

Diagnosis of significant abdominal trauma after road traffic accidents: preliminary results of a multicentre clinical trial comparing minilaparoscopy with peritoneal lavage

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Summary

A prospective multicentre study comparing the value of the recently introduced minilaparoscopy with peritoneal lavage in patients with abdominal trauma is in progress. To date 55 patients with blunt abdominal trauma have been entered into the study. Following initial resuscitation, 26 were randomised to peritoneal lavage and 29 to minilaparoscopy performed under intravenous sedation and local anaesthesia. The two groups were comparable with respect to age, sex, incidence of multiple injuries and mortality (2 patients in the lavage group and 1 in the minilaparoscopy group).

A negative test was obtained in 15 patients subjected to lavage and 12 patients who underwent minilaparoscopy. A further four patients in the minilaparoscopy group were found to have a minimal static haemoperitoneum. All these patients were treated conservatively and none required surgical intervention on the abdomen. Thus neither investigation carried a false negative rate.

A positive test was obtained in 11 patients in the lavage group and significant findings were observed in 13 patients assessed by minilaparoscopy. All these patients were subjected to emergency laparotomy. Absence of significant bleeding or trauma was observed at laparotomy in 3/11 (27%) and 1/13 (8%) in the lavage and minilaparoscopy groups respectively. Although both procedures were highly sensitive for the detection of significant intra-abdominal injury (100%), the specificity was 83% for peritoneal lavage and 94% for minilaparoscopy. The predictive

value of a positive minilaparoscopic examination was 92% as opposed to a positive predictive value of 72% for peritoneal lavage.

Introduction

Peritoneal lavage (1) has proved useful in the diagnosis of intra-abdominal injury following abdominal trauma and has largely replaced the 4-quadrant tap. However, false positive results from this procedure which lead to an unnecessary laparotomy are well documented (2-6). Even the use of CT has not eliminated the problem of negative laparotomy in patients suspected of intra-abdominal trauma (7). There have been favourable reports on the use of laparoscopy in these patients (8,9). As the conventional laparoscope is, however, not ideal for emergency work, the 4 mm miniature laparoscope—the minilaparoscope—was developed (10). Initial assessment with its use in the emergency department had indicated its safety and reliability in establishing the presence or absence of significant abdominal trauma (11). Encouraged by these early results, a prospective multicentre randomised clinical trial was designed to compare the value of abdominal lavage and minilaparoscopy in patients with blunt abdominal trauma. This paper reports on the preliminary findings of the study which is still in progress.

Patients and methods

Trial protocol All patients with blunt trauma and abdominal pain and positive signs (tenderness, rebound,

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diminished/absent bowel sounds) who were cardiovascularly stable after the initial resuscitation were entered into the trial. Patients who required immediate surgical intervention because of evidence of severe continuing internal bleeding or established peritonitis were excluded from the study. Following entry into the trial, each patient was randomised either to peritoneal lavage or minilaparoscopy.

The technique of peritoneal lavage was standardised with insertion of the cannula through a small subumbilical incision after local infiltration with 1% plain lignocaine. Ringer lactate solution (1.0 litre) was then instilled. The criteria for a positive test were:

- (1) Gross bleeding
- (2) RBC count >100,000/ml
- (3) WBC equal or >500/ml
- (4) Amylase >175 U/ml

The minilaparoscope (Storz, Tuttlingen) and accessories were used. The procedure was performed under intravenous sedation (diazepam) and local infiltration anaesthesia (1% lignocaine) of the subumbilical region in the midline. After the insertion of a Veress needle controlled insufflation of the peritoneal cavity (1.0–1.2 litres/min) was performed by a Semm's insufflator using nitrous oxide or CO₂. The stab wound in the abdominal wall was then enlarged slightly and the laparoscopic trocar/cannula assembly then inserted. The trocar was then removed, the prewarmed telescope attached to a fibrelight source introduced through the cannula, which was then connected to the gas tube from the insufflator. An accessory trocar/cannula was next inserted in the left upper quadrant to enable the introduction of the palpating/suction probe. The laparoscopic findings were classified as:

- (1) Negative
- (2) Minimal haemoperitoneum: small static amount of blood in either paracolic gutter
- (3) Moderate haemoperitoneum: obvious pooling in the peritoneal gutters and/or pelvis
- (4) Severe haemoperitoneum: generalised accumulation of blood throughout the peritoneal cavity surrounding intestinal loops
- (5) Solid organ trauma and perforation of hollow organ or indirect evidence of the latter, ie yellow fluid in the paracolic gutters.

All the patients with a negative lavage or minilaparoscopy and those with minimal static haemoperitoneum on laparoscopic assessment were managed conservatively, whereas patients with positive tests were submitted to emergency laparotomy soon after the investigation was completed.

Statistical analysis This was performed using Fisher's exact test between the two groups.

Results

The injuries were sustained in car ($n=43$) or motorcycle crashes ($n=9$) and 3 were pedestrians who were run over. The age range of the patients entered into the study so far is 7–67 years, median 26 years. Multiple injuries (head, osseous, intra-abdominal) were present in 19 patients and there were 3 deaths (severe head injuries in 2, multisystem failure/sepsis in 1). The details of the lavage ($n=26$) and minilaparoscopy group ($n=29$) are shown in Table I. The two groups were comparable with

TABLE I Details of patients entered into the study

	Lavage	Minilaparoscopy
No of patients	26	29
Male sex	16	22
Age in years, median (range)	30(7–67)	26(19–42)
Multiple injuries	10	9
Abdominal signs only	8	6
Deaths	2	1

TABLE II Findings in the lavage group

Lavage	Management	n
Negative	Conservative	15
Positive	Positive laparotomy*	8
Positive	Negative laparotomy†	3

*Significant active bleeding/trauma at operation

†No active bleeding, minor trauma at surgery

TABLE III Findings in the minilaparoscopy group

Laparoscopy findings	Management	n
Negative	Conservative	12
Minimal haemoperitoneum	Conservative	4
Moderate haemoperitoneum	Negative laparotomy*	1
Severe haemoperitoneum	Positive laparotomy†	11
Free intestinal fluid	Positive laparotomy‡	1

*No active bleeding or trauma

†Active bleeding/trauma

‡Small bowel perforation

TABLE IV Operative findings in patients submitted to emergency laparotomy

Injuries	Lavage	Minilaparoscopy
Multiple	2/8	2/12
Negative*	3/	1/13
Hepatic	3	6
Splenic	3	5
Colon	1	0
Mesenteric tear	2	2
Small bowel	0	1
Urinary bladder	1	0

*No active bleeding/minor trauma

respect to age, sex, incidence of multiple injuries and mortality.

The findings in the 26 patients submitted to peritoneal lavage are shown in Table II. Fifteen patients had a negative result and were treated conservatively. None of these patients required a subsequent laparotomy. A positive lavage was obtained in 11 patients, all of whom were subjected to emergency laparotomy. Three of these patients had no significant active bleeding, and only minor trauma was found which could have been managed conservatively: torn falciform ligament, minor omental tear, small non-bleeding surface laceration of right lobe of liver (1 cm).

Out of the 29 patients who were investigated by minilaparoscopy, 12 had a negative inspection of the

peritoneal cavity and 4 had a small static haemoperitonium (Table III). These 16 patients were treated conservatively and did not require subsequent laparotomy. The laparoscopy findings in the remaining 13 patients were considered significant enough to warrant a laparotomy soon after admission. All but one were found to have significant trauma/bleeding at operation. The only false positive case in this group was a patient with moderate haemoperitonium associated with a fractured pelvis without major intra-abdominal/pelvic organ injury. Details of the operative findings in the patients submitted to emergency laparotomy from the lavage and minilaparoscopy groups are outlined in Table IV.

The only difference between the two groups that has emerged so far is the higher unnecessary laparotomy rate in the lavage group (3/12) when compared to the patients which had a minilaparoscopy as their initial assessment for the detection of intra-abdominal injury although this difference is not significant (Fisher exact test $P=0.23$). Based on these data, both procedures are highly sensitive for the detection of significant intra-abdominal injury (100%). The specificity was 83% for peritoneal lavage and 94% for minilaparoscopy. The predictive value of a positive minilaparoscopic examination was 92% as opposed to a positive predictive value of 72% for peritoneal lavage. There were no complications attributable to either lavage or minilaparoscopy.

Discussion

This trial has shown that 60% of patients with a stable cardiovascular state who have abdominal pain or tenderness after a road traffic accident do not have serious intra-abdominal injury. However, significant intra-abdominal injury and bleeding may be present with minimal signs and early detection requires specific investigative procedures to identify pathology at an early stage soon after admission. In this respect both peritoneal lavage and minilaparoscopy are 100% reliable in excluding significant intraperitoneal injury. The results of the trial to date suggest that minilaparoscopy may have an advantage over peritoneal lavage in reducing the number of unnecessary laparotomies. Although there were no false positives in the lavage group, 27% of patients with a positive lavage had no active bleeding at operation and could thus have been managed conservatively. This finding accounts for the lower specificity and predictive value of a positive test observed in relation to peritoneal lavage when compared with minilaparoscopy. The difference in the diagnostic discrimination of the two

procedures is the result of small inconsequential static haemoperitonium from small tears of the peritoneal folds/ligaments or minor lacerations of the liver which can be identified and watched for several minutes by laparoscopy but which give rise to a positive lavage test.

It is not possible to determine the gain by early detection of these injuries by the two procedures over repeated clinical observations and it seems likely that the majority of these injuries would have been detected in this way or by radiological/ultrasound investigations. Nonetheless the delay factor would on *a priori* grounds enhance the morbidity of these patients. Also, sudden cardiovascular collapse can occur in a previously stable patient whilst being investigated in a radiological department.

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