

Role of Laparoscopy in the Management of Visceral Injuries Following Abdominal Stab Wounds

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ABSTRACT

Background: Laparoscopy offers several advantages in the treatment of abdominal stab wounds. In this paper, we report our experience during 2004, where hemodynamically stable patients with stab wounds were managed laparoscopically.

Patients and Methods: Between January and December 2004, 8 hemodynamically stable patients (7 men, 1 woman) underwent laparoscopy for anterior abdominal stab wounds. Median age was 28.5 years (range, 17–55). All patients underwent an abdominal computed tomography (CT) prior to the laparoscopy.

Results: Exploration of the wound under aseptic conditions, carried out as a part of the physical examination, confirmed peritoneal penetration in 7 of the 8 cases. Abdominal CT revealed positive findings in 7 (87.5%) cases. Laparoscopy was performed after a median time of 60 minutes (range 30–90). Laparoscopic exploration evidenced peritoneal penetration in 100% of the cases and visceral lesions in 87.5% of the cases. All visceral injuries were managed laparoscopically. Median operative time was 135 minutes (range, 45–200). Operative mortality was 0% and early morbidity was 12.5%. Median hospital stay was 5 days (range, 1–11). After a median follow-up of 12 months (range, 1–28), 1 patient complained of persistent chest pain and a ventral hernia at the site of the abdominal stab wound was diagnosed in another patient.

Conclusions: Laparoscopy should be included in management algorithms in patients with anterior abdominal stab wounds who are hemodynamically stable. In addition to its diagnostic ability, this study demonstrates that laparoscopy can be an effective management modality with minimal morbidity and no mortality.

INTRODUCTION

ABDOMINAL PENETRATING WOUNDS have been treated historically by different methods. At the onset of World War I, observation of penetrating wounds of the abdomen was the mainstay of treatment. By the end of

World War II, abdominal exploration had become routine in the management of penetrating wounds of the abdomen.¹ The dogma of systematic laparotomy for all penetrating wounds of the abdomen^{2,3} was first questioned in 1960 by Shaftan,⁴ who reported a peritoneal penetration rate of 63% in his series of 112 abdominal wounds.

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Following this, several publications commented on the negative laparotomy rate after stab wounds, which varies from 9% to 61%.⁵⁻⁸ This is largely secondary to the absence of peritoneal penetration or the absence of visceral injuries in the presence of peritoneal penetration. It is crucial to appreciate that the morbidity of nontherapeutic and negative laparotomies can be as high as 33.3%^{6,9} and is related to pulmonary problems, wound infections, postoperative ileus, and ventral hernia.

Application of minimally invasive surgery in patients presenting with abdominal stab wounds potentially offers several advantages, such as low rates of negative laparotomy, confirmation of peritoneal penetration and visceral injury, reduced postoperative morbidity, and a shortened length of hospital stay.

The aim of this paper was to evaluate the sensitivity of abdominal computed tomography (CT) and laparoscopy in the diagnosis of visceral injuries and the feasibility of their management by laparoscopic techniques.

PATIENTS AND METHODS

We followed a specific management algorithm for patients with penetrating wounds on the anterior abdomen. If patients were hemodynamically stable and local wound exploration revealed no evidence of peritoneal penetration, they were observed in hospital for 24 hours. Hemodynamically unstable patients underwent an urgent laparotomy, in keeping with the Advanced Trauma Life Support (ATLS) protocol, whereas hemodynamically stable patients underwent an urgent abdominal CT. In this study, all patients—regardless of the results of the abdominal CT—underwent a laparoscopic exploration.

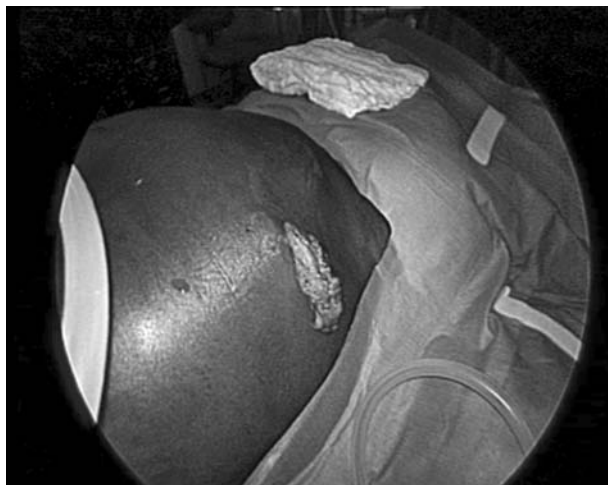


FIG. 1. Evisceration of the greater omentum at the left upper quadrant.

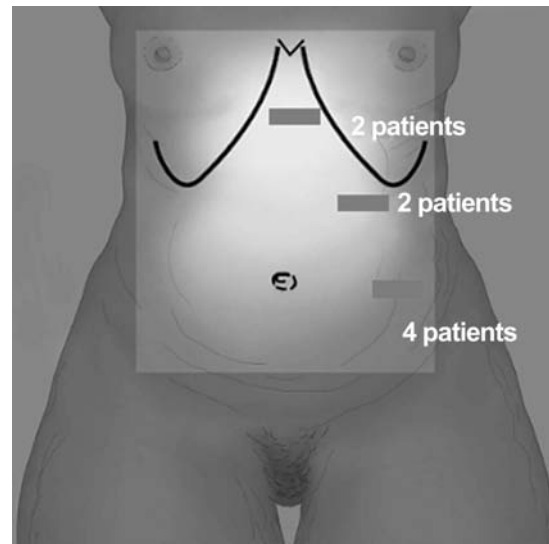


FIG. 2. Different sites of abdominal stab wounds.

Between January and December 2004, 8 hemodynamically stable patients (7 men, 1 woman) were admitted from the Emergency Unit for one or more stab wounds to the anterior abdominal wall (Fig. 1). All underwent a physical exam, a digital exploration of the stab wound under local anesthesia under aseptic conditions, and, as stipulated in the algorithm, an urgent CT followed by a laparoscopy. Median time from admission to laparoscopy was 60 minutes (range, 30–90). The median age was 28.5 years (range, 17–55). Of these 8 patients, 4 had an injury to the left flank, 2 to the left upper quadrant, and 2 to the epigastrium (Fig. 2). One patient presented with concomitant thoracic injury on the fifth left lateral intercostal space. Laparoscopic exploration and final clinical evaluation were used to determine the sensitivity of each modality (i.e., abdominal CT and laparoscopy).

Laparoscopic technique

The patient was installed in the supine position, with the legs apart. The surgeon stood between the legs and the assistant to his left. The pneumoperitoneum was obtained by an “open laparoscopy” technique at the right side of the umbilicus. A 30-degree angled optical system was inserted through a 10-mm trocar. After an initial exploration of the abdominal cavity, other trocars were placed in optimum ergonomic positions and others depending on the findings, with the aim of achieving a 90-degree working angle above the target organ.

Thorough laparoscopic exploration was carried out by “walking” the entire length of the small bowel and the colon, including an inspection of the liver and then the spleen, exploration of the retroperitoneum, and, in cases

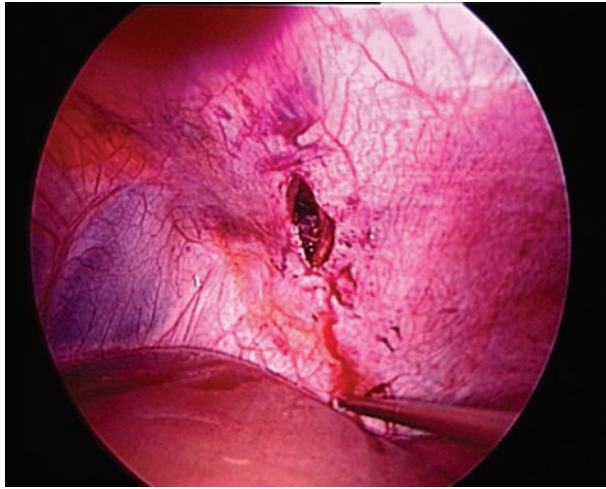


FIG. 3. Left diaphragmatic injury.

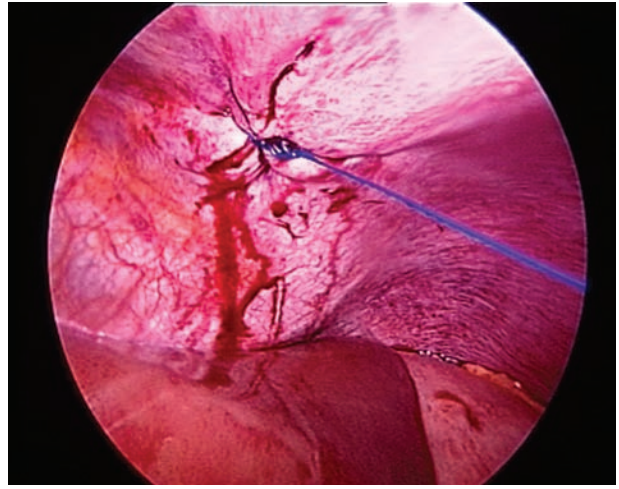


FIG. 6. Left diaphragmatic injury repair.

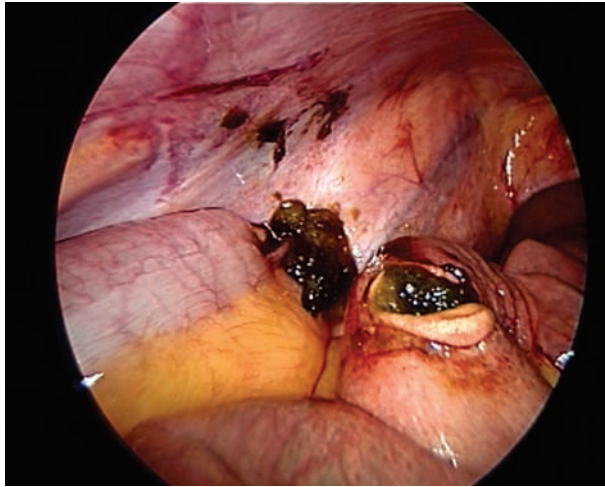


FIG. 4. Small bowel injury.

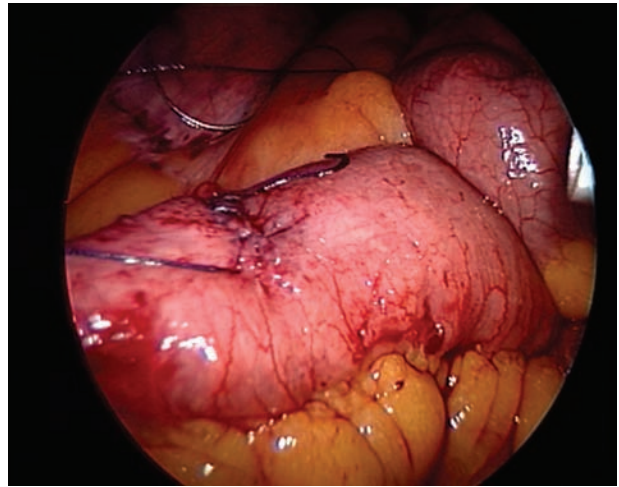


FIG. 7. Small bowel injury repair.

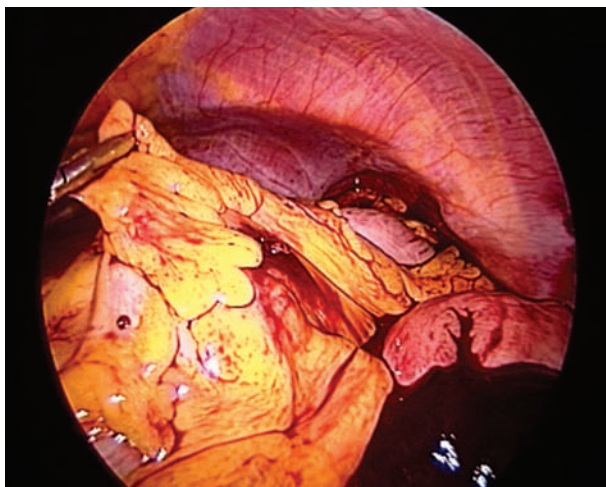


FIG. 5. Transverse mesocolon injury.

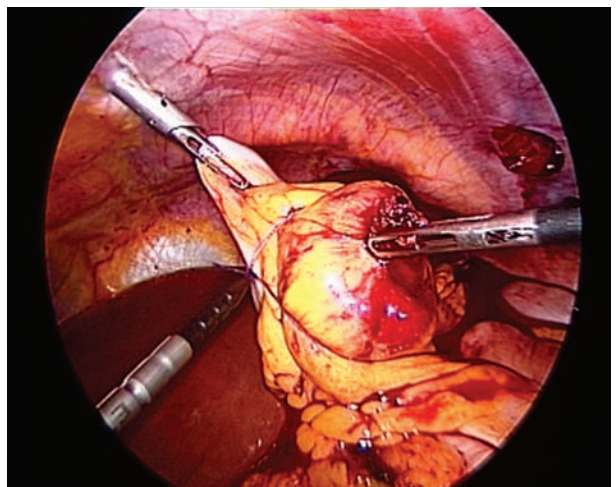


FIG. 8. Transverse mesocolon injury repair.

TABLE 1. SUMMARY OF THE INJURIES DIAGNOSED

<i>Patients</i>	<i>Physical exam</i>	<i>Computed tomography</i>	<i>Laparoscopy</i>	<i>Injury</i>
1	+	+	+	Mesocolon bleeding
2	+	+	–	Nil
3	–	+	+	Left diaphragm, left liver
4	+	+	+	Small bowel
5	+	–	+	Small bowel
6	+	+	+	Left diaphragm, small bowel ^a
7	+	+	+	Stomach, left diaphragm
8	+	+	+	Right diaphragm

^aThe patient had a missed small bowel injury who underwent a laparotomy.

of injury, to the upper part of the abdomen by gaining access to the lesser sac through the gastrocolic ligament. Finally, a lavage of the abdominal cavity was carried out and a drain was inserted in the pouch of Douglas. The stab wound and the 10-mm port site were closed with reabsorbable stitches. The skin of the stab wounds was closed primarily.

RESULTS

Wound exploration under local anesthesia revealed peritoneal penetration in 7 of 8 cases (87.5%) and was questionable in the 8th patient. An abdominal CT revealed positive findings in 7 of 8 cases (87.5%); it showed intraperitoneal fluid in 3 cases (37.5%), extraperitoneal free air in 1 case (12.5%), a combination of fluid and air in 3 cases (37.5%), and remained negative in 1 case (12.5%). Laparoscopic exploration of the abdominal cavity showed peritoneal penetration in all the cases and evidence of visceral injuries in 7 of 8 cases (87.5%). Table 1 gives details of the injuries detected: 1 right-sided diaphragmatic laceration, 3 left-sided diaphragmatic lacerations (Fig. 3), 1 injury to the anterior gastric wall, 2 injuries to the small bowel (Fig. 4), 1 active bleeding of the left hepatic lobe, and 1 bleeding of the transverse

mesocolon (Fig. 5). However, a small bowel perforation was unrecognized in a patient with a left-sided diaphragmatic injury. All diagnosed injuries were treated successfully by laparoscopy. The patient presenting a missed injury underwent a laparotomy for signs of peritonitis after the first 24 postoperative hours. Table 2 gives details of the strategy used for the laparoscopic management of the injuries, which consisted of suture repair of the diaphragmatic wound by nonreabsorbable stitches (Fig. 6), repair of the gastric wall and small bowel by reabsorbable stitches (Fig. 7), and control of bleeding by monopolar coagulation and nonreabsorbable sutures for the left hepatic lobe laceration and by reabsorbable stitches for the transverse mesocolon tear (Fig. 8).

In our series, an additional two or three 5-mm trocars were inserted for the laparoscopic management and the median operative time was 135 minutes (range, 45–200). Operative mortality was 0%, and there was no procedure-related morbidity. A chest drain was inserted in 1 patient with a concomitant thoracic stab wound and in 1 other patient with a diaphragm laceration from an abdominal injury. Serial chest X-rays were used to monitor the progress and resolution of the hemothorax and pneumothorax, and no secondary complications were noted.

Median length of hospital stay was 5 days (range, 1–11). At a median follow-up of 12 months (range, 1–28),

TABLE 2. LAPAROSCOPIC TREATMENT OF THE INJURIES AND HOSPITAL STAY

<i>Patients</i>	<i>Injury</i>	<i>Laparoscopic treatment</i>	<i>Hospital stay (days)</i>
1	Mesocolon bleeding	Suture repair	2
2	Nil	Nil	1
3	Left diaphragm, left liver	Suture repair, coagulation	6
4	Small bowel	Suture repair	4
5	Small bowel	Suture repair	3
6	Left diaphragm, small bowel ^a	Suture repair (+ chest drain)	11
7	Stomach, left diaphragm	Suture repair	9
8	Right diaphragm	Suture repair (+ chest drain)	7
			Median 5:

^aThe patient had a missed small bowel injury who underwent a laparotomy.

1 patient presented with chest pain after 5 months and another 1 with a ventral hernia at the site of abdominal stab wound after 14 months.

DISCUSSION

Clinical examination^{5,10} and digital exploration of the wound are the mainstays of the assessment of patients with stab injuries to the anterior abdomen. In our series, digital exploration had a sensitivity of 87.5% to diagnose a peritoneal penetration. Doubt can persist in the case of noncompliance by the patient, obesity, or in the case of extensive wound bleeding. The sensitivity of abdominal CT in showing visceral injury, in our study, was 87.5%. Rates of sensitivity of abdominal CT vary from 82% to 100%.^{10–12} Small bowel injury can result in false negatives, as was demonstrated in this series in 1 of our patients, in whom there were no CT signs of injury (e.g., fluid or free air).

When a doubt of perforation persists after a physical and CT examination, as occurred in 2 of our patients, a diagnostic laparoscopy should be considered and not just simple observation in the case of a nonpenetrating wound.¹³ Laparoscopy results in confirming or ruling out visceral injuries suspected on clinical or radiologic assessment and, more importantly, reveals lesions that do not justify surgical treatment.^{14–20} Laparoscopy, in our study, appeared to have a sensitivity of 87.5%, and in order to achieve a sensitivity of 100%, the systematic exploration of the abdominal cavity is mandatory, including “walking” the small bowel from the angle of Treitz down to the caecum, even if a perforation is detected, as multiple small bowel injuries are not uncommon. A small bowel perforation remained unrecognized in our series, either secondary to a technical failure or it is possible that the perforation was a result of the procedure itself, as small bowel injuries are known to occur, albeit rarely, both during and after laparoscopic surgery.²¹

The feasibility of the laparoscopic approach depends on the basic rules of laparoscopy. As this series demonstrates, an entirely laparoscopic approach to an injury can follow a diagnostic laparoscopy and depends on the experience and training of the surgeon. These procedures are usually performed after working hours and other rules, such as the presence of trained and experienced team members and optimum ergonomic conditions, are imperative. All lesions, in our study, were treated by laparoscopy with a 0% conversion rate, despite the fact that these procedures can be technically demanding. As demonstrated with other laparoscopic procedures, when compared to open surgery,^{22,23} patients are able to resume feeding faster with a reduced hospital stay, as was observed in this study.

CONCLUSIONS

Considering the accuracy of diagnosis and efficiency of treatment, we recommend that hemodynamically stable patients presenting with stab wounds, in whom there is a suspicion of peritoneal penetration, should always undergo laparoscopy, followed by the laparoscopic management of detected injuries, if they are amenable to the laparoscopic approach and if the expertise is available.

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