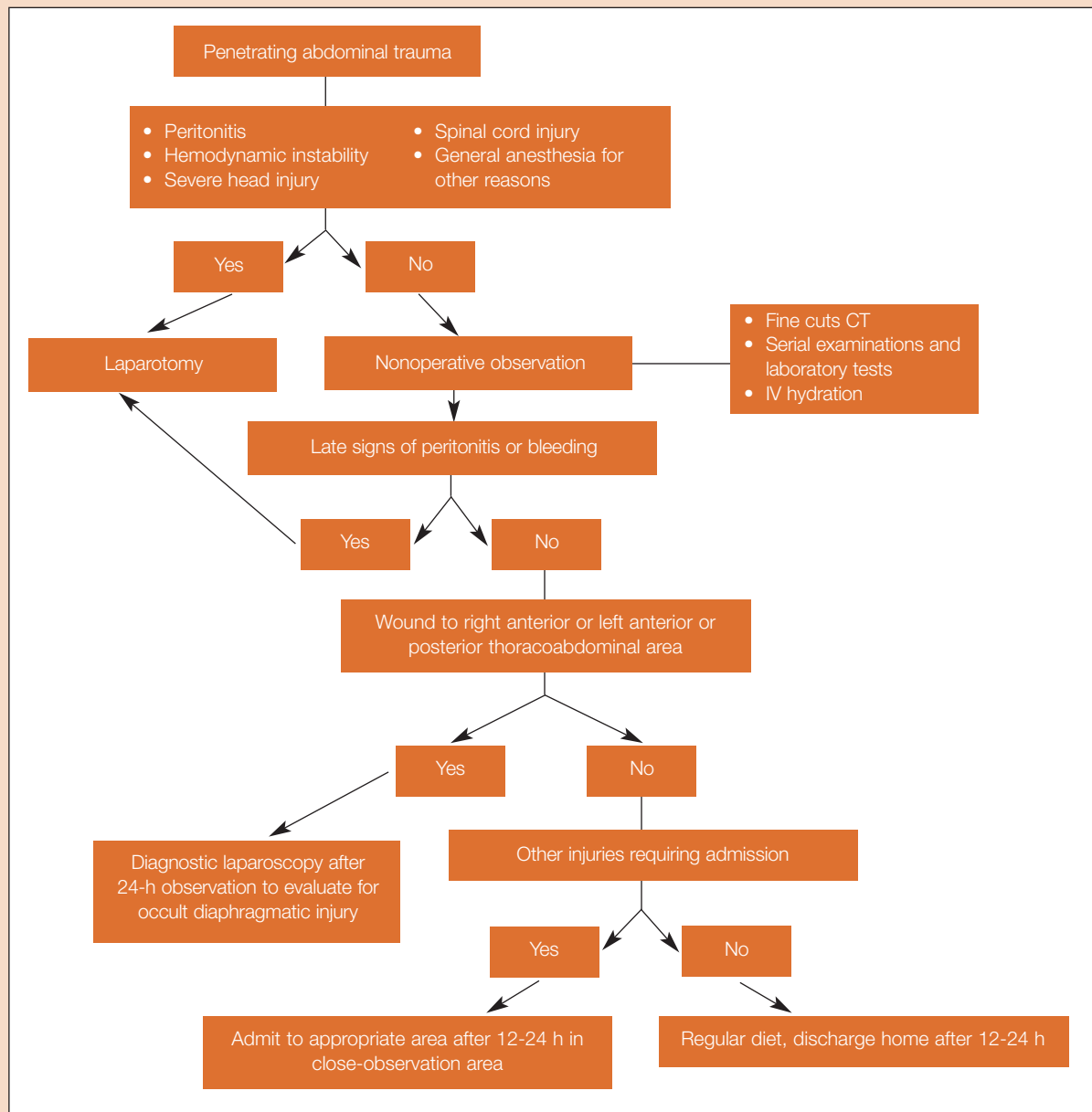
Every 4 hours, the patient is reassessed clinically and by laboratory value analysis. Abdominal examinations are performed every 4 hours. A CBC is performed to look for an elevation in the WBC count or a drop in the hemoglobin level. A BMP is obtained to look for developing acidosis as heralded by a low CO₂ level.¹³

Physical examination When possible, the patient is examined throughout the observation period by the same clinician to look for signs of developing peritonitis. Any change in the physical findings is noted and documented. A patient who develops peritonitis or hemodynamic instability is immediately taken to the OR for exploratory laparotomy.

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ALGORITHM

Nonoperative management of penetrating abdominal trauma



Medical support and treatment During this observation period, patients receive IV hydration with isotonic crystalloid solutions (Ringer’s lactate is preferred in our institution) and kept on NPO status. We give no antibiotics, other than the standard single dose of cefazolin, given in the ED, to avoid masking developing symptoms.

Stab wounds are routinely irrigated and closed during this time. Gunshot wounds are irrigated but left open to heal by secondary intention. Serial examinations and laboratory tests are continued for 12 to 24 hours. Patients

whose wounds are located in the anterior or posterior left upper quadrant or in the posterior right upper quadrant are recommended for diagnostic laparoscopy to evaluate for occult diaphragmatic injury.^{14,15}

All other patients who remain afebrile, hemodynamically stable, and asymptomatic are given a regular diet. If they tolerate the diet, they are discharged home, unless they require admission for other injuries. Patients who require admission for other reasons and have remained stable for the 12 to 24 hours they were observed

will go to a lower-acuity area, such as the ward, unless their other injuries require closer monitoring. If CT demonstrates a solid-organ injury, such as a liver laceration, management will continue to be nonoperative as long as hemodynamic stability is maintained, but the patient will be admitted to the ward or the ICU for continued hemoglobin monitoring depending on the severity of the injury as classified by CT.¹⁶⁻¹⁹ Failure of nonoperative management usually occurs within 24 hours, so more lengthy observation is unwarranted in the absence of significant solid-organ injury.¹⁷

Discussion

A policy of selective nonoperative management has been accepted for blunt trauma in most trauma centers. Acceptance of selective nonoperative management of stab wounds to the abdomen has increased over the past two decades. However, gunshot wounds and stab wounds with proven peritoneal violation have been managed much more aggressively, with routine surgical exploration. Several studies now have examined the safety and utility of selective nonoperative management of gunshot and stab wounds to the abdomen.^{1,17,20-22} Our center has found that approximately 25% to 30% of anterior abdominal gunshot wounds and approximately 50% of anterior abdominal stab wounds can be managed successfully without surgery.

Observation is important Clinical observation is accurate for selecting patients requiring exploration. Site of entry or exit of the penetrating trauma should not be the sole deciding factor in whether the patient needs operative intervention (see Figure 2, page 53). Some authors have expressed concern about missing hollow viscus perforation or that a delay in diagnosis will increase morbidity and mortality, but many studies have shown that a few hours' delay does not worsen outcomes.^{8,23,24} The initial examination was 97.1% sensitive in identifying patients needing operation. Subsequent examinations will identify the remaining patients without increasing morbidity or mortality.^{10,17}

Advantages Selective nonoperative management has the advantages of avoiding unnecessary surgery in a great number of patients, lowering overall hospital costs, and shortening hospital stays. One study found that the mean hospital stay for patients with nontherapeutic operations was 6.4 days, with a complication rate of 27.6% and a mean hospital charge of \$18,123.¹⁷ In five of the eight patients who developed complications, these were likely a direct result of the anesthesia or laparotomy. In the observed group, 13% required an operation, with four of these patients having a delay of 6 to 13.5 hours, during which one of them developed a psoas abscess. For the patients successfully managed nonoperatively, the mean hospital stay was 3.3 days and mean hospital charges

were \$8,595.¹⁷ Successful observation can avoid the potential complications of nontherapeutic operation, including wound infection, possible future small bowel obstruction, and the risks associated with anesthesia.

Conclusion

If a center follows strict protocols for close monitoring of hemodynamics, laboratory values, and clinical status, a large number of patients with penetrating abdominal trauma can be successfully managed nonoperatively. Proper patient selection, resources that permit close observation, and frequent abdominal examinations are paramount in obtaining the best results. Selective nonoperative management of penetrating abdominal trauma is safe, efficient, and cost-effective in the appropriate clinical setting and can lead to fewer unnecessary operations in patients with penetrating wounds to the abdomen. □

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