SAJS
General Surgery

Non-operative management of abdominal stab wounds – an analysis of 186 patients

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Summary

Background. The modern management of abdominal stab wounds remains controversial and subject to continued re-appraisal. In the present study we reviewed patients with abdominal stab wounds to examine and validate a policy of selective non-operative management with serial physical abdominal examination in a busy urban trauma centre with a high incidence of penetrating trauma.

Methods. Over a 12-month period (2005), the records of all patients with abdominal stab wounds were reviewed. Patients with abdominal stab wounds presenting with peritonitis, haemodynamic instability, organ evisceration and high spinal cord injury underwent emergency laparotomy. No local wound exploration, diagnostic peritoneal lavage or ultrasound was used. Haematuria in patients without an indication for emergency surgery was investigated with a contrasted computed tomography (CT) scan. Patients selected for non-operative management were admitted for serial clinical abdominal examination for 24 hours. Patients in whom abdominal findings were negative were given a test feed. If food was tolerated, they were discharged with an abdominal injury form.

Results. One hundred and eighty-six patients with abdominal stab wounds were admitted. There were 171 (91.9%) males, with a mean age of 29.5 years. Seventy-four patients (39.8%) underwent emergency laparotomy. There were 5 negative laparotomies (6.8%). The remaining 112 patients (60.2%) were assigned for abdominal observation. One hundred (89.3%) of these patients were successfully managed non-operatively. The remaining 12 patients underwent delayed laparotomy, which was negative in 2 cases (16.7%). Non-operative management was successful in 53.8% of patients overall. The overall sensitivity and specificity of serial abdominal examination was 87.3% and 93.5%, respectively.

Conclusion. Serial physical examination alone for asymptomatic or mildly symptomatic patients with abdominal stab wounds enables a significant reduction in unnecessary laparotomies.

General trauma surgeons in urban trauma centres frequently manage patients with abdominal stab wounds. Patients presenting with peritonitis, shock and evisceration require immediate surgery. Mandatory laparotomy in haemodynamically normal asymptomatic patients remains controversial. The roles of diagnostic laparoscopy (DL), local wound exploration (LWE), diagnostic peritoneal lavage (DPL), ultrasound (US) and computed tomography (CT), all aimed at reducing hospital stay and negative laparotomy rates, remain unclear. We conducted a review of patients with abdominal stab wounds in an attempt to examine and validate a policy of selective non-operative management with serial physical abdominal examination over a 24-hour period in a busy urban trauma centre with a high incidence of penetrating trauma.

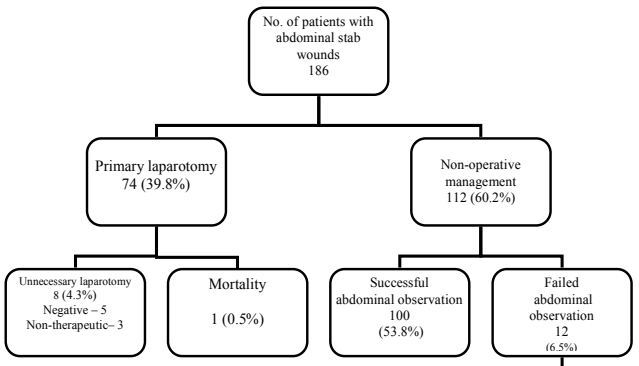
Patients and methods

Over a 12-month period (2005), the records of all patients with abdominal stab wounds presenting to an urban level one-type trauma centre at Groote Schuur Hospital, Cape Town, South Africa, were prospectively collected and reviewed. The abdomen was divided into four regions: anterior abdomen – subcostal margin above, anterior axillary lines laterally and pubis and inguinal ligaments below; posterior abdomen – subcostal margin above, posterior axillary lines laterally and buttock crease inferiorly; thoracoabdominal area – 4th intercostal space anteriorly, inferior angle of scapula posteriorly and costal margins inferiorly; and flank – costal margins above, anterior superior iliac spine below, between anterior and posterior axillary lines. All patients were initially assessed and resuscitated along Advanced Trauma Life Support (ATLS)® guidelines. Indications for emergency laparotomy were peritonitis, haemodynamic instability, organ evisceration, and a high spinal cord injury in addition to the abdominal stab wound. When the abdominal findings were benign, eviscerated omentum protruding from the anterior abdomen and flanks was ligated extracorporeally, resected and the remaining stump pushed back into the abdomen with fascial closure in the emergency room. No LWE, DPL or US was used. DL to detect unsuspected diaphragm injury

in a thoracoabdominal stab wound is not routinely practised. Instead, a highly select group of patients undergo DL to rule out diaphragm injuries: those with persistent left upper quadrant tenderness following abdominal observation, omentum herniation through the chest wall, and/or free air under the diaphragm despite benign abdominal signs.[1] Laparoscopic-assisted repair of diaphragm injuries (LARD) was attempted when these injuries were detected. Haematuria in the presence of peritonism was investigated with a single-shot intravenous pyelogram to ascertain whether both kidneys were functioning. Haematuria without an indication for immediate surgery was investigated with a CT scan of the abdomen with intravenous contrast. All patients with isolated grade 1 - 4 renal injuries were given a trial of non-operative treatment. Patients undergoing emergency surgery were administered triple antibiotic therapy; those with confirmed renal injuries undergoing non-operative management were given a single dose of gentamicin. An unnecessary laparotomy was further classified as negative where no intra-abdominal injuries were found, and non-therapeutic where an injury was found but did not require any intervention. Patients selected for non-operative management were admitted for 4 - 6-hourly repeated abdominal examinations and 4-hourly recording of vital signs (temperature, blood pressure, pulse, respiratory rate), including haemoglobin estimation. The in-house on-call surgeon (surgical registrar with college intermediate examination) was notified immediately if the patient developed abdominal distension, nausea, vomiting, diarrhoea, pyrexia and/or haemodynamic changes. After 24 hours, patients in whom abdominal findings were negative (non-peritonitic) were given a test feed, and if this was tolerated, were discharged with an abdominal injury form.

Results

One hundred and eighty-six patients sustained abdominal stab wounds during the study period. One hundred and seventy-one (91.9%) were male and 15 (8.1%) were female. The mean age was 29.5 (range 14 - 56) years. The final management outcome is shown in Fig 1. Seventy-four patients (39.8%) met the criteria for emergency laparotomy.



Total number of patients	186
Mortality	1 (0.5%)
Total laparotomy	86 (46.2%)
Therapeutic laparotomy	74 (86.0%)
Negative laparotomy	7 (8.1%)
Non-therapeutic laparotomy	5 (5.8%)
Non-operative success	100 (53.8%)

Fig. 1. Outcome in 186 patients with abdominal stab wounds.

There were 8 unnecessary laparotomies (4.3%), 5 (2.7%) being negative and 3 (1.6%) non-therapeutic. Damage control laparotomy was performed in 6 patients. There was 1 death, due to an aortic injury. The remaining 112 patients (60.2%) were selected for non-operative management, which was successful in 100 cases (89.2%). Twelve patients (6.5%) developed positive abdominal signs and underwent delayed laparotomy. The indications for surgery in this group are shown in Table I. There were 2 negative and 2 non-therapeutic laparotomies.

A total of 34 CT scans were done for haematuria. Only 3 patients with microscopic haematuria were not investigated (breach of protocol). Outcome in these cases was uneventful. Seventeen patients were found to have a kidney injury (grade 2 – 10, grade 3 – 5, grade 4 – 2). All were managed successfully non-operatively, including 3 patients with positive abdominal findings who had a delayed laparotomy for other reasons. Three patients returned following discharge after successful non-operative treatment of the kidney injury with delayed or recurrence of macroscopic haematuria. An intrarenal false aneurysm (2 cases) and arteriovenous fistula (1) were successfully aniographically embolised in these cases. The mean hospital stay for patients with no positive abdominal findings was 39.12 (range 30 - 51) hours. The mean stay for patients who underwent laparotomy for positive findings was 5.58 (range 4.5 - 6) days. The overall sensitivity and specificity of clinical abdominal evaluation was 87.3% and 93.5%, respectively. There was 100% follow-up at 2 weeks for patients with conservatively treated kidney injuries with no complications. No follow-up was done for the remaining patients successfully managed non-operatively. Our local interhospital policy is that all patients treated at our institution must return to our unit, or be transferred there immediately should they present elsewhere, if they develop a problem related to that admission after discharge. Since only 3 patients returned with complications (mentioned above), we assume that the remaining 97 did well with no complications.

TABLE I. INDICATIONS AND FINDINGS AT LAPAROTOMY IN PATIENTS WITH POSITIVE ABDOMINAL FINDINGS

Positive abdominal finding	
Peritonitis (including 1 patient with omentum evisceration)	**8**
Increasing local tenderness	**3**
Ureteric injury on intravenous pyelography	**1**
Negative laparotomy	**2**
Non-therapeutic laparotomy	**2**
Paracolic haematoma, kidney laceration	**1**
Liver laceration, haemoperitoneum	**1**
Therapeutic laparotomy findings	
Diaphragm injury, splenic laceration	**1**
Posterior gastric perforation and lesser sac abscess	**1**
Diaphragm injury	**2**
Diaphragm injury with omentum herniation	**1**
Transverse colon injury	**1**
Ureter (diagnosed on IVP), kidney, liver	**1**
Diaphragm, kidney laceration	**1**

Discussion

It is well established that in one-third of cases stab wounds to the anterior abdomen, flank and back do not enter the peritoneal cavity or injure retroperitoneal viscera. Also, anterior abdominal wounds only injure viscera in about two-thirds of patients.[2] To reduce unnecessary laparotomy rates, asymptomatic or mildly symptomatic patients with or without peritoneal breach may therefore undergo selective non-operative management. The diagnostic modalities available to the attending surgeon include serial physical examination and observation, or further testing such as DPL, LWE, US, CT scan and DL.

Routine exploration of abdominal stab wounds was generally the rule, until the hallmark report by Shaftan[3] in the 1960s. Shaftan, 'dissatisfied by a policy which permitted little use of surgical judgement', described the feasibility and success of selective conservative management. Using serial physical examination alone, other studies have further popularised this selective approach with excellent results.[4-12] Only 0 - 5.5% of patients have had delayed operations (false-negative initial physical examination), while negative and non-therapeutic laparotomies have been noted in only 1 - 5.8% and 2.3 - 8.5% of patients, respectively. In the present series, 8 patients (4.3%) had a delayed therapeutic laparotomy with no increase in morbidity. The unnecessary laparotomy rate was 6.4% (negative 7 (3.8%), non-therapeutic 5 (2.7%)), in keeping with previously reported results.

Evisceration (omentum and organ) has traditionally been an indication for emergency laparotomy. The rate of organ injuries has been reported to be as high as 70 - 80%.[13-16] However, many reports have refuted omentum evisceration as an indication for laparotomy.[17-19] While omentum evisceration with benign abdominal findings does not warrant emergency surgery, we emphasise the distinction between organ and omentum evisceration. In the current series there were 13 patients with omentum evisceration, 9 of whom presented with peritonism and had a therapeutic laparotomy. Of the remaining 4 patients who underwent abdominal observation, 1 developed peritonism and had a therapeutic laparotomy. Ten patients presented with organ evisceration and 9 underwent therapeutic laparotomy (Table II).

For this reason, organ evisceration remains an indication for emergency surgery in our centre.Omentum herniating through the chest wall in patients with benign abdominal findings must alert the treating physician to a possible diaphragm injury that requires further investigation and treatment.

LWE of anterior and flank wounds allows for identification of peritoneal penetration and for emergency room discharge when non-penetration is identified. We have never felt the need to employ LWE as part of our management of abdominal stab wounds, our rationale being that stab wounds rarely tract perpendicular to the abdominal wall, and in a slightly obese patient or one with thick abdominal musculature who is also combative and intoxicated LWE could be a tedious and technically demanding procedure to perform under local anaesthesia in a busy emergency room.

DPL has been used in clinically evaluable patients with anterior abdominal stab wounds to determine peritoneal penetration and the significance of intraperitoneal injury, with various DPL counts mandating operative intervention. DPL counts of less than 1 000 red blood cells (RBCs)/mm^3 have been shown to identify patients with negative LWE or insignificant abdominal stab wounds. Accuracy rates for therapeutic laparotomy range from 88% to 94%.[20] Some authors have even suggested that asymptomatic patients with DPL counts of less than 1 000 RBCs/mm^3 can safely be discharged from the emergency room.[21] We have no experience with DPL and penetrating trauma, and prefer to not perform invasive procedures in clinically evaluable patients.

The role of US in penetrating truncal wounds is unclear. Rozycki *et al.*[22] concluded that the use of emergency US is most valuable in patients with suspected pericardial tamponade and multisystem injuries where the cause of hypotension is unknown. Udobi *et al.*[23] showed a good positive predictive value with focused abdominal sonar for trauma (FAST) for injury, although the negative predictive value significantly reduced the accuracy of the test, 'limiting its overall utility'. US has recently been employed to detect fascial integrity after anterior abdominal stab wounds. When compared with LWE, fascial US had an overall sensitivity of 59% and specificity of 100%.[24] We do not practise FAST at all, and have found no place for US for penetrating abdominal trauma except in the stable patient with a suspected haemopericardium. At present the major role for laparosocopy in penetrating abdominal trauma may be in stable patients with anterior abdominal stab wounds who either have documented peritoneal breach or left thoracoabdominal stab wounds with suspected occult diaphragm injuries. It is well known that laparoscopy is a poor detector of hollow viscus injury and does not visualise the retroperitoneum adequately. DL is no better than serial physical examination, and in some series LWE and DPL, in reducing the incidence of unnecessary laparotomies. Leppaniemi *et al.*[25] showed in a prospective randomised study that laparoscopy offers little benefit over exploratory laparotomy in patients with demonstrated peritoneal violation. In patients with equivocal peritoneal penetration on LWE, laparoscopy detects more (mostly minor)

TABLE II. OUTCOME IN PATIENTS WITH EVISCERATION (*N* = 23)

Omentum evisceration	**13**
Organ evisceration	**10**
Indication for surgery: omentum evisceration	
Peritonism on admission	**9**
Admitted for abdominal observation	**4**
Delayed laparotomy for peritonism	**1**
Therapeutic laparotomy	**10**
Organ evisceration: laparotomy findings (10 patients)	
1. Small bowel	**Colon injury**
2. Small bowel	**Colon, diaphragm, kidney**
3. Small bowel & transverse colon	**Nil**
4. Small bowel	**Colon**
5. Small bowel	**Small bowel (x 2)**
6. Small bowel	**Small bowel (x 4)**
7. Small bowel	**Small bowel (x 2)**
8. Small bowel	**Active mesentery bleeding**
9. Small bowel	**Stomach**
10. Small bowel	**Small bowel and stomach**
Therapeutic laparotomy	**9**

organ injuries than expectant non-operative management, but increases hospital costs and stay, and sick leave requirements. They concluded that DL cannot be recommended as a routine diagnostic tool in anterolateral and thoracoabdominal stab wounds. We only use DL to detect obvious or symptomatic diaphragm injuries.[1]

Stab wounds to the posterior abdomen need special mention, because the diagnosis of hollow viscus and vascular injury is more difficult than in anterior wounds. Recent reports support the finding that repeated physical examination, supplemented by appropriately indicated studies, provides a high degree of patient safety. Henao *et al*.[26] (Bogota, Colombia) reported a false-negative laparotomy rate of less than 5% and a mortality rate of 1.3%. Similarly, Demetriades *et al.* [27] (Baragwanath Hospital) reported a prospective study of 230 patients, in which 5 patients underwent a non-therapeutic laparotomy and 30 (13%) a therapeutic laparotomy; diagnosis was delayed in 5 patients (2.2%), and there were no deaths. Furthermore, Whalen *et al*.[28] (King Edward VIII Hospital) report a 'negative' laparotomy rate of 4% and no mortality. We have also found that a selective approach rather than routine laparotomy for patients without clinical findings of bleeding or peritonitis is safe and reduces unnecessary laparotomies. Special studies such as DPL, angiography and CT are indicated on a case-by-case basis, and their routine use remains to be proven.

The primary diagnostic tool currently used in our centre for determining the need for abdominal observation following penetrating abdominal trauma is serial physical examination, which in this series has an overall sensitivity and specificity of 87.3% and 93.5%, respectively. The institutional algorithm is depicted in Fig. 2.

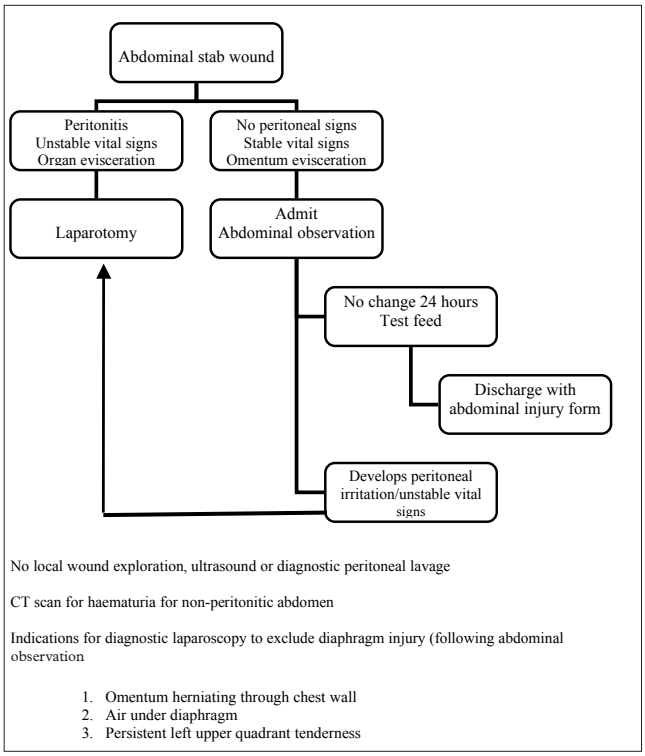


Fig. 2. Groote Schuur Hospital Trauma Centre management algorithm for abdominal stab wounds.

Presented at the annual meeting of the Surgical Research Society of South Africa, Nelson Mandela Medical School, Durban, July 2006.

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