UTTAR PRADESH JOURNAL OF ZOOLOGY

43(24): 128-138, 2022
ISSN: 0256-971X (P)

MANAGEMENT OF PENETRATING WOUNDS OF ABDOMEN, A REVIEW

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AUTHORS' CONTRIBUTIONS

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

Article Information

DOI: 10.56557/UPJOZ/2022/v43i243304

Editor(s):
(1) Dr. P. Veera Muthumari, V. V. Vanniaperumal College for Women, India.
Reviewers:
(1) Manjula Sarkar, D Y Patil School of Medicine, India.
(2) Sujan Narayan Agrawal, India.
(3) Deepak Sethi, Rabindra Nath Tagore Medical College, India.

Received: 14 October 2022
Accepted: 22 December 2022
Published: 26 December 2022

Review Article

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ABSTRACT

The small colon, big bowel, liver, and intra-abdominal vasculature are the most often injured organs in penetrating abdomen wounds. The treatment of individuals with penetrating abdominal has evolved during the past few years. The best way to treat abdominal stab wounds is still debatable. The objective is to locate injuries and treat them in a way that is both safe and economical. Local wound exploration (LWE), diagnostic peritoneal lavage (DPL), laparotomy, and computed tomography (CT) imaging are all common evaluation procedures. It has been demonstrated that clinical practice guidelines enhance healthcare delivery. Although they are rare, anterior abdominal stab wounds provide a problem for trauma management in both rural and urban areas. These clinical practice recommendations place a lot of emphasis on choosing the diagnostic and therapeutic methods that are the most trustworthy, safe, effective, and affordable. The guidelines will include evidence-based suggestions for treating patients who present to both rural and urban hospitals with anterior abdominal stab wounds. In this article we explain the types of the abdominal stab wounds and state the approaches which can be used to manage the abdominal stab wounds and the followed guidelines for ideal management.

Keywords: Penetrating abdominal injuries; wounds; laparotomy; diagnostic peritoneal lavage; screening laparoscopy.

1. INTRODUCTION

Abdominal injuries caused by stab wounds are a common reason for admission to general hospital emergency rooms. Many nations experience penetrating abdominal trauma. A gunshot or stab wound is the most frequent cause. The liver (30%), small bowel (50%), large bowel (40%), and intra-abdominal vascular (25%) are the most often affected organs [1]. Injuries sustained at close range have greater kinetic energy than those sustained at a distance. Additional missile injuries from bone or bullet fragments are possible. Assessing stab wounds which penetrate the abdominal wall is challenging. Occult injuries may go unnoticed, leading to postponed consequences that might increase morbidity [2,3].

Because of the increase in violence in our society, piercing trauma is becoming more common. Many patients with penetrating abdominal trauma are referred to trauma centers with normal vital signs and a negative abdominal examination [4]. Regarding the decision to perform an emergency laparotomy on these individuals, there is considerable disagreement among experts [5, 6]. In spite of the fact that the presence of traditional symptoms including shock, visceral evisceration, and peritoneal irritation supports laparotomy following penetrating abdominal knife wounds, the tendency has changed in the last 20 years from required exploration to selective approach [7,8].

There are currently a number of approaches available for the examination of penetrating abdominal injuries in trauma patients with normal hemodynamics and no peritonitis symptoms [9]. Most of these patients will experience some surface-level soreness near the incision site, but no peritoneal inflammation will be present [10]. Any strategy for identifying injuries needing surgical repair and preventing needless laparotomies and the related morbidity should be the main objectives [11].

Several diagnostic procedures, such as serial physical examination (PE), local wound exploration (LWE), ultrasonography (US), computerised tomography (CT), diagnostic peritoneal lavage (DPL), and diagnostic laparoscopy (DL), may be utilised on carefully selected patients with minor injuries. Patients with abdominal stab wounds can have LWE performed at the bedside quickly and safely. Under local anaesthetic, the wound is expanded, and the track is followed through tissue layers [12].

Despite the revolutionary effects of cross-sectional imaging on the treatment of contemporary trauma patients, it must be noted right away that penetrating situations frequently render this common test useless. The standard of care for seriously injured blunt trauma patients has undoubtedly evolved to include a policy of liberal computed tomography (CT), but anatomic and algorithmic approaches to stab and bullet wounds distinguish the skilled and effective clinician from the uncomfortable one [13].

Surgery should only be done when absolutely essential to reduce the risk of complications from both therapeutic and non-therapeutic laparotomies. Furthermore, non-therapeutic laparotomy may result in a hospital stay of up to 5-7 days (compared with 1 day for non-operative management) [14]. One of the main objectives of these clinical practice recommendations is to identify the diagnostic and therapeutic methods that are the most trustworthy, safe, effective, and affordable. For the management of patients with anterior abdominal stab wounds who present to both rural and urban hospitals, the guidelines will provide evidence-based advice [15].

The size of the damage and the time of emergency department presentation affect the prognosis for patients with penetrating abdominal trauma. The death rates are high in cases of severe abdominal contamination caused by a ruptured viscous, hemorrhage, multi-organ injury, concomitant brain injury, or coagulopathy [16]. The fatality rates are still low in patients who receive rapid resuscitation and examination. Gunshot wounds typically have a considerably worse prognosis than abdominal stab wounds. These individuals frequently require some form of rehabilitation to return to their prior level of function, depending on the damage. The abdominal stab wounds often result in issues down the road in addition to immediate harm as Sepsis, Fistulas, Wound dehiscence, Colostomy/ileostomy or Short bowel syndrome [17].

2. ETIOLOGY

When a foreign item pierces the skin and enters the body, it causes a wound known as penetrating trauma. The skin is not always damaged in blunt or non-penetrating trauma. When an object penetrates tissue, it either stays in the tissue or travels through the tissues and leaves the body. A perforating injury is one in which an object enters the body and passes through. There is a connection between an entrance wound and an exit wound in perforating trauma [17].

An object does not pass through, according to piercing trauma. Violence can result in penetrating trauma and can lead to: shattered bone fragments, Knife and gunshot wounds, Internal organ damage from penetrating trauma frequently results in shock and infection. The severity is determined by the affected body organs, the qualities of the object, and the energy communicated. MRI, CT, and x-rays are used in the assessment process. Surgery is used as a form of treatment to remove foreign objects and restore damaged structures [18].

3. EPIDEMIOLOGY

In the United States, 35% of patients treated to urban trauma centers and up to 12% of patients admitted to suburban or rural facilities suffer from penetrating abdominal trauma [18].

In line with Lone et alreport .'s of a male to female ratio of 4.4: 1 among abdominal trauma patients, considerably more males than females (87.1% vs 12.9%) reported with abdominal trauma. Young males, especially those between the ages of 20 and 30, have reportedly been the most common victims. There were blunt abdominal injuries in 69.4% of the patients. Our findings are in line with earlier research that indicated blunt trauma to be the most common culprit in abdominal injuries. Abdominal trauma is more likely to be overlooked because of the subtle clinical indications. Clinical symptoms are less pronounced [19].

Stabbing was the most common cause of penetrating abdominal injuries (47.4%). In other research, gunshot wounds were the most often reported cause (77.65%) [20].

In our dataset, abdominal trauma patients had a 25.8% overall death rate, which is a high percentage. Penetrating trauma patients had a substantially greater mortality rate than blunt trauma patients (57.9% vs. 11.6%, respectively) [21]. Other researchers have reported fatality rates for piercing and non-penetrating injuries of 9.2% and 8.2%, respectively. However, patients undergoing emergency laparotomies who are hemodynamically unstable and with abdominal or suspected abdominal injuries have a substantially higher reported fatality rate, up to 56%, particularly those whose blood pressure is below 60 mmHg [22].

4. INITIAL ASSESSMENT AND RESUSCITATION

It is crucial to get patients with penetrating injuries to a trauma center as quickly as possible. The key factor determining a patient's chance of survival is the amount of time between the injury and bleeding control [23]. Urban areas with sophisticated pre-hospital infrastructures and skilled trauma surgeons (i.e., quick decision-making) consequently frequently have outstanding survival traits in spite of serious vascular injuries [24]. More precisely, all patients need to have their wounds checked for penetrating injuries carefully and right away (i.e., axilla, groin, perianal, perineum). Palpating the actual penetrating wound is not beneficial because it is quite painful for the sufferer. Missing wounds are a frequent cause of morbidity that can be avoided. The tests that will trigger transfer to the operating room if results are positive should be used by the doctor to start the diagnostic search for injuries of importance. For better radiograph interpretation, all wounds should be quickly tagged with a radio-opaque marker. To gather information on potential injuries and trajectory changes, early resuscitation procedures must include both anterior-posterior and cross-table lateral radiographs. In general, an even number should result when the number of holes is multiplied by the quantity of missiles. Rarely is this rule broken. In cases of hemothorax, pneumothorax, and/or free intraperitoneal air, plain radiographs also signal the need for action. A full diagnosis of all injuries is not necessary prior to surgical intervention in hypotensive

patients who are close to physiologic exhaustion, while the physician should strive to avoid missing any injuries. Additionally, a nontherapeutic laparotomy continues to be an avoidable cause of serious morbidity that can be prevented by taking a systematic approach to penetrating wounds [25].

More specifically, problems can affect up to 41% of patients, lengthening hospital stays significantly and increasing expenditures [26]. For the purpose of identifying a potential pericardial bleeding, a focused assessment with sonography for trauma (FAST) examination must be performed immediately (i.e., cardiac injury). In the absence of hypotension, diffuse peritonitis, or evisceration, it is also helpful in detecting the presence of fluid within the peritoneal cavity, but this should not significantly change a clinician's care. As a result, FAST's primary role in penetrating circumstances is to assess patients for multisystem injuries and rule out pericardial tamponade. Increase bleeding is a definite and recurring side effect of raising a patient's systolic blood pressure above 80 mm Hg before achieving definitive haemorrhage control [23].

The justifications for emergency department thoracotomies (EDT) are still debatable. EDT continues to be particularly beneficial for patients who have penetrating cardiac trauma and loss of signs of life in the trauma bay. The likelihood of functional neurologic salvage in a patient who has stopped breathing increases along with the amount of time without vital signs. ED laparotomy no longer has a purpose. Despite early enthusiasm in the 1970s, it is obvious that EDT is largely ineffective for decreasing haemorrhage within the peritoneal cavity. Exsanguination still frequently results from back bleeding caused by the substantial blood volume below the aortic clamp. When the liver, hepatic veins, right iliac vein, or inferior vena cava are injured, resuscitation with a femoral central line is ineffective [13].

Additionally, it should be highlighted that patients with narrow complicated pulseless electrical activity (PEA), despite hotly contested arguments about absolute indications for EDT extending back nearly 40 years, are typically suitable candidates for EDT. The opposite end of the spectrum is represented by patients who come in asystole and are almost always irreparable [13].

Even after the typical 1-3 hours of attempted resuscitation and surgical intervention, patients who present with wide complicated PEA reflect a shift toward cardiac death and are therefore extremely seldom saved with functioning neurologic outcomes. Before beginning EDT in these individuals, care must be taken. Blood in a Foley catheter or the presence of blood in nasogastric tubes should alert the medical professional to possible injured organs. The scope of this review does not allow for a thorough discussion of damage control procedures and indications, but it is important to keep in mind that only patients who continue to show progressive decompensation with regard to intraoperative physiology despite ongoing massive resuscitation are candidates for damage control surgery (including open abdomens) [13].

5. ABDOMINAL STAB WOUNDS

Compared to gunshot wounds, stabbing injuries have substantially less kinetic energy. This fact leads to a significantly decreased likelihood of harm requiring repair, which should translate into a lower intervention rate. About 55% of all stabbing victims present at a trauma center with hypotension (hemodynamic disturbances), diffuse peritonitis, and/or evisceration. These are absolute criteria for urgent surgical intervention in the majority of centers, regardless of anatomic zone [23].

6. ANTERIOR ABDOMEN

There are a lot more diagnostic possibilities and discussions available when treating patients who have suffered an anterior abdominal stab wound. Routine laparotomies, local wound exploration, screening laparoscopies, CT scans, diagnostic peritoneal lavage (DPL), and observation are a few of the alternatives available. The high kinetic energy of a bullet and the entrainment of air give the doctor an excellent visual trajectory/tract in the case of gunshot wounds, hence it should be highlighted that CT is far less helpful in these patients [27,28]. However, the deepest extent of a knife trajectory is often very challenging to define and frequently deceiving. Because of these findings and the obvious limitations of CT in verifying injuries to the intestine or diaphragm, the majority of high-volume centres no longer routinely image anterior abdominal stab wounds with CT.

Despite the abundance of unique case studies in the literature that detail extreme occurrences, routine laparotomies for anterior abdominal stab wounds will result in a nontherapeutic laparotomy rate of close to 60% [29]. This rate can be reduced to less than 50% by including a local wound exploration (LWE) [30].

However, it should be highlighted that the definition of a LWE is a surgical process carried out with the proper sterile method and instruments that define either the most superficial fascial level or the base of the wound (whichever is encountered first) [31]. The LWE is deemed positive if the wound extends past the

fascia. Given the rise in local morbidity and the known high rate of peritoneal penetration when the anterior fascial layer is breached, progressing to deeper layers of the abdominal wall is discouraged. Thus, compared to "probing" the wound with a finger or other object, the LWE is fundamentally different [32]. The main benefit of the LWE is that patients who test "negative" can have their tissue closed and leave the hospital. However, it should be emphasized that pain related to the LWE itself can complicate later physical tests if a patient is admitted for serial surveillance after a positive LWE. Another diagnostic approach is laparoscopy, which proceeds anatomically [33].

A laparoscopy is considered "positive" when the peritoneum has been penetrated (screening laparoscopy); a diagnostic laparoscopy includes a thorough examination of all intra-peritoneal and retroperitoneal structures, including the lesser sac, gastro-esophageal junction, and pelvis; and a laparoscopy involving the active repair of injured structures (therapeutic laparoscopy) [31].

Screening laparoscopy has emerged as the most popular of these procedures because of how simple it is to do and how broadly applicable it is to most trauma surgeons. The percentage of patients who undergo a nontherapeutic laparotomy drops to 40% if a positive screening laparoscopy is utilized as the catalyst. It should be emphasized that the published missed injury rate related with diagnostic laparoscopy ranges from 0% to 82%, likely because to varying competence levels. Although there is a wide range, larger studies tend to group at 9%–18% [31]. Combining laparoscopy and DPL is one modern and innovative solution to this ongoing problem. Following the laparoscopy, a typical DPL is carried out through any available port. This combination strategy could help reduce the main issue with standalone DPL [34].

More precisely, it is too sensitive and leads to an unacceptable high proportion of nontherapeutic investigations when DPL alone is used as a justification for a further laparotomy in patients with anterior abdominal stab wounds. Admission and monitoring with periodic clinical assessments is an alternative and more common strategy to care patients with an anterior abdominal stab wound in the absence of hypotension, diffuse peritonitis, and evisceration [35].

Today, it might be argued that selective non-operative management (SNOM), sometimes known as "selective conservatism," is the norm for treating stab wounds in a variety of settings with diverse resources and cultures. Although critics of this theory frequently and falsely point to the existence of highly specialized observation wards in high-volume centers, it is evident that SNOM is not safe if serial clinical assessments by a physician are not accessible [13].

Importantly, patients undergoing non-abdominal surgical operations who are unable to assist in follow-up clinical evaluations should also be excluded, as well as those who have concurrent traumatic brain or spinal cord injuries or are intoxicated. When performed on any patient, the physical examination must be trustworthy. The use of narcotic analgesics, which can conceal clinical findings, should be limited in SNOM patients, and they should be watched for changes in their vital signs and laboratory test results (such as hemoglobin and white blood cell count). An total ban on SNOM does not apply to isolated omental evisceration. In patients who get SNOM, there is no evidence of an increase in morbidity or length of hospital stay. Within 12 hours of anterior abdominal stab wounds, the majority of visceral injuries that need to be repaired will result in a good clinical evaluation. For wounds on the flank and back, this time frame is increased to 18 hours [13].

7. LOCAL WOUND EXPLORATION

Local wound exploration to look for fascial penetration has been proposed in the past and is currently being promoted. Previous research has shown that local wound exploration is necessary even in the absence of ultrasonography findings that are promising [36,37,38]. Wound exploration can be done in the emergency room while under local anesthesia in low volume centers when the majority of patients have wounds that are superficial to the peritoneum in order to determine fascial integrity [39]. Following formal wound examination, facial integrity eliminates the need for additional research, allowing the patient to be securely discharged.

In the current investigation, there was a low rate of formal ED wound exploration, which may have been due to emergency physicians' uncertainty about how to carry out the technique or how to interpret the results. As well as expertise and experience in the proper technique, sterile conditions and adequate illumination are crucial criteria. Techniques for exploring wounds have been previously discussed. It's crucial to visually inspect the fascia directly rather than 'probing' to check for integrity. The skin laceration will typically need to be extended as part of the exploration process under local anaesthesia. The surgical team can do exploration in the operating room when ED wound exploration is technically challenging, either due to operator inexperience or a

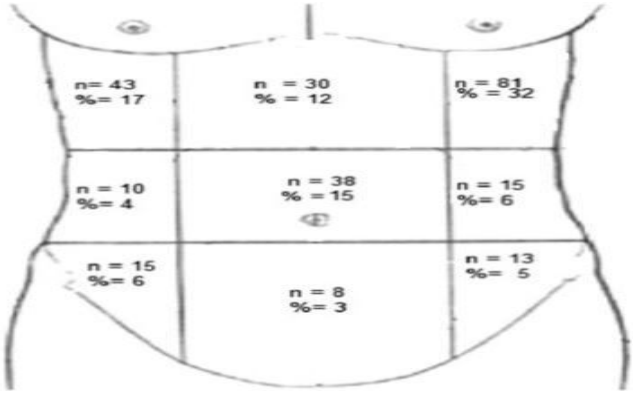

Fig. 1. The front abdomen was covered in a pattern of stab wounds

lack of proper facilities. CT scanning is crucial in cases where there is fascial breach evidence in order to look for intra-peritoneal pathology [40,41].

8. CT SCAN

According to reports, using CT scanning can lower the rate of necessary laparotomies [42]. With a sensitivity of 97%, triple contrast CT scans have been used successfully in patients who are hemo-dynamically stable [43]. However, Australia uses triple contrast CT scans seldom, and none were done in this series. The current investigation demonstrates that CT is unreliable in ruling out peritoneal penetration or intra-peritoneal injury, despite the fact that solid organ injuries seen on CT may be eligible for conservative therapy [44].

9. ASSESSMENT WITH SONOGRAPHY FOR TRAUMA

When used by skilled operators, FAST in trauma patients is a tried-and-true approach for identifying intra-peritoneal fluid in settings where the incidence of intra-peritoneal injuries is low [45]. Due to the high specificity of FAST, stable patients who test positive can have a CT abdomen to look into the possibility of conservative therapy without having wound investigation. Both formal education and access to ultrasound among emergency physicians are still limited [46]. FAST is valuable since it is quick and non-intrusive, and when the results are favorable, it can guide early management. The limited sensitivity of FAST, however, necessitates additional steps to steer disposition in the event of a negative result [44].

10. LAPAROSCOPY

When a normal or ambiguous FAST is present and fascial integrity cannot be firmly established by wound exploration, laparoscopy has many benefits over laparotomy, including financial savings [47]. Although none were found in this series, laparoscopy in the trauma setting has been linked to a number of problems, including tension pneumothoraces, elevated intracranial pressure, gas embolism, and missing injuries [48].

When utilized to find peritoneal perforation or diaphragmatic injury in lower thoracic wounds, laparoscopy can lower negative laparotomy rates [49]. Laparoscopy, used largely to find a breach of the peritoneal cavity, is a diagnostic technique that lies between wound exploration and laparotomy [50]. Its effectiveness as a therapeutic approach is constrained by technical shortcomings in recognizing hollow organ injuries, variation in laparoscopic proficiency among trauma surgeons, and worries about missing injuries [51]. The predictive potential of laparoscopy may be further enhanced by newer methods of laparoscopic diagnostic peritoneal lavage [52].

Strict protocols must be created where conservative management through serial observations is used to guarantee that patients receive regular follow-up examinations by trauma surgical experts with experience. It has been demonstrated that an initial negative physical examination has little relationship to intra-peritoneal pathology [53]. This is more important for emergency trauma patients since pain and stress responses may obscure the data. Serial exams, however, can lower the rate of negative laparotomies and laparoscopies when combined with supplementary investigations [54]. Serial examinations are more informative since the key factors that contributed to early physical examination inaccuracies—the existence of distracting injuries, altered state of consciousness, and personal response to trauma—have probably improved. Additionally, serial FAST scanning provides a quick and easy way to monitor patients with stable hemodynamics [55].

11. ANTERIOR ABDOMINAL STAB WOUNDS IN A RURAL OR URBAN HOSPITAL WITHOUT AN ON-CALL SURGEON: THE IDEAL MANAGEMENT

Guideline: In a thin patient, the general practitioner should perform local wound exploration (LWE) to check for anterior rectus sheath (fascial) penetration [56]. If it is determined with confidence that there has been no fascial penetration, the patient should be sutured loosely, kept under observation for 24 hours, and then discharged from the rural hospital the following day. This option relies on the general practitioner's fundamental surgical abilities, thus it shouldn't be used unless the doctor is confident performing it. If fascial penetration is found, the patient should be transferred right away to the closest primary trauma center. Many institutions have employed the scientifically-based LWE to determine if a laparotomy is necessary.

Scientific basis: Many institutions employ LWE to determine whether a laparotomy is necessary [56]. LWE has come under fire for being inaccurate in people who are obese or who have thick abdominal muscles that make it challenging to observe the peritoneum [57]. However, the sensitivity and specificity are 100% and 96% respectively when LWE is employed as a screening technique to identify patients with an intact fascia. The safety and effectiveness of LWE have both been investigated by Oreskovich, Carrico, and Goldberger et al. [58].

12. THE OPTIMUM EMERGENCY CARE OF STABLE INDIVIDUALS WITH ANTERIOR ABDOMINAL STAB WOUNDS WHEN SURGICAL SERVICE IS AVAILABLE

Guideline: Early exploratory laparotomy should be performed on hemodynamically stable individuals who have generalized peritonitis or evisceration [59]. LWE should be performed on a thin, cooperative patient to check for anterior rectus sheet fascial penetration. If fascial penetration is found, the patients should be taken right away to the operation room [57]. The patient may also choose to have a laparoscopy or DPL if LWE cannot be confidently performed due to obesity, uncooperative individuals, or a poor or insufficient view of the abdominal rectus sheath. If the results of either of these tests are positive or uncertain, the patient should be taken right away to the operation room.

Scientific basis: Probabilities: The place of entrance alone cannot precisely identify which organs are at risk, yet it may give hints as to which organs could be hurt [60]. Hemodynamic instability and abnormal physical examination are the best indicators of serious intra-abdominal damage. Shock has a positive predictive value of much over 80% for predicting successful laparotomies. The incidence of serious intra-abdominal damage for patients who present without shock but with evidence of widespread peritonitis exceeds 85%. In 75% of individuals who have experienced omental or intestinal evisceration, there may be substantial abdominal injuries; half of these patients have sustained lesions to two or more organs [57].

Assessing patients who don't exhibit shock, peritonitis, or evisceration symptoms is more challenging. In asymptomatic individuals, the frequency of intra-abdominal damage varies between 8 and 28%; this variance is attributable to institutional variations in the definition of stable patients. When there is peritoneal penetration, the risk of damage increases. Overall, peritoneal penetration patients will sustain an organ harm in 68–70% of cases, with 37% of these cases leading to significant morbidity if ignored [56].

In asymptomatic individuals with anterior abdominal stab wounds, there is a 7% chance of concealed diaphragmatic injury, which, if undiagnosed, increases the risk of hollow viscus herniation in the future [56].

investigations: For detecting intra-abdominal damage necessitating surgical treatment, clinical examination has a reported sensitivity of 88-100% and specificity of 79-94%. The majority of patients (90%) with intra-abdominal injuries necessitating laparotomy will be identified by clinical examination looking for symptoms of shock, ongoing haemorrhage, evisceration, and broad peritonitis. However, despite a careful clinical evaluation, 1–10% of patients may have a serious injury that goes unnoticed. A more precise screening test should therefore be used in addition to the physical examination [59].

Many institutions have employed LWE to determine whether a laparotomy is necessary. It is extremely accurate and won't miss any injuries when LWE is used as a screening tool to evaluate the integrity of the fascia (sensitivity 100%, specificity 96%). The ability of each clinician and an acceptable view of the peritoneum are essential for LWE to be successful. If LWE cannot rule out a fascial puncture, DPL or laparoscopy may be performed in its place [56].

Patients with upper abdomen stab wounds are more likely to sustain diaphragmatic injury that won't show up on a DPL. As a result, these patients should have a diagnostic laparoscopy without DPL to rule out any possible diaphragmatic damage. Evaluation of peritoneal penetration and diaphragmatic damage during laparoscopy has demonstrated its reliability [61,62,32].

In order to rule out hemo-peritoneum, damage to the upper abdominal organs, diaphragmatic tears, and retroperitoneal hemorrhages, screening laparoscopy is quite accurate. Laparoscopy, however, performs poorly (18–50%) as a diagnostic technique, especially when it comes to identifying lesions to the hollow viscous and lower abdominal organs. Laparoscopy should therefore be used primarily to rule out peritoneal penetration and to identify diaphragmatic perforation. The ability to identify damage to these structures is 98–100% sensitive. To better see the prospective site of abdominal wall penetration during laparoscopy, a 30° telescope should be used [63].

13. CONCLUSION

Abdominal stab wounds, which are frequently encountered by emergency personnel, were treated using various approaches that adhered to strict guidelines. being carried out with care for avoiding internal organ damage. Although CT has been utilized in some regimens, it has low sensitivity and specificity for these lesions and requires people with sufficient technical and clinical expertise to interpret it. When there is a question as to whether an intra-cavitary injury exists in patients with AASW who have positive wound exploration and who are stable, laparoscopy can be employed. Due to the variety of approaches, each service should design its own protocol based on its human resources, such as trauma surgeons with experience in both surgery and nonsurgical treatments. Patients should be taken to the hospital as soon as possible, and procedures like IV cannulation should be completed on the way. employing a clinical evaluation to treat only anterior abdominal stab wounds. The ability of each practitioner will determine how well this management regimen works. It is advised that the patient be moved to the primary trauma center for additional ancillary diagnostic work-up if DPL or LWE cannot be confidently performed in a rural setting.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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