Management of perforated peptic ulcer in a district general hospital

AC Critchley¹, AW Phillips², SM Bawa³, PV Gallagher³

¹Royal Victoria Infirmary, Newcastle upon Tyne, UK

²Freeman Hospital, Newcastle upon Tyne, UK

³Wansbeck General Hospital, Ashington, UK

ABSTRACT

INTRODUCTION Laparoscopic surgery has become increasingly popular for elective surgery but it has gained slow transference to emergency surgery. The management of perforated peptic ulcers (PPU) laparoscopically is an accepted strategy yet it still remains infrequently used. The purpose of this study was to analyse the utility and outcomes of laparoscopy versus open repair for PPU in a district general hospital. In addition, we evaluated whether the subspecialty of the on-call consultant affected the method of repair performed and the training opportunities for trainee surgeons.

METHODS Between 2003 and 2009, 53 patients underwent laparoscopic repair, 89 patients underwent open repair and a further 20 patients had laparoscopic repair that was converted to open repair for PPU. The results from a prospectively compiled database were analysed with primary outcome measures including operative time, length of hospital stay and mortality.

RESULTS The median operating time in the laparoscopic group was 60.0 minutes compared with 50.5 minutes in the open group. Hospital stay in surviving patients was significantly shorter in patients treated completely laparoscopically (5 days) when compared with the open group (6 days) ($p < 0.01$). There were six deaths in the laparoscopic group (11%) compared with 13 in the open group (15%) and one in the converted group (5%). Trainees performed 53% (47/89) of open repairs and 13% (7/54) of laparoscopic repairs.

CONCLUSIONS Both laparoscopic and open repair are equally safe in the management of PPU. Our findings support the view that this procedure can be successfully used as a training operation.

KEYWORDS

Laparoscopy – Peptic ulcer perforation – Training

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CORRESPONDENCE TO

Adam Critchley, ST6 in General Surgery, Royal Victoria Infirmary, Queen Victoria Road, Newcastle upon Tyne NE1 4LP, UK
E: adamcritchley@doctors.net.uk

The introduction of *Helicobacter pylori* eradication therapy and the use of proton pump inhibitors have led to a decline in the incidence of perforated peptic ulcers (PPU).^{1,2} Despite this, PPU remains a frequent surgical emergency with 2,060 cases reported in England in 2008–2009³ with an average mortality rate of 5.8% in a recent review of the literature.⁴ If left untreated beyond 24 hours, the mortality approaches 50%.⁵ Non-operative management has been shown to be effective in certain patients although it is difficult to predict reliably those who will respond successfully.⁶ Surgical management usually involves an upper midline laparotomy and repair of the perforation with a combination of simple suture repair and pedicled omentoplasty.

Since laparoscopic PPU repair was first attempted in 1990,⁷ three randomised controlled trials have shown laparoscopic management to be a safe and efficacious strategy with significant reductions in post-operative pain.^{8–10} Multiple non-randomised studies also support this view.^{11–22} In addition, Siu *et al* demonstrated shorter operating time, reduced chest complications, shorter post-operative hos-

pital stay and earlier return to normal daily activities than with open repair.⁹ However, both Lau *et al*⁸ and Bertleff *et al*¹⁰ demonstrated significantly longer operating times and no significant reduction in hospital stay or incidence of post-operative complications. The 2005 Cochrane review concluded that ‘outcomes from laparoscopic surgery for PPU are not clinically different from those of open surgery, which is the actual gold standard’.²³ The heterogeneity of data available may partly explain why laparoscopy is still not commonly employed as a first-line strategy in suspected PPU.

Between 2000 and 2009 there was a 33% fall in the number of emergency operations for PPU.⁵ Coupled with the time constraints of the European Working Time Regulations, this decline may impact on surgical training by reducing the exposure of surgical trainees to managing PPU. Laparoscopic management may further impinge on training if consultants are performing the procedure themselves as part of their learning curve.

Table 1 Demographics of patients operated and operative data. Values are median (range).

	Laparoscopic repair <i>n</i> =54	Laparoscopic Converted to open <i>n</i> =20	Open repair <i>n</i> =89	<i>p</i>
Age (years)	54 (17–96)	53 (18–82)	60 (17–95)	0.13*
Sex (M:F)	38:16	12:8	49:40	0.19**
ASA grade				0.0703*
I	10	5	16	
II	22	5	25	
III	12	6	22	
IV	8	3	22	
V	0 (52)	0 (19)	3(88)	
Operating time (mins)	60 (10–180)	70 (45–225)	50.5 (15–120)	0.056†
Length of Stay (days)	5 (1–21)	6 (1–21)	6 (1–29)	0.01†
Surgeon Specialty				<0.001**
Upper GI	41	10	16	
Colorectal	9	3	37	
Breast	4	7	36	
Operating Surgeon				<0.001**
Consultant	47	12	42	
Trainee	7	8	47	

* Kruskal Wallis test

** Chi-square test

† Mann-Whitney U test

The aims of this study were to evaluate the methods of repair performed within a single NHS trust and to assess patient outcomes following either laparoscopic or open repair. In addition, we evaluated whether the subspecialty of the on-call consultant affected the method of repair performed and the training opportunities for trainee surgeons.

Methods

The Northumbria Healthcare Trust (NHCT) provides health-care to more than 500,000 people over a wide geographical area. Consultants from colorectal, upper gastrointestinal and breast subspecialties cover the general surgery on-call rota across two hospital sites. The decision of whether to manage a suspected PPU by laparoscopic means is left to the discretion of the operating surgical team.

Data were collected from a prospectively compiled surgical database (Surgical Information Recording and Interrogation System, Xentec Ltd, Wallsend, UK) between September 2003 and September 2009. The start date of 2003 was identified as it coincided with the appointment of three upper gastrointestinal consultants with a special interest in laparoscopy within NHCT. All patients operated on for PPU were included. Diagnosis was made on clinical and/

or radiological grounds. The consultant in charge chose the method of repair.

Three distinct subgroups were analysed depending on the operation performed. These included definitive laparoscopic repair, primary open repair and those converted from laparoscopic to open repair. Further information including sex, age and ASA (American Society of Anesthesiologists) grade were recorded. The primary outcome measures included length of operative time, length of hospital stay and post-operative mortality. Reasons for conversion from laparoscopy to laparotomy, the subspecialty of the consultant in charge and the grade of the operating surgeon were also analysed.

Median (range) values were calculated for continuous variables and for all time data. Statistical analysis was carried out with Mann-Whitney U or Kruskal-Wallis tests. A chi-square test was used for categorical data. A *p*-value of <0.05 was considered statistically significant. All statistical procedures were carried out using VassarStats (<http://faculty.vassar.edu/lowry/VassarStats.html>).

Table 2 Breakdown of repair methods in each sub treatment group

	Laparoscopic repair	Converted	Open repair
Omental Patch Repair	35	18	81
Suture Repair	8	1	5
Irrigation	10	0	0
Other	0	1	3

Table 3 Mortality rates in each group

Causes of Mortality	Open repair	Laparoscopic repair	Laparoscopic converted to open
Multi-organ failure	6	4	1
Pneumonia	1	1	0
Cardiac	3	1	0
Other	3*	0	0
Total (%)	13 (15%)	6(11%)	1 (5%)

*1 CVA, 1 small bowel infarction 1 liver failure

Results

A total of 163 patients underwent surgical repair for PPU over a 6-year period. The demographic characteristics of the three groups are shown in Table 1. They were similar in age range, sex distribution and ASA classification status. The majority of perforations were of the duodenum (135/163, 83%) but gastric perforations (23/163, 14%) and pre-pyloric perforations (5/163, 3%) were also encountered. Over half the patients (55%, 89/163) underwent a primary laparotomy and 33% (54/163) underwent definitive laparoscopic repair. Within the group of 74 patients in whom laparoscopic management was attempted, there was a 27% conversion rate (20/74). The operative technique employed is shown in Table 2.

Length of operation

There was no significant difference in length of operation time between the laparoscopic and open groups ($p=0.056$). The converted group had longer operating times than both with a median of 70 minutes. There were no reoperations in the laparoscopic or primary laparotomy groups.

Length of hospital stay

The median length of stay in surviving patients was significantly shorter in patients treated completely laparoscopically (5 days) when compared with the open group (6 days) ($p=0.01$).

Table 4 Reasons for conversion of laparoscopic cases to open repair

Reason for conversion	Number (%)
Unable to visualise ulcer	8 (40)
Laparoscopy for diagnostic intent only	6 (30)
Adhesions	3 (15)
Technically unable to repair	2 (10)
Suspected Malignancy	1 (5)

Mortality

The causes and rates of mortality are shown in Table 3. Deaths within the laparoscopic group comprised five ASA grade 4 patients and one ASA grade 3 patient (median age: 69 years, range: 53–96 years). Within the group treated by open repair, eight patients were ASA grade 4 or 5 and three were ASA grade 3. The ASA grade of two patients was unknown. (Median age: 75 years, range: 52–95 years). There was one death in the group of patients converted from laparoscopic to open repair (ASA grade 4).

Reasons for conversion

The reasons for conversion to open repair are shown in Table 4. One patient in the converted group was found to have a large supraposterior ulcer that had perforated into the lesser sac. The perforation was too large to repair, necessitating a distal gastrectomy and gastrojejunostomy. Two further laparotomies were required within the first 30 days for management of duodenal stump blowout. There was no significant difference in conversion rates according to patient sex (24% male [12/50] vs 33% female [8/24], $p=0.639$).

Consultant subspecialty and grade of operating surgeon

As a subspecialty, oesophagogastric consultants performed the most procedures overall (67/163, 41%) and the majority of laparoscopic repairs (41/54, 76%). The output of colorectal and breast teams were similar. Consultants performed 62% (101/163) of all procedures combined and 87% (47/54) of all definitive laparoscopic repairs. However, trainees performed 53% (47/89) of open repairs.

Discussion

Laparoscopic management of PPU has been shown to be a safe procedure with a definite reduction in post-operative pain.^{5,8–10,17,19–21} The 2005 Cochrane review suggested a trend towards a decrease in septic abdominal complications but that larger randomised controlled trials are needed to prove this assumption and to assess the effect of the surgeon's learning curve on patient outcome.²⁵ Solomon and McLeod demonstrated that patient outcome improves with increasing surgical experience whenever a new technique is introduced.²⁴

Our results show that for 45% of PPU treated surgically laparoscopy was used initially. In 73% of these the perfora-

tion was managed successfully without requiring conversion to an open repair. Interestingly, in those patients who did have their operation converted, the documented reason for nearly a third of cases was that the laparoscopy was for diagnostic purposes only. The two main reasons for conversion from laparoscopy to open repair in our study were failure to identify the perforation (40%) and diagnostic intent (30%). Technical problems including adhesions, inability of the surgeon to make a safe repair and suspected malignancy made up only a minority of cases. The three most common reasons for conversion in the literature are size of perforation (often >10mm), inadequate ulcer localisation and difficulties placing reliable sutures owing to friable edges.^{4,25} Overall, conversion rates in the literature average 12.4% (range: 0–28.5%).⁴

Our study has demonstrated a significantly shorter hospital stay in those patients having a completely laparoscopic repair, as reported in various other studies.^{9,14,26,27} Nevertheless, these findings must be interpreted with caution given the lack of randomisation and potential for data heterogeneity. The suggestion that operative time is significantly longer in patients treated laparoscopically was not corroborated by our data.^{8,10} Length of operation was shown to be among the most heterogeneous outcomes in the 2005 Cochrane review.²⁵

PPU still carries high morbidity and mortality rates with wound infection, intra-abdominal collections, sepsis and multiple organ failure proving major obstacles to recovery.⁴ Our results showed comparable mortality between the three subgroups (15% in the laparotomy group vs 11% in the laparoscopic group vs 5% in the converted group). In the 2009 literature review by Bertleff and Lange, average mortality was quoted as 3.6% following laparoscopic repair and 7.2% following open repair.⁴ In our study, 45% of patients (74/163) were ASA grade 3–5 and all 20 mortalities fell within this group. Mortality rates of up to 50% within elderly groups have been documented.²⁸ At our institution, elderly age and high ASA grade did not preclude patients from laparoscopic management. Certain studies have regarded ASA grade 3/4 status, age of >70 years and perforation diameter of >10mm as a contraindication to laparoscopic repair.^{20,29–31}

There were six deaths in the laparoscopic group. Five of these were patients classified as ASA grade 4 and the other was grade 3. It could be inferred from this that laparoscopy is certainly very effective in those patients of ASA grade 1 and 2 but less so in patients with greater co-morbidities. However, we would suggest that laparoscopic management should be at least considered for these patients. Ten patients were found at laparoscopy to have sealed perforations. In these cases the seal was left undisturbed and the peritoneum irrigated, a technique that has been described before.^{32,33} Previous studies have documented exposing the already sealed perforation to assess the underlying pathology.⁹

In high-risk patients where the trauma of a laparotomy incision would increase the surgical stress response and impede post-operative recovery, laparoscopy could provide diagnosis and treatment with less trauma to the patient.³⁴ Bertleff and Lange found 93–98% of all diagnoses in patients

with an abdominal emergency could be established with diagnostic laparoscopy, of which 86–100% are subsequently therapeutic.⁴ Large abdominal incisions carry a significant risk of wound infection and post-operative incisional hernias in up to 15%.^{35,36} Song *et al* advocated the single-stitch laparoscopic repair method for perforations of ≤10mm diameter.³⁷ They suggested this straightforward technique could reduce laparoscopic operating time and could be performed by the on-call surgical team with basic laparoscopic skills.

There remains no consensus in the literature as to the ideal method of PPU repair although multiple techniques have been described.^{18,21,22,38–40} In our study, the method of repair was left to the discretion of the operating surgeon (Table 2). There were no incidences of post-operative leak or morbidity due to the technical factors in ulcer repair.

Management of PPU was undertaken by consultants with interests in three main subspecialties: oesophagogastric, colorectal and breast surgery. Our findings demonstrated a noticeable impact of consultant background on the type of repair undertaken. Within our trust the oesophagogastric surgeons have a strong interest in laparoscopic surgery. This may have influenced both the decision to use laparoscopy primarily and the success in completing operations without needing to convert to open repair.

The incidence of PPU has declined since the treatment of *H pylori*.^{1,2} Surgical management of these patients was previously a common operation seen frequently by surgical trainees. However, with fewer presentations of perforated ulcers, the advent of laparoscopic management and trainee surgeons working fewer hours, the opportunity to manage these patients has reduced. Our own findings have demonstrated that while trainees are more likely to be the primary surgeon in open repairs (53%, 47/89), the use of laparoscopy will mean they are much less likely to be the primary surgeon (20%, 15/74).

Despite this, 13% of patients (7/54) managed completely laparoscopically had a trainee as the primary surgeon, demonstrating that this procedure can be used successfully as a training operation. This is supported by the 1997 study by Siu *et al* where trainees under supervision performed approximately 80% of cases in the series.³⁶ Nevertheless, the trend towards consultant-led management of surgical emergencies and a perceived greater technical demand in carrying out a laparoscopic repair may lead to even fewer opportunities.

Conclusions

The implementation of laparoscopy as a first line treatment is more likely in surgeons with a particular interest in laparoscopy although trainees under direct supervision can carry out safe repair. Our findings provide good evidence that laparoscopic surgery is a safe method for managing PPU. We found no significant increase in operating time and no additional mortality risk compared with conventional open repair. Furthermore, laparoscopic management should not necessarily be confined to those patients with fewer pre-ex-

isting co-morbidities and may confer advantages to patients conventionally thought of as high risk.

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