Comparison study between the outcome of laparoscopic and open repair of perforated duodenal ulcer

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Background Duodenal ulcer perforation is a surgical emergency that may lead to a risk for major morbidity and even mortality. Patient selection criteria are crucial to guide the surgeon in selecting the option of laparoscopic approach for patients with perforated duodenal ulcers. The purpose of this study was to compare the resulting outcomes for laparoscopic and open approaches for the repair of perforated duodenal ulcers.

Patients and methods A total of 26 patients with perforated duodenal ulcers were included in this study, operated at Alain Hospital and Ain Shams University Hospitals, from June 2013 to June 2016. A total of 13 patients were operated by the laparoscopic approach and 13 patients were operated by the open approach. Follow-up indices such as mean operative time, hospitalization expense, and postoperative pain were included. The main outcomes were immediate surgical postoperative complications, fatalities, and reoperation. Secondary outcomes included operative time, postoperative pain, postoperative hospital stay, and time to resume diet.

Results There were no major differences in the selected patients between these two procedures in main outcomes including overall surgical efficacy including surgical complication rate and surgery-related deaths. Further analysis of the surgical outcome revealed that laparoscopic repair had less surgical wound complication rate (wound infections and incisional hernias) compared with the open approach. Otherwise both approaches had almost similar rates of leakage, intra-abdominal collections, and ileus and thromboembolic complications. Regarding the secondary outcomes, it was notable that postoperative pain was much less, return to the regular diet was earlier, and hospital stay was decreased in the laparoscopic approach. This remarkable improvement of the secondary outcome attributed to overall patient satisfaction in the laparoscopic approach.

Conclusions Laparoscopic approach is comparable with the open approach as a modality of repair for perforated peptic ulcer in the properly selected patients. The obvious advantages of laparoscopic surgery are the lower surgical site infection rates, early return to regular diet, shorter hospital stay, early return to work, less postoperative pain, better cosmetic outcome, and improved overall patient satisfaction. However, more studies should be undertaken to further assess the safety and efficacy of laparoscopic repair for peptic ulcer disease in the high risk patients' category.

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Introduction

Omental patching has been introduced in 1937 by Roscoe Reid Graham, who published his study on a series of cases of perforated duodenal ulcer that were successfully treated with an omental patch. He reported that omental patch is enough for the proper closure of duodenal perforation [1,2]. Laparoscopic repair of a perforated duodenal ulcer was first done by Mouret *et al*. in 1990 [3]. About 70 years after the initial description of omental patching, till now, this approach is very useful in selected patients with perforated duodenal ulcers. The first studies have aimed to determine the feasibility and safety of that approach [4–6]. Laparoscopic repair of perforated duodenal ulcer (DU) is better than open repair in the aspects of reduced pain, shorter hospital days, cosmetic outcome, and patient satisfaction. These improved outcomes of laparoscopic repair have led to a general inclination to relay on that laparoscopic repair which gradually replaced open repair for patients with perforated DU in selected cases. This trend was supported by the remarkable improvement in pharmacologic management and more standardization of the laparoscopic technique. However, it is worth mentioning that not all patients are suitable for laparoscopic repair. Some studies have concluded a significantly higher reoperation rate after laparoscopic repair than after open repair [7,8]. Despite the fact that many studies have reported that the outcome of laparoscopic and open repair in perforated DU is almost similar, the choice of management plan frequently remains a challenge to surgeons. [9].

Objective

The aim of this study was to compare surgical outcomes of laparoscopic and open intervention for perforated DU including intraoperative and postoperative phases, highlighting the advantages

and disadvantages, the possible complications in both approaches with specific consideration to overall patient satisfaction.

Patients and methods

This is a comparative study that was conducted in Ain Shams University Hospitals and Alain Hospital from June 2013 to June 2017. A total of 26 cases of perforated DU were included in this study distributed randomly into two groups (groups 1 and 2) of 13 cases each. Patient demographics as regards age preference ranging from 26 years for the youngest and 59 years for the eldest, all having informed written consent; 22 cases were men and four cases were women. In group 1 the laparoscopic approach was used and in group 2 the open approach was used. Patients in each group were assessed regarding the following parameters: (a) conversion rates to open method, (b) procedure time, (c) intraoperative complications, (d) postoperative pain, (e) postoperative complications, (f) duration of hospital stay, (g) Reoperation, and (h) cost effectiveness.

Intravenous fluid resuscitation and electrolyte correction, intravenous antibiotic therapy, and proton-pump inhibitors (PPIs) were applied for all patients preoperatively.

The inclusion criteria: patients with perforated duodenal ulcer and confirmed by exploration, any gender and any age.

The exclusion criteria: patients with late presentation more than 24 h, shocked patients, those with gastric outlet obstruction and bleeding ulcer.

Conversion criteria

Patients with perforation more than 10 mm, difficult identification of the perforation, cardiovascular instability, and iatrogenic injury that could not be managed laparoscopically were set to be converted to laparotomy.

The procedure followed is in accordance with ethical standards of the responsible institutional committee on human experimentation and with the Helsinki Declaration of 1975, as revised in 1983.

All the patients were assessed through patient's history, clinical evaluation, radiological evaluation, and laboratory investigations (complete blood picture, bleeding profile, liver function tests, renal function tests, sodium, and potassium) for routine preoperative evaluation.

Surgical technique for the laparoscopic procedure

The patients were usually operated in the Lloyd-Davies (French) position with anti-Trendelenberg position and the operating surgeon stood between the patient's legs. The peritoneal cavity is accessed either by veress needle or the Hasson technique. A 10 millimeter port was introduced through a supraumbilical incision. A 30° camera was introduced through that port for primary abdominal exploration. If the diagnosis is confirmed, the other trocars are placed under laparoscopic guidance. Two 5 mm working ports were placed on the right and left midclavicular lines superior to the level of the umbilicus. The prepyloric and the duodenal regions are visualized to localize the perforation. After that, meticulous peritoneal irrigation and suction of all abdominal compartments was accomplished with extra attention to subphrenic, subhepatic, and pelvic regions along with obtaining samples for cultures. An amount of 5–7 l of saline might be needed to do proper irrigation. Then, the perforation was repaired using intracorporeal 3/0 interrupted stitches that were tied over a pedicled omental patch. The number of stitches depends on the size of the perforation. In our practice, two to three stitches can provide sufficient outcome. Before ending the procedure, in selected cases methylene blue test was used to rule out leak from the repair.

Surgical technique for the open procedure

After the patient is placed in supine position on the operating table, the abdomen is prepared and draped in a standard fashion. An exploratory upper midline abdominal incision is fashioned for entry into the peritoneal cavity.

Suctioning of gastrointestinal spillage and of any fibrinous exudates is quickly performed, and attention is turned to inspection of the doudenum and visualization of the perforation. The perforation can be usually found on the anterior wall of the duodenum, in proximity to the duodenal bulb. If the perforation is not apparent, mobilization of the duodenum along with inspection of the stomach and jejunum should be carried out next.

In our technique, three or four suture full-thickness bites were placed ~0.5 cm away from the edges of the perforation from one margin to the other and are laid out on each side of the duodenum.

A patch of omentum is brought without tension and positioned over the perforation, and the sutures are successively tied from the superior to the inferior aspect

across the omental patch to anchor the omental graft in place.

In our technique, in case of bigger ulcers, the modified Graham patch is applied to ensure competency of the closure.

That patch in which a jejunual loop is used to patch the perforation by seromuscular sutures. However, we did not use this technique in this study.

Postoperative management

The patients were assessed and monitored postoperatively (vital signs, fluid chart, abdominal drain output observation, along with clinical chest, and abdominal examination). Therapeutic management was done including antibiotics and venous thromboembolism prophylaxis in addition to the intravenous PPI. Nasogastric tube was usually removed once the bowel motility was regained and the amount of the aspirate was decreased. The patient was allowed to start with sips of oral liquids at the beginning and then graduate progression to full oral intake is maintained as the patient is tolerating.

Patients were discharged if they are vitally stable; the pain is controlled, without vomiting, with no abdominal drains, or nasogastric tubes. Oral PPI medication was prescribed for 2–3 months. Upper gastrointestinal endoscopy was performed to assess healing of the ulcer and to evaluate the status of *Helicobacter pylori* infection. The *H. pylori*-positive patients were given a 2-week course of triple therapy that included lansoprazole, amoxicillin, and clarithromycin.

Follow-up

The first outpatient follow-up was 1week after discharge; the usual postoperative follow-up of patients with perforated duodenal ulcers included the following: lifestyle modification, reviewing the medications and endoscopy for ensuring of ulcer healing and eradication of *H. pylori* were recommended after 6 weeks postoperatively. All patients were followed up clinically for 6 months.

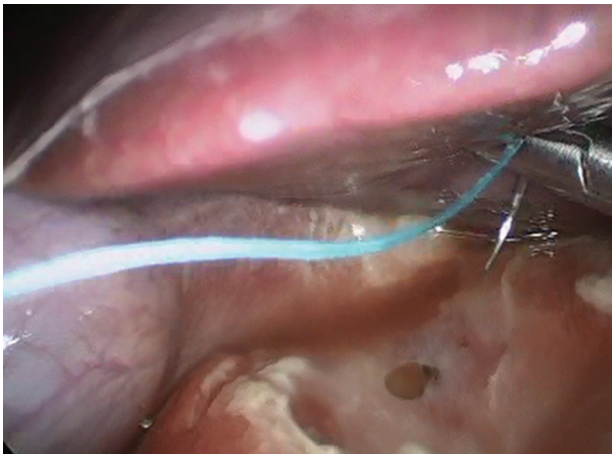
Results

A total of 26 patients with a perforated duodenal ulcer were included in this study, who were operated at Alain Hospital and Ain Shams University Hospitals, from June 2013 to June 2016. Totally, in13 patients the laparoscopic approach was used (Figs 1–3).

Group 1 had a mean age of 35.7 years and group 2 (13 patients operated with open approach); had a mean age of 39.6 years 22 (84.6%) patients were men and 4 (15.6%) patients were women. Both patients in the laparoscopic and the open repair groups were all matched for age, sex, and insurance policy.

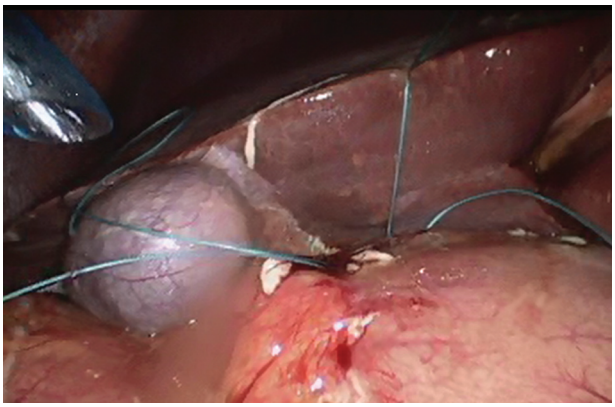
Anterior duodenal wall perforation was found in 26 patients, indicating the rarity of perforation of the posterior wall. No cases were converted from the laparoscopic approach to the open during this study. The mean operative time was longer in the laparoscopic group, 79.58 vs. 66.88 min in the open group. The mean hospital stay was 5.1 days (range: 4–8 days) for laparoscopy versus 8.8 days (range: 6–14 days) in the open surgery group. Most of the patients restored their bowel movements in the second or third postoperative day. However, two patients from the open group suffered from ileus,

Fig. 1



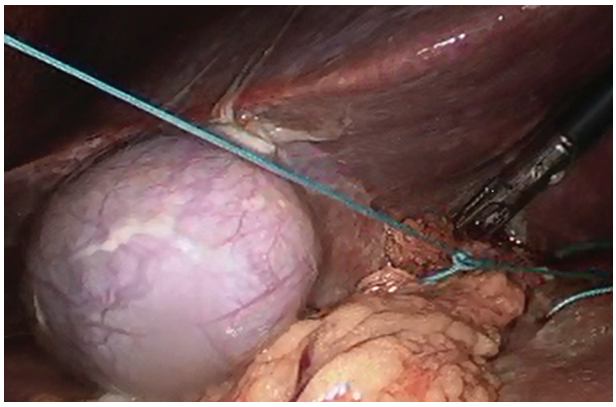
First duodenal part perforation.

Fig. 2



The perforation is repaired using intracorporeal 3/0 interrupted stitches.

Fig. 3



Interrupted stitches are tied over a pedicled omental patch.

regained their intestinal mobility in the fifth and sixth day. The resume of oral intake was gradual and was guided by the return of intestinal sounds and the decease of the drained amount by the nasogastric tube. Generally most of the patients in both groups started gradually oral intake between the third and sixth postoperative day. Regarding wound infection, only two patients from the open group were noted to have surgical site infection, and were treated with limited drainage and prolonged antibiotic course. No thromoembolic complications were detected in both groups as standard VTE prophylaxis was applied.

All patients in the study came for postoperative follow-up over the whole period of the scheduled follow-up time.

Pain

Assessment of postoperative pain in this study was objectively estimated by measuring the needed analgesics to control the patient's pain.

The postoperative pain was markedly lower in group 1 (laparoscopic repair); only mild analgesics (paracetamol) were required to control the pain in most cases (92.3%) and only for 3–5 days. Patients in group 2 (open repair) suffered from moderate to severe pain due to the exploratory abdominal wound. Multimodal analgesics including opioids were needed to control the pain in all patients for a prolonged period of 5–10 days.

Moderate or severe pain that can interfere with the daily activity or prevent from was not recorded in any of the two groups.

Reoperation

One case of the laparoscopic group was reoperated on the fourth postoperative day due toaccumulation of abdominal collection because of the repair failure. It was diagnosed clinically as indicated by the abdominal drain content and was confirmed radiologically. The patient was reapproached by open abdominal exploration and extensive washout was done. The previous repair was taken down and the modified Graham patch was applied. The patient after the second intervention had an uneventful postoperative course.

Cost

The initial costs were higher in the laparoscopic group more than in the open repair group; however, the early recovery and return to work should balance this initial higher expenses.

Discussion

Since the introduction of the management of perforated duodenal ulcers by omental (Graham) patch plication in 1937, the surgical technique has been evolved with the introduction of different modifications and approaches which often used the same principle of closure of the perforation combined with extensive peritoneal lavage. The approach of open repair of perforated duodenal ulcers remained the gold-standard treatment. It was simple and effective and provided long-term regression of the disease when combined with eradication of *H. pylori* and recess of nonsteroidal anti-inflammatory medication. In these patients, mortality is frequently associated with underlying sepsis and inflammatory response, which correlates with patient risk factors rather than surgical technique or complications. With the advent of the laparoscopic era and the radical shift to the minimally invasive techniques, most of the surgical schools started looking into less invasive approaches to manage perforated DU. The first successful laparoscopic repair of perforated duodenal ulcer was done in 1990. And since then with progressive acquaintance with the laparoscopic concept and laparoscopic suturing skills, and the reduction in the duration of surgery, many improvements and modifications to the mini-invasive techniques has been introduced making it more reliable and popular.

The laparoscopic technique offers patients with perforated duodenal ulcers the same general advantages as for other laparoscopic surgeries – a cosmetically improved outcome, less surgery-related pain, less surgical wound complications (surgical

hernias and wound infection), and rapid recovery as indicated by early mobilization and return to work.

It was the goal of this study to highlight the efficacy and the improved outcome of laparoscopic approach of perforated duodenal ulcer repair based on the analysis of the collected data in this study that stands for the critiques who still underestimate the laparoscopic approach outcome.

The ultimate result from our research is that the decision-making regarding the choice of the laparoscopic approach and the decision to convert to open is the main stay of patient safety and surgery success, not the laparoscopic technique itself, the superiority of which might be considered out of discussion by some, in the properly selected cases.

Although we were not able to randomly select the patients for the laparoscopic approach for ethical reasons, it is essentially known from previous studies that high risk patients might be prone to postoperative complications like leakage and might need resurgery. We used mainly Boey's scoring system as reference and in this study all the laparoscopic groups were either of Boey's score 0 or 1.

Hence, we cannot state that the laparoscopic approach is absolutely superior to the open approach; a more accurate term is – we think – that it is only superior when applied to the same category of patients, Boey's 0 and 1 only. Going beyond this, it is still an area of uncertainty; yet, at this stage, encouraging laparoscopic intervention for more advanced cases (Boey's 2 and 3) is beyond the scope of this study.

Conclusion

The laparoscopic approach for perforated duodenal ulcers has more advantages over open surgery in selected patients. Our study showed that laparoscopic repair for perforated DU results in better overall patient satisfaction as indicated by less postoperative pain, shorter use of nasogastric tube, improved cosmetic result, shorter hospital stay, and early return to routine activities in comparison with open repair. There are overall fewer complications in the laparoscopic group although larger randomized trials may be still needed to confirm this. Most importantly, a standardized approach with special care to suturing, focused sequential lavage, and early mobilization postoperatively is essential for improved outcomes.

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Conflicts of interest

There are no conflicts of interest.

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