

## Emergency laparoscopy for abdominal stab wounds

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### Abstract

**Background:** Management strategies for abdominal stab wounds (ASW) in initially asymptomatic patients range from mandatory explorative laparotomy (EL) to conservative approaches with observation alone. Emergency diagnostic laparoscopy (DL) may play a potential role between these two extremes—hence lowering the rate of unnecessary laparotomies and keeping the rate of missed injuries to a minimum.

**Patients and Methods:** At our institution mandatory EL was carried out in every patient with ASW until 1992. In a retrospective study the charts of 43 patients with ASW were reviewed in terms of initial diagnostic procedures, intraabdominal injuries, and course and length of hospital stay. Between 5/1993 and 4/1995 DL was performed in a prospective study in 15 patients with suspected peritoneal penetration (PP) after ASW according to a standardized diagnostic and therapeutic algorithm.

**Results:** In 17 patients (40%) EL showed no PP; 15 (35%) had significant intraabdominal injuries, while 11 patients with PP didn't have lacerations of intraabdominal organs, resulting in an overall rate of nontherapeutic laparotomy of 65%. Mortality was 6% ( $n = 3$ ), average hospital stay 8 days. Primary DL could exclude PP in 10 out of 15 patients (66%). The remaining five patients (33%) showed PP: In two patients with ASW to the right upper quadrant, intraabdominal injuries could be excluded by DL, and in one patient a low-grade liver injury was treated laparoscopically, thus avoiding laparotomy in a total of 87% ( $n = 13$ ). In two patients with PP laparoscopy was converted to laparotomy: no pathological finding in one case, splenectomy for spleen laceration in the second patient, resulting in a rate of nontherapeutic laparotomies of 7%. All patients in this series had an uneventful course; average hospital stay was 2.4 days.

**Conclusions:** DL offers an important diagnostic tool in excluding peritoneal penetration in ASW, hence lowering the rate of unnecessary laparotomies. Given experience and

skills, laparoscopy may be used therapeutically in selected cases of ASW.

**Key words:** Abdominal stab wounds — Laparoscopy — Penetrating trauma

The necessity of urgent explorative laparotomy as a standard procedure in the treatment of abdominal stab wounds is controversial. Many surgeons, especially in the United States, tend to follow a more conservative approach in uncomplicated cases, arguing that 30–50% of all stab wounds do not even perforate the peritoneum and another 20–40% cases with perforated peritoneum do not involve visceral injuries which require surgical interventions—resulting in nontherapeutic laparotomy rates of up to 70% [8, 10, 15, 21, 26]. Until the end of the 1980s most European surgeons recommended an exploratory laparotomy if local exploration could not determine the depth of the wound. The argument is that even if there are no clinical signs of intraabdominal injuries, the disadvantages associated with an unnecessary laparotomy are minor compared to the danger of peritonitis in cases of delayed diagnosis of intestinal perforation [5, 9, 22, 24, 29, 34].

An alternative to these extremes is laparoscopy which allows the inspection of the peritoneum for signs of perforation and furthermore, in selected cases, the treatment of intraabdominal injuries [4, 10, 13, 14, 17, 21, 24, 26, 35]. The rate of nontherapeutic laparotomies, which are associated with a considerable morbidity, may thus be reduced, as well as the length of hospital stay and treatment costs [10, 17, 27, 32].

### Patients and methods

In a retrospective study we analyzed the type and extent of abdominal injuries caused by 43 stab wounds treated at our department between 1984 and 1992. In hemodynamically stable patients the decision for surgery was based on the findings of a wound exploration under local anesthesia. Only patients with suspected peritoneal perforation and subsequent laparotomies were taken into account. Ultrasonography was routinely used to determine

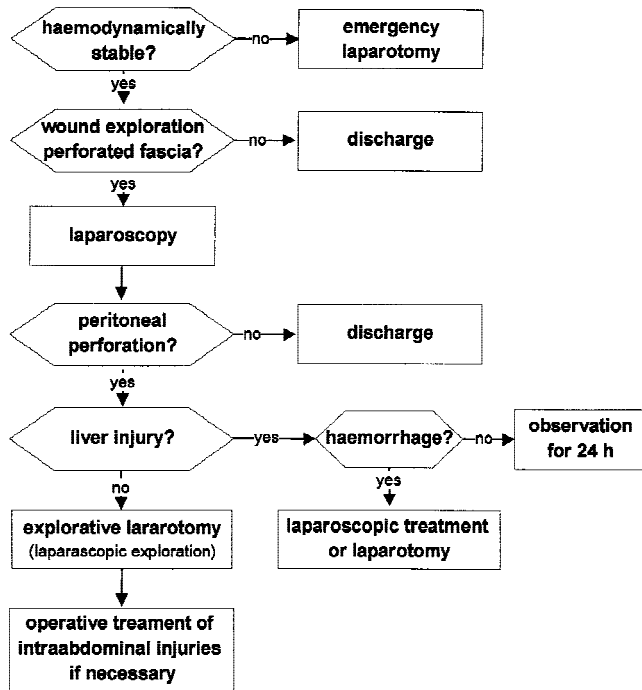


Fig. 1. Algorithm regarding the diagnostic procedure of abdominal stab wounds.

free fluid in the abdomen. Results were evaluated by the number of negative and/or positive findings. A laparotomy was considered nontherapeutic ("negative") if there was no injury to the peritoneum or a perforation but no intraabdominal trauma and hence required no further treatment.

Between May 1993 and April 1996 we conducted a prospective study employing video laparoscopy as the primary procedure in hemodynamically stable patients to determine whether the peritoneum had been penetrated (Fig. 1). Laparoscopy was performed after insufflation of approx. 2,500 cc CO<sub>2</sub> via a Veress needle, introducing the camera through a 10-mm port below the umbilicus. First, the peritoneum was carefully inspected for signs of perforation. In case of no peritoneal injury the laparoscopy was concluded, and the patient was discharged the following day. In case of peritoneal perforation, two additional 5-mm ports were inserted to allow retraction and better visualization of liver, spleen, omentum, and the paracolic fossae. In two cases hemorrhages from liver injuries were treated laparoscopically using diathermia and fibrine. In cases of suspected gastrointestinal perforation, open laparotomy through a midline incision was performed and the intestine was systematically explored.

## Results

Between 1/1/1984 and 1/4/1993, 43 laparotomies were performed due to abdominal stab wounds: forty (93%) patients were male; the average age was 34 years (range 16–67 years). Twenty-two (50%) stab wounds were in the left upper quadrant, 12 (29%) in the right upper quadrant, and nine (21%) in the lower abdomen. In 26 patients laparotomy disclosed a peritoneal perforation, but only 15 (35%) had additional injuries to intraabdominal organs. Here, a perforation of the small intestine was diagnosed in nine patients. A perforation of the stomach was found in two patients, whereby in both cases the anterior and posterior wall were penetrated. Three patients sustained injuries to the diaphragm; one patient had additional injuries to the left lung. Penetrations in the liver were observed in five cases and one patient each showed injuries to the right kidney, the spleen, and vena cava inferior. The mortality rate was 6%. One of

Table 1. Diagnostic and therapeutic management of ASW with suspected peritoneal perforation in hemodynamically stable patients<sup>a</sup>

	Explorative laparotomy	Diagnostic laparoscopy
Number of patients	43	15
Peritoneal perforation	26 (60%)	5 (33%)
Intraabdominal injury	15 (35%)	2 (13%)
Rate of negative laparotomies	28 (65%)	1 (7%)
Hospital stay (days) <sup>b</sup>	6.4	2.4
Morbidity <sup>c</sup>	5 (12%)	0
Mortality <sup>d</sup>	3 (7%)/0	0/0

<sup>a</sup> Mandatory laparotomy between 1984 and 1992 or diagnostic laparoscopy according to a standardized algorithm (Fig. 1) between 1993 and 1996.

<sup>b</sup> Average hospital stay for patients after *negative laparotomy* vs *negative laparoscopy* (no intraabdominal injury).

<sup>c</sup> Morbidity (local wound complications, thromboembolic events, pneumonia, atelectasis, intestinal obstruction, etc.) only for patients after *negative laparotomy* vs *negative laparoscopy*.

<sup>d</sup> Mortality: entire patient group/negative laparotomy vs laparoscopy.

these three patients died from severe injuries to the liver and inferior caval vein; another died from injuries to the branches of the pulmonary artery, and a 66-year-old patient died from myocardial infarction on the 1st postoperative day.

The average hemoglobin in patients with intraabdominal injuries was found to be 13.6 (6.2–17.2) with an average shock index of 0.8 (0.5–1.5). Preoperatively, all patients had abdominal X-ray examinations, which demonstrated free air in only two patients with intestinal perforation. Ultrasound examinations were carried out in all hemodynamically stable patients but did not reveal pathological findings. The average hospital stay was 8 days (2–25 days) for the entire group: eleven days after therapeutic laparotomy compared to 6.4 days in patients after nontherapeutic laparotomy. Table 1 gives a synopsis of the presented data.

Since May 1993, we performed a diagnostic laparoscopy as the primary procedure in all hemodynamically stable patients with abdominal stab wounds and suspected laceration of the anterior muscular fascia. In 10 of the 15 study patients (66%) peritoneal perforation was laparoscopically excluded and thus unnecessary laparotomy was avoided. Five patients had peritoneal perforation (33%): In one case a superficial but bleeding liver injury could be controlled laparoscopically using diathermia and fibrine; in two patients with the stab wound directing from the right upper quadrant into the right colic fossa we were able to exclude an intestinal perforation by laparoscopically mobilizing the cecum and ascending colon. They all had an uneventful course with a median hospital stay of 2.4 days. There were no intra- or postoperative complications resulting from laparoscopy and no false-negative laparoscopy.

Two patients eventually underwent laparotomy: without pathological findings in one case and for hemorrhage control with laceration of the spleen in the second patient. The average hospital stay in this group was 5.1 days (Table 1).

## Discussion

Considering the "rule of one-third" in anterior abdominal stab wounds (ASW) with suspected transperitoneal exten-

sion—roughly one-third of patients do not even have peritoneal penetration, one-third do not have intraabdominal lacerations in spite of peritoneal perforation, and only one-third show injuries which require surgical intervention—the use of exploratory laparotomy in all such patients is questioned [8]. In recent years more conservative and selective approaches have been advocated in order to reduce the 40–60% incidence of unnecessary—so called nontherapeutic—laparotomies with a policy of mandatory laparotomy [7, 21, 26, 35]. This seems quite reasonable with regard to overall treatment costs, a considerable morbidity of nontherapeutic laparotomies, which is reported to be up to 20%, and a mortality in the range of 0–5% [10, 27, 32].

A large volume of literature has surfaced which considers adjunctive measures such as sinogram [1], local wound exploration [21, 24, 25, 31, 33], peritoneal tap/lavage [11, 12, 16, 20], and combinations thereof in order to determine peritoneal penetration.

Most authors would agree that diagnostic procedures such as diagnostic peritoneal lavage (DPL) or ultrasonography (US) are only of limited use in the estimation of the severity of a stab wound [11, 24, 30, 34]. While injuries of parenchymatous organs are recognized with a sensitivity of more than 95% using US or DPL, early diagnosis of hollow viscus perforations is associated with a risk of 20–40% false-negative results, even with various enzyme determinations in the lavage fluid [3, 20, 23, 34]. On the other hand, the immediate performance of a laparotomy in cases of suspected peritoneal penetration has been disputed for many years. It is authors from Europe who appear to favor an immediate operation [5, 9, 22, 23, 29], while surgeons from parts of the world where stab wounds are more common prefer a conservative approach with the argument that 30–40% of these injuries do not even perforate the peritoneum. Some authors even report a laparotomy rate of less than 20% [8, 10, 15, 21, 26]. Patients showing no apparent clinical symptoms and inconspicuous routine diagnostics were merely observed for 1–2 days [26].

Of the 43 patients in the present retrospective study having undergone primary laparotomy, 26 (61%) had a peritoneal perforation and only 15 (35%) had injuries to intraabdominal organs. Hence, in retrospect, laparotomy was unnecessary in 28 patients (65%). In the prospective study using laparoscopy as the primary diagnostic procedure, peritoneal perforation was seen in five out of 15 patients, whereby in two cases no further injuries could be detected. These figures coincide with recent studies examining the significance of diagnostic laparoscopies in trauma patients [4, 6, 10, 13, 17–19, 28], while keeping negative laparotomy with its associated morbidity to a minimum. In conclusion, it must be said that only 30–40% of abdominal stab wounds require operative treatment.

It is difficult to decide whether it is justified to perform a great number of unnecessary laparotomies to prevent possibly severe complications in approx. 30% of cases. In this situation, laparoscopy offers a fair compromise between the two concepts. It represents an excellent minimal invasive procedure that can be performed in a short period of time and with only little distress to the patient.

In the present study the objectives of laparoscopy were to determine peritoneal perforation, to demonstrate intraabdominal injuries, and to determine the need for laparotomy.

It also served as a therapeutic instrument. It was possible to control bleeding from the liver in one case, and in another, the cecum and ascending colon were mobilized to exclude a perforation of the colon. There are reports of successful repairs of diaphragmatic and splenic injuries. Other authors, however, have warned that laparoscopy underestimates the extent of intestinal and splenic injuries [17]. We would certainly opt for open laparotomy if there was even the slightest possibility of an injury to hollow viscus. In our opinion, the laparoscopic technique is not yet advanced enough to allow an exact inspection of the small intestine.

It would be interesting to calculate a cost comparison of laparoscopy vs laparotomy or laparoscopy vs observation and laparotomy in selected cases. Although this aspect has not been investigated in the present study, we are convinced that due to the short hospitalization with an average stay of 2.3 days laparoscopy would be more cost efficient.

In summary, emergency laparoscopy in the diagnosis of abdominal stab wounds represents an excellent technique to exclude peritoneal perforation, hence lowering the number of unnecessary laparotomies. Some authors even perform emergency laparoscopies under local anesthesia, eliminating the disadvantages of general anesthesia [2, 30]. In our opinion, the advantages outweigh by far the disadvantages and possible complications. We are convinced that further developments in minimal invasive surgery will allow the use of laparoscopy not only as a diagnostic technique but also as a potent and valuable therapeutic instrument.

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