Penetrating anterior abdominal stab wounds: is exploratory laparotomy mandatory?

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Received: 10 November 2023
Revised: 6 December 2023
Accepted: 9 December 2023
Published: 31 January 2024

The Egyptian Journal of Surgery 2024, 43:139–146

Background
Despite the consensus that patients with penetrating anterior abdominal stab wounds (AASWs) who presented with shock, diffuse peritonitis, or evisceration should be offered immediate laparotomy, the treatment of stable patients with negative abdominal examination is a bit controversial. It seems that selective nonoperative management (SNOM) of stable patients is picking up steam.
Aim
This study aimed to evaluate our experience in treating AASW patients and assess the safety and efficacy of the SNOM of AASWs.
Patients and methods
From March 2023 to October 2023, this study was conducted at the Aswan University Hospital's General Surgery Department. It involved 69 patients with penetrating AASWs. Group I: 31 hemodynamically stable patients who showed no signs of peritonitis underwent local wound exploration and were monitored with serial examinations. Group II: 38 individuals had evisceration, shock, and peritonitis treated by emergency laparotomy.
Results
Group I patients had successful nonoperative management in 83.87% of cases. The remaining 16% had delayed laparotomies, all of which were therapeutic. In group II, out of the 38 patients who had emergency laparotomies, 21% had unnecessary laparotomies. By combining selective management with diagnostic tests, we were able to bring the rate of unnecessary laparotomies down to zero. Complications occurred in 12.5% of patients who had an unnecessary laparotomy.
Conclusion
The SNOM of AASW patients who are asymptomatic or minimally symptomatic allows for a large reduction in unnecessary laparotomies.

Keywords:
anterior abdominal stab wounds, laparotomy, selective nonoperative management

Egyptian J Surgery 43:139–146

1110-1121

Introduction

There is currently no agreed-upon technique for treating penetrating abdominal stab wounds, making it a contentious topic. The goal was to lower the rate of unnecessary laparotomies, which ranged from 23 to 53% [1]. The most contentious question is whether a standard laparotomy should be routinely done after an injury or in response to symptoms of infection or bleeding (also known as laparotomy on demand). The purpose of a laparotomy on demand is to locate and control the cause of bleeding or leakage. The best evidence currently available supports this practice [2].

Although urgent laparotomy is unquestionably required for patients with severe physiological abnormalities, hemodynamic instability, visceral evisceration, or peritoneal irritation following penetrating abdominal injury, the selective approach seems to be gaining ground for patients with normal hemodynamic signs and a negative abdominal examination [3–5]. There are several unanswered questions about the treatment of patients with visceral evisceration. Although visceral evisceration is a sign requiring an emergency laparotomy in some trauma centers, other facilities choose additional diagnostic techniques [6,7].

Mandatory laparotomies for penetrating abdominal injuries identify certain unexpected injuries early and more correctly, but they also increase the risk of nontherapeutic laparotomies and length of hospital stay. Since nontherapeutic laparotomies in trauma patients have a demonstrated morbidity, it is best to avoid them wherever possible. Contrarily, the dangers of delaying surgical management are severe and must be avoided. The choice for laparotomy should be weighed against the risks of missing or delayed

injury diagnosis and the hazard of laparotomy. Therefore, the surgeon's clinical awareness and acumen are crucial in making the decision [8].

In areas with limited resources, exploratory laparotomy for all penetrating abdominal injuries still has a place. In inadequate circumstances, the poor diagnostic techniques made immediate laparotomy for anterior abdominal stab wound (AASW) extremely challenging, which demonstrates the value of having a high index of suspicion. However, the rate of nontherapeutic laparotomies will be too high. When supplementary techniques like computed tomography are available, it is difficult to support such a policy [9–11]. While selective nonoperative management (SNOM) for abdominal stabs is generally effective, cost-efficient, and reliable, it may counteract the advantages of laparotomy [12–14].

Reviewing our experience in treating people who had suffered AASWs to assess the safety and efficacy of this management approach was the goal of this study.

Patients and methods

This was a 7-month study conducted at Aswan University Hospital's Department of General Surgery from March 2023 to October 2023. It included 69 patients. They were sent to the emergency room with a penetrating abdominal stab wound. As recommended by Advanced Trauma Life Support guidelines, the conventional resuscitative protocol utilized for all patients' care was used as an initial step. All patients were evaluated through physical examination, laboratory tests, and imaging studies (some patients came with peritonitis and/or shock, necessitating an emergency laparotomy before any diagnostic tests could be conducted).

Two groups were formed based on the clinical presentation:

Group I: 31 patients were hemodynamically stable, with no indications of peritonitis or physiological dysfunctions. Local wound exploration was performed on the patients. Patients with superficial abdominal wall wounds that did not violate the posterior fascia or peritoneum were excluded from the study. Patients with peritoneal violations were transported to the OR for fascial closure and hospitalized for 72 h to design the serial clinical assessments. Omentum herniation was not considered as a reason for emergency surgery. After excision of the nonviable omentum or reduction of the herniated organs into the abdomen, these patients were handled selectively (partial omentectomy was performed in six cases of omental evisceration). Serial clinical assessments were continued under surveillance with repeated physical examinations and paraclinical evaluations such as a complete blood count, plain radiograph, and abdominal ultrasound to check for evidence of persistent hemorrhage or intraabdominal viscus injury. A laparotomy is performed when hemodynamic instability, peritonitis, or evidence of continuous blood loss develops. Patients were discharged when nutrition was normal and there was a clinical improvement.

Group II: 38 patients underwent emergency laparotomy for peritonitis, hemoperitoneum with shock, and herniated bowel reduction failure. Until surgical intervention, all patients received parenteral fluids, antibiotics, nasogastric aspirations, and frequent vitals monitoring.

We studied:

(1) Clinical, paraclinical, and therapeutic evolution of group I patients.
(2) Site of the lesions, the surgical procedure in group II patients.
(3) Evolution (mortality, morbidity) and hospital stay of the operated patients.

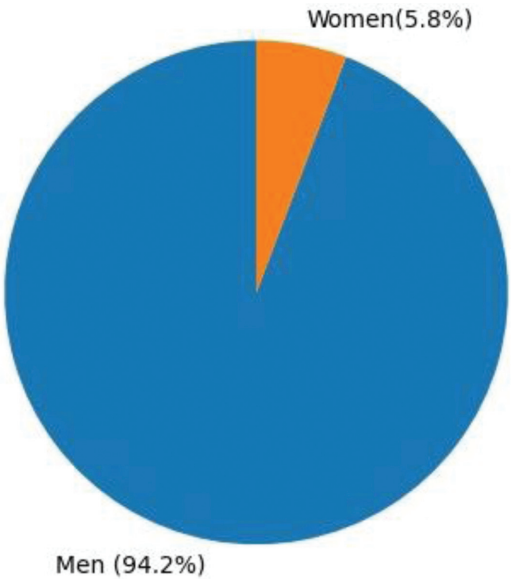
Laparotomy classification

A laparotomy was considered 'therapeutic' if it revealed intraabdominal injuries that needed to be repaired and was considered 'nontherapeutic' if the injuries did not necessitate surgical repair (for instance, nonexpanding retroperitoneal hematomas, serosal bowel injuries, and nonbleeding liver and/or spleen lacerations). When there were no intraabdominal injuries discovered, the laparotomy was designated as 'negative.' 'Unnecessary laparotomies' were defined as all nontherapeutic and negative laparotomies. When patients underwent early or delayed laparotomies, selective management was regarded to have failed.

Ethical approval and consent statement

Ethical consideration: this study follows all regulations of the ethical committee of faculty of medicine at Aswan University. All selected patients will sign a written informed consent after explaining the benefits and hazards of exploratory laparotomy and Selective Non-Operative Management (SNOM).

Figure 1



Sex distribution in the study group.

Figure 2

Chest radiography following abdominal trauma. There appears to be free air under the diaphragm.

Results

Between March 2023 and October 2023, our center admitted 69 patients in a row who suffered from stab wounds to the abdomen. The average age was 28.3 years (range, 15–52); there were 65 (94.2%) men and four (5.8%) women (Fig. 1).

About group I patients (31 patients)

Thirty-one hemodynamically stable patients with AASWs comprised the study group. Blood counts and serial examinations were used to assess the patients. Out of the 31 patients, five (16%) exhibited characteristics that required surgical exploration:

(1) Three peritonitis conditions were reported 24, 48, and 72 h following monitoring.
(2) Two cases of shock and hemoperitoneum were reported 8 and 24 h following monitoring.

In the patients who developed hemoperitoneum and shock, complete blood count demonstrated a reduction in hemoglobin from 11.8 to 8.4 g/dl 24 h following observation. In cases of peritonitis, there was progressive abdominal tenderness, elevated leucocyte levels, and fever. A pneumoperitoneum was discovered on an abdominal radiograph in two peritonitis patients (Fig. 2). An abdominal ultrasound revealed moderate peritoneal collections in the patients who had a shock and one case of peritonitis but no evidence of organ damage.

As part of their treatment approach, these five patients underwent secondary surgery. Table 1 summarizes the surgical lesions and procedure. These five (16%) patients were operated with favorable outcome (Figs 3 and 4).

The outcome of the other patients who did not have surgery was likewise favorable [n=26 (84%)]. The average duration of hospital stay was 3 days, with a range of 2–7 days.

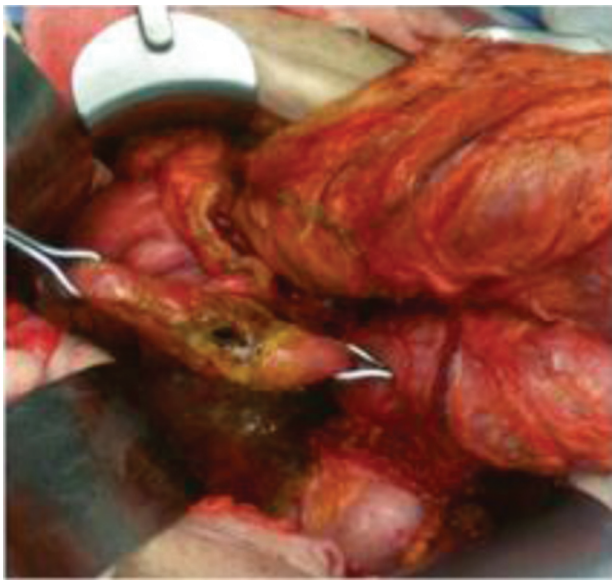
About group II patients (38 patients)

The surgical procedures were:

Table 1 Lesions and surgical technique in patients in group I underwent secondary operations

Patients	Intraoperative lesions	Treatment	Morbidity
Peritonitis on 24 h	Small bowel wound	Resection-anastomosis	–
Peritonitis on 48 h	Small bowel wound	Suture	–
Peritonitis on 72 h	Stomach, diaphragm	Suture	Wound infection
Hemoperitoneum+shock on 8 h	Active bleeding splenic wound	Splenectomy	–
Hemoperitoneum+shock on 24 h	Active bleeding liver wound	Hepatorrhaphy	–

Figure 3



Surgical image of small bowel wound 72 h following monitoring.

(1) Suture or resection-anastomosis for digestive tract lesions (Figs 5 and 6).
(2) Hemostatic suture for hemorrhagic lesions of the liver, mesentery, and mesocolon.
(3) Omentum.
(4) Splenectomy for hemorrhagic splenic injury.
(5) Colostomy for colonic injury.
(6) Cholecystectomy for gallbladder injury.

Table 2 provids information on the patients who underwent immediate surgery.

Figure 4

Surgical image of active bleeding liver wound 24 h following monitoring.

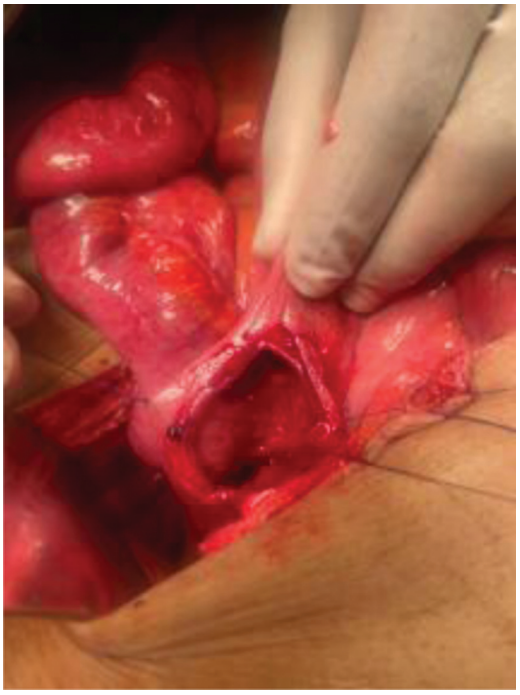
Figure 5

Surgical image of large bowel wound during urgent laparotomy.

Table 3 and Fig. 7 summarize the distribution of lesions according to organs in therapeutic and nontherapeutic laparotomy (in 38 patients).

Negative laparotomy was observed in two cases of small bowel evisceration, two cases of peritoneal syndrome,

Figure 6



Surgical image of small bowel wound during urgent laparotomy.

Table 2 Thirty-eight patients' urgent laparotomy indications and results

Indication	Patients	Therapeutic laparotomies	Nontherapeutic laparotomies	Negative laparotomies	Injured organs	Morbidity	Mortality
Hypotension	8	7	1	0	Spleen (2) Liver (3) Mesocolon Duodenum +pancreas Small bowel+mesentery	Pneumonia Wound infection	0
Evisceration	10	7	1	2	Omentum (2) Colon (2) Stomach Small bowel (3)	Wound infection	0
Peritonitis	9	7	0	2	Small bowel (2) Colon (2) Stomach (2) Liver +gallbladder	Wound infection	0
Both hypotension and evisceration	6	4	1	1	Colon+omentum Small bowel+mesentery +superior mesenteric vessel Small bowel+ mesocolon Liver+diaphragm Stomach +pancreas	Duodenal fistula	1
Both hypotension and peritonitis	5	5	0	0	Stomach+colon Small bowel+mesentery (2) Liver+gallbladder Small bowel	Wound dehiscence	0

Table 3 Lesions were distributed according to organs during laparotomy in 38 patients

Seat of lesions	Frequency	%
Small bowel	13	34.2
Colon	6	15.8
Liver	7	18.4
Stomach	6	15.8
Spleen	3	7.9
Mesentery	4	10.5
Omentum	3	7.9
Mesocolon	2	5.3
Gallbladder	2	5.3
Duodenum	1	2.6
Superior mesenteric vessel	1	2.6
Diaphragm	2	5.3
Pancreas	2	5.3
Total	38	

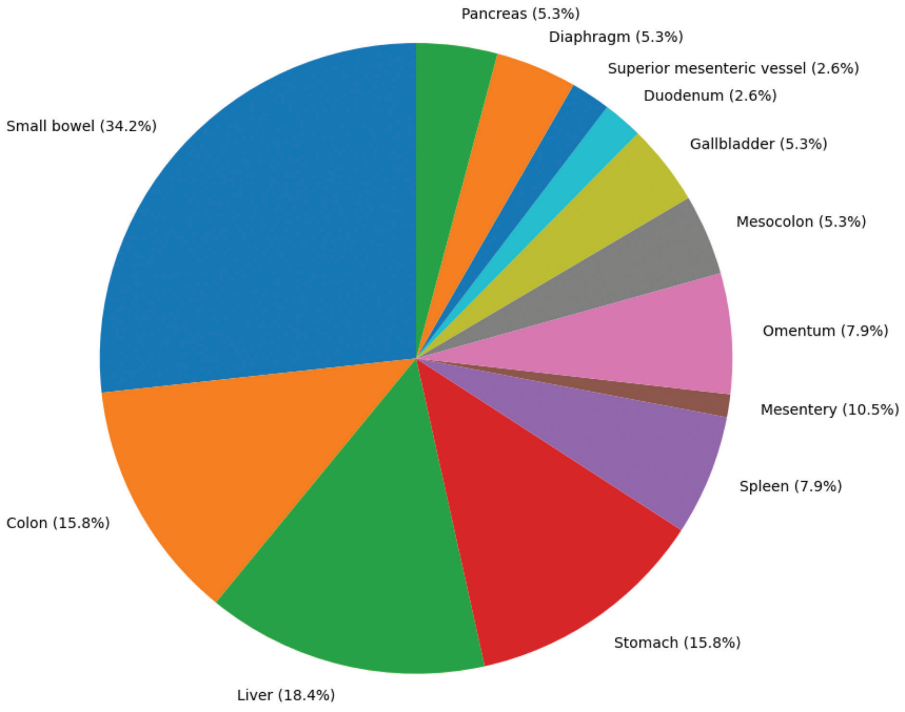
and one (11.6%) case of hypotension with evisceration of patients operated on as first-line therapy, whereas nontherapeutic laparotomy was seen in one case of small bowel evisceration, one case of hypotension, and one (7.9%) case of hypotension with evisceration.

Among patients who had second-intention surgery, the rate of unnecessary laparotomies was zero.

One (2.3%) case of superior mesenteric artery injury resulted in the death of the patients who underwent surgery.

Forty-three (62.3%) patients were operated on, 38 as first intention and five as second intention. For 35 (81.4%) patients, there were no complications

Figure 7



The distribution of lesions according to organs during laparotomy in group II patients.

following the operation. Complications in eight (18.6%) patients included wound infection, wound dehiscence, pneumonia, fistula, and death. The average hospital stay for patients who had surgery was 11 days, with extremes ranging from 5 to 27 days. Wound infection was the most frequent consequence (50%). Morbidity rates in the early and delayed laparotomy groups were 15.8 and 20%, respectively. The overall mortality rate for patients undergoing surgery as first-line therapy was 2.6% (one case of superior mesenteric vascular damage), whereas patients who underwent surgery with the second intention had no mortality.

Discussion

The most frequent surgical therapy for treating abdominal stab wounds in the early stages is laparotomy. It is also the most sensitive method for identifying and treating concurrent injuries. But, there have been reports of complication rates as high as 40% [15]. As a result, the conservative strategy has become more popular as the accuracy of radiologic diagnostic technologies'. According to clinical trials, 50% of stab wounds that penetrate the anterior wall of the abdomen can be treated without surgery. As a result, nonoperative treatments are used more frequently in these patients [1,16,17]. The most beneficial method for assessing patients with penetrating abdominal injuries is still a thorough physical examination, which was employed successfully in 79% of patients in a study with 117 participants by Ertekin *et al.* [18].

In this study, 69 patients with AASWs were evaluated, and 38 (or 55%) of them received emergency laparotomies. For the remaining 31 (or 44.9%) patients, abdominal observation was prescribed. Twenty-six (83.87%) of these patients received successful nonoperative treatment. The delayed laparotomy performed on the remaining five (16%) patients was always therapeutic. In line with prior studies, we discovered that 88.37% of cases who underwent exploratory laparotomies had visceral injuries [3–5]. Due to the potential benefits and hazards, the use of emergency laparotomy in patients with visceral evisceration has been highly disputed. Some researchers advise using selective observation [17,19–21]. However, numerous studies have demonstrated that visceral evisceration is a sign that an emergency laparotomy is necessary since intraabdominal injuries occur frequently – roughly 70–80% of the time [3,6,9–11]. According to the findings of our study, 10 (14.5%) and 12 (17.4%) patients experienced small bowel and omentum eviscerations. Four (33.33%) of the 12 cases with an isolated omental evisceration have been successfully treated without a laparotomy. Emergency laparotomy seems reasonable in patients with visceral evisceration because laparotomy revealed visceral injury in 15 (68.2%) of 22 instances that presented with visceral evisceration.

In our study, the nonoperative management had an 83.87% success rate. According to a South African study by Zafar *et al.* [22], 83.2% of patients who were chosen for nonsurgical therapy with monitoring only based on clinical evaluation succeeded. This study emphasizes the value of physical examinations in patient selection and follow-up throughout nonoperative treatment. No negative laparotomies with a second intention were discovered in this present research. There was no mortality in the second intention, in accordance with some researchers [22,23] who reported that delayed laparotomy did not raise mortality or morbidity.

Nonoperated patients' median hospital stay was 3 days, which was shorter than some African researchers had estimated [24,25] who rated it 8 days. Compared to the nonoperated patients, the routine exploration group's mean length of stay was 9 days instead of 3 days.

According to clinical searches, intestines are traumatized most often with stab wounds of the abdomen [17,26]. According to some authors, the liver (40%), small intestine (30%), diaphragm (20%), and colon (15%) are the most often injured organs by abdominal stab wounds [27]. In our analysis, the small bowel (34%), liver (18%), stomach (16%), and colon (16%) were the organs that were most frequently affected (Table 3). Our research reveals that young men with a mean age of 28 who were stabbed during a fight are the majority of those who suffer abdominal stab wounds in Aswan. Males in the city are 16 times more likely to be stabbed than females are.

The symptoms of AASWs vary, as do the persons who experience them. When a surgeon is handling a problem that is atypical for the practice, it presents a substantial challenge [3,21,28]. It is widely agreed that patients who are in shock, have diffuse peritonitis, or have been eviscerated should receive an emergency laparotomy [21,28]. Before any diagnostic tests can be carried out, a laparotomy is necessary in some of these situations. The likelihood of intraabdominal damage necessitating a therapeutic laparotomy in these patient categories is greater than 65% [21]. Additionally, there are several situations where an

immediate laparotomy is advised. A patient with a knife that has been retained could be one of those [9,28].

The literature has discussed the treatment of AASW with omental evisceration. Despite the controversy regarding it, published management guidelines support omental evisceration as a sign that a laparotomy is necessary to thoroughly check for intraabdominal injuries, which can occasionally be obscure. [28,29]. Nonetheless, a number of publications have emerged that reject omental evisceration as a laparotomy indication [17,19,20]. In one study, all cases with intestinal evisceration needed therapeutic exploration [21]. According to a different study, people who have had their bowels eviscerated can be managed safely using the SNOM approach [29].

This study did not include any missing intraabdominal injuries that required a laparotomy. Five out of the 31 individuals in our study who received selected treatment needed delayed surgical procedures, of which one (20%) had complications (wound infection). Eight (21%) of the 38 patients who received emergency laparotomies were unnecessary laparotomies [five (13.15%) negative laparotomies and three (7.9%) nontherapeutic laparotomies] whose indications were peritonitis, evisceration, and hypotention. While seven (18.4%) patients of the group undergoing emergency laparotomy developed complications, only one patient (2.6% of them died) from injury of the superior mesenteric vessel.

It is well acknowledged that the goal of treatment for individuals with AASWs should be to reduce the number of unnecessary laparotomies while identifying those who do require emergency laparotomy. According to clinical studies, individuals with AASWs have an unnecessary laparotomy incidence of 23–53%, and complications arise in 2.5–41% of trauma patients who have an unnecessary laparotomy [30,31]. These rates dropped to 7 and 4% throughout the study's later stages, when selective therapy was the standard procedure [32]. The treatment for abdominal stab wounds was guided by serial medical examinations that were performed by investigators from the Netherlands [11]. Without increasing mortality or morbidity from delayed exploration, they decreased the rate of laparotomies for stab injuries from 55 to 30% and the rate of nontherapeutic laparotomies from 24 to 0%.

Of the 38 patients in this study who presented with AASWs and had emergency laparotomies, 21% (n=8) had unnecessary laparotomies. However, by combining the diagnostic tests with selective treatment, we were able to reduce the rate of unnecessary laparotomies down to 0%. Previous studies revealed that a 5–22% complication rate is linked to negative laparotomy [31]. Our study's findings demonstrated that one patient, or 12.5% (one patient) of all patients receiving unnecessary laparotomies, developed complications (wound infection).

The low incidence of morbidity and unnecessary laparotomies in second intention laparotomies and short hospital stays of nonoperated patients makes routine emergency laparotomy controversial and SNOM in hemodynamically stable patients with AASWs seems prudent in agreement with many studies revealed that the nonoperative approach is reliable, applicable, and cost-effective for abdominal stabs in a large proportion of patients [12–14].

The surgeon should be aware that it could be challenging to differentiate between abdominal tenderness resulting from entrance wound and rebound tenderness in some patients. It is important to remember that bleeding from the entrance wound into the peritoneal space might occasionally result in peritoneal irritation. These could result in the false-positive diagnosis of diffuse peritonitis. In fact, the most accurate indicator of significant injury in our study was the symptoms of 'peritonitis' and 'hypotension.' Of the 17 laparotomies done for peritonitis, 15 were therapeutic, and among the 21 hypotensive patients, 18 were therapeutic. Nevertheless, according to some studies, the least accurate indicator of a significant injury was the subjective finding of 'peritonitis' [29,33].

Twenty of the twenty-six patients who received nonoperative treatments were seen for follow-up in the trauma clinic. None of them had any undiagnosed or delayed diagnosed injuries. The explanation for the number of patients missed during follow-up could be attributed to the potential that the other six patients may have presented to different hospitals with injuries. The goal of future research should be 100% follow-up.

Based on the findings of our study, it seems that an SNOM protocol is a secure and noninvasive method. The risks of delayed or missing diagnosis of injuries and the morbidity of laparotomy must be carefully considered while deciding to undergo SNOM. You may streamline this decision-making process by concentrating on two important questions. (a) In light of the imaging scan, laboratory tests, and

physical examination, what is the likelihood of intraabdominal injuries? (b) What tools are at the ready for you?

This investigation has to be performed with a much bigger patient sample to ascertain the incidence and clinical implications of delayed diagnoses. We suggest conducting a prospective, randomized multicenter trial to evaluate this strategy's cost-effectiveness and safety-effectiveness of this approach.

Conclusion

We concluded that a considerable decrease in unnecessary laparotomies is possible when patients with abdominal stab wounds who are asymptomatic or only mildly influenced receive the selective nonoperative treatment. However, visceral evisceration is a sign that an exploratory laparotomy is warranted since, in our study, the majority of individuals sustained organ damage. Patients who had abdominal stab wounds and demonstrated hemodynamic compromise or overt peritonitis were considered for emergency laparotomy.

Financial support and sponsorship

Nil.

Conflicts of interest

There are no conflicts of interest.

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