

Comparison between Laparoscopic and Open Repair of Perforated Duodenal Ulcer

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Background: A fatal consequence of peptic ulcer (PU) is perforation, which necessitates prompt surgical intervention. The easiest, most dependable, and best option is to simply close the hole with an omental patch. Laparoscopic repair of a perforated duodenal ulcer is preferable to open repair in terms of less discomfort, less time spent in the hospital, improved wound healing, and decreased risk of incisional hernias.

Aim of work: to compare the postoperative outcome of laparoscopic repair of perforated duodenal ulcer, with the outcome of the conventional open repair using omental patch in both groups.

Patients and methods: this prospective comparative study was conducted in emergency department of Kasralainy hospital, Cairo University and included 40 patients presenting with acute abdominal pain and diagnosed with perforated duodenal ulcer divided into 2 groups 20 patients for each group.

Result: Group underwent open repair, mean duration of the operation was shorter with higher rate of surgical site infection and longer post-operative hospital stay. Group underwent laparoscopic repair, mean duration of the operation was longer, with shorter mean post-operative hospital stay and less incidence of postoperative complications.

Conclusion: we suggest that laparoscopic repair of a perforated duodenal ulcer is a safe and dependable surgery that should be considered for all patients providing that necessary expertise is available.

Key words: Peptic ulcer (PU), perforated duodenal ulcer, omental patch, re-admission, leakage, laparoscopic repair.

Introduction

A potentially fatal consequence of peptic ulcers (PU) is perforation, which often necessitates prompt surgical surgery.¹ In 2–10% of peptic cases particularly in the elderly, perforation occurs with a high mortality risk.²

The anterior surface of the duodenum is where most perforated ulcers are found. Most of the patients are chronically unwell older people, and 40–50% of them use medications that might cause ulcers, including non-steroidal anti-inflammatory medicines.³

The mortality rate for perforated duodenal ulcer ranges from 1.3% to 20%. Risk factors for perforated duodenal ulcer include corticosteroids, smoking, NSAIDs, physiological stress, *Helicobacter pylori* (*H. pylori*), and a prior history of perforation.⁴

perforated duodenal ulcer symptoms include upper abdominal pain, due to gas and stomach juice that enter the peritoneal cavity and cause chemical peritonitis. Sudden onset of abdominal pain or pain that becomes worse quickly is typical for perforated duodenal ulcer.⁵

Chemical peritonitis, and excruciating pain might cause tachycardia. The hallmark of perforated duodenal ulcer is the typical triad of abrupt onset of abdominal pain, tachycardia, and abdominal stiffness.⁶

The fundamental important tests are a serum

lipase/amylase test and an immediate erect chest X-ray. On an upright chest X-ray, 75% of perforated duodenal ulcer had air under the diaphragm.²

The easiest, most dependable, and best option is to simply close the hole with an omental patch.⁷

It is proposed that laparoscopic repair of a perforated duodenal ulcer is preferable to open repair in terms of less discomfort, less time spent in the hospital, improved wound healing, better cosmetics, and decreased risk of incisional hernias.²

Some writers employ laparoscopy only on low-risk patients and strictly choose individuals with perforated peptic ulcers for the procedure. Some treat perforated peptic ulcers by using a "laparoscopy-first" approach.⁸

Aim of the work

The aim of the present work was to compare the postoperative outcome of laparoscopic repair of perforated duodenal ulcer, with the outcome of the conventional open repair using omental patch in both groups.

Patients and methods

Patients employed in the study are males and females ageing from 18 to 65 years presenting to emergency department of Cairo University hospitals with acute abdominal pain and diagnosed with perforated duodenal ulcer.

Data from male and female patients who attended to the emergency department in the study period meeting the study criteria, presenting with acute abdominal pain, erect chest X-ray showing air under diaphragm, with a prior history suggestive of perforated duodenal ulcer and scheduled for open (group A) or laparoscopic (group B) exploration and omental patch repair were employed in the study groups.

► **Inclusion criteria of the study**

1. Male and female patients with perforated duodenal ulcer.
2. Age between 18-65 years old.

► **Exclusion criteria of the study**

1. Children below 18 years.
2. Traumatic perforations.
3. Patients with co-morbidities.
4. Pregnant females in first or third trimester.
5. Covid +ve patients.
6. Patients with septic shock.

► **Sample Size:**

40 patients; 20 for each group.

Group A: Open surgery group

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

Suctioning of gastro-intestinal spillage and of any fibrinous exudates is performed quickly, and attention is directed to inspection of the duodenum and visualization of the perforation.

Proper Peritoneal irrigation and suction of all abdominal compartments was accomplished with 5–7 L of saline.

Three full-thickness sutures of vicryl 3/0 were placed 0.5 cm away from the edges of the perforation 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 were successively tied from the superior to the inferior aspect across the omental patch to anchor the omental graft in place (**Fig. 1**).

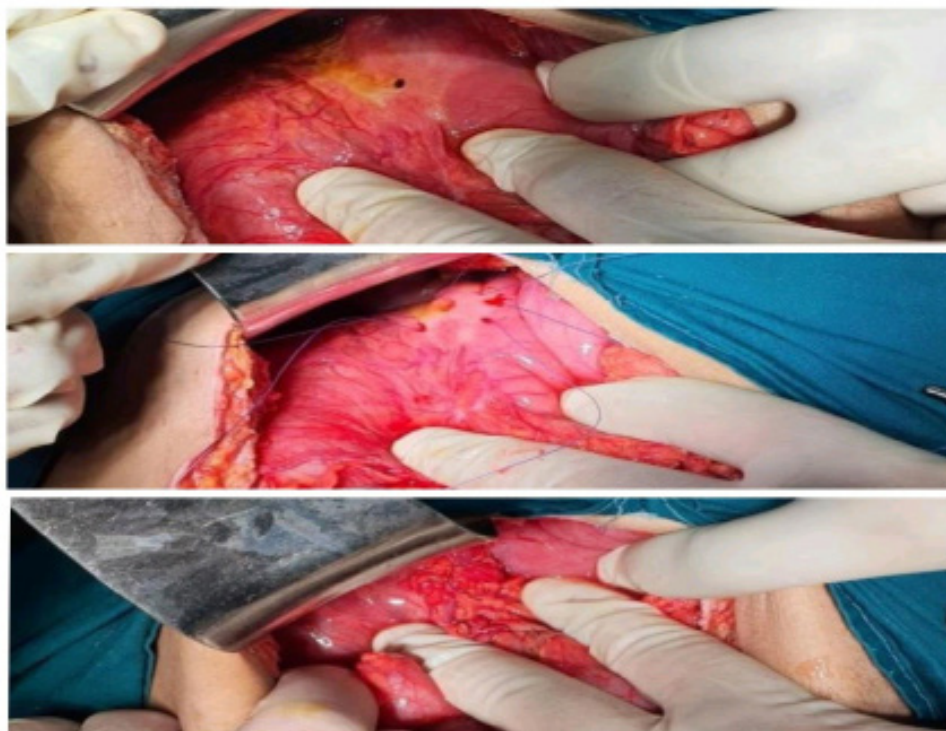


Fig 1: Open repair of a perforated duodenal ulcer by omental patch.

Group B: Laparoscopy group

The patients were operated in the anti-Trendelenburg 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 supra umbilical 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 5–7 L of saline.

Then, the perforation was repaired using three full-thickness sutures of vicryl 3/0 that were tied over a pedicled omental patch (**Fig. 2**).

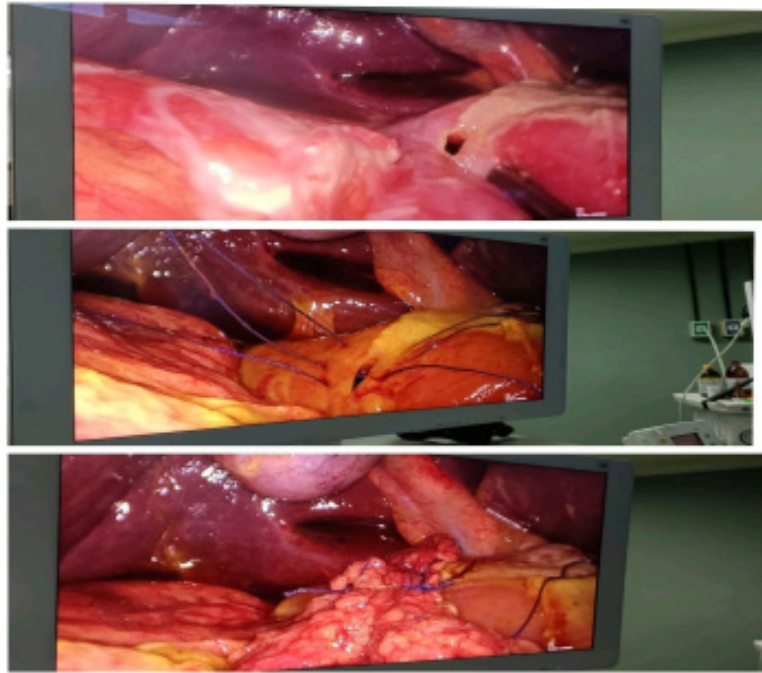


Fig 2: Laparoscopic repair of a perforated duodenal ulcer by omental patch.

The two groups; open and laparoscopic omental patch closure of perforated duodenal ulcer, were compared regarding the following points:

1. Postoperative leakage. n (%).
2. Postoperative hospital stay. (In days).
3. Mean duration of the operation. (In minutes).
4. Surgical site infection. n (%).
5. Re-admission. n (%).

Results

This study was conducted on 40 patients with perforated peptic ulcer who came to the emergency department at Cairo University Hospitals.

The median age of the patients was 38 years old, and they ranged from 25 years old to 56 years old. 77.5% of the patients employed in the current study were males. 55% of the study patients diagnosed

with perforated duodenal ulcer mentioned a positive history of NSAIDS intake, 45 % reported a history of smoking and 17.5% reported history of addiction. History of previous episodes of peptic ulcer disease represented 15%. Only 5% of the patients reported history of steroids intake (**Table 1**).

Mean duration of the operation was found to be shorter in the open group (75.5 ± 12), when compared to laparoscopic group (81 ± 11). The difference between open and laparoscopic group was statistically insignificant. (P value > 0.05)

2.5% of the patients were complicated with postoperative leakage; which represents 5% of the open group and 0% in the laparoscopic group. (P value > 0.05)

Mean post-operative hospital stay was 6.2 ± 0.6 days in open repair group, and was significantly less in laparoscopy group (4.85 ± 0.7 days). (P value < 0.05)

10% of the patients were complicated with surgical site infection; with a percentage of 15% of the open group and 5% of the laparoscopic group. (P value > 0.05)

Only 2.5% of the patients were readmitted for burst abdomen which is only 1 case in the open group with percentage of 5% of the open group and 0% in the laparoscopic group. (P value > 0.05) (**Table 2**).

Table 1: Demographic and clinical data of the patients

	All	Group A	Group B
Age	38.4±8.7	38.8±9.1	37.9±8.5
Gender			
Males	31	15	16
Females	9	5	4
History of NSAIDs intake (Yes)	22	10	12
History of steroids intake (Yes)	2	0	2
History of smoking (Yes)	18	10	8
History of peptic ulcer (Yes)	6	5	1
History of addiction (Yes)	7	5	2

Table 2: Comparison of the outcomes of open and laparoscopic repair

	All	Open	Laparoscopic	p- value
Mean postoperative hospital stay (In days)	5.5±0.6	6.2±0.6	4.85±0.7	0.0001*
Post-operative leakage	1	1	0	0.31
Mean duration of the operation (Minutes)	78.58±11.8	75.5±12	81±11	0.13
Surgical Site Infection	4	3	1	0.29
Readmission	1	1	0	0.31

Discussion

One of the most critical causes behind severe abdominal pain presentation at the emergency department is peptic ulcer perforation. Accurate diagnosis of perforated duodenal ulcer is challenging; it requires meticulous history taking, physical examination and rapid investigations all combined together. Rapid diagnosis and early decision can be life-saving to the patient.

Since the advent of laparoscopic cholecystectomy, minimal access surgery has come to play an increasingly significant role in gastrointestinal surgery. Although laparoscopic cholecystectomy has quickly become a standard practice for elective cholecystectomy in much of the world, its use for perforated peptic ulcers remains unclear.⁸

The aim of the present work was to compare the postoperative outcome of laparoscopic repair of perforated duodenal ulcer, with the outcome of the conventional open repair using omental filling in both groups.

Median age of the study population was 38 years old. (25-56). Other studies as Bhogal et al., 2008,²⁰

reported prevalence of perforated duodenal ulcer in older mean age among patients which was 54 years old.

In our work, more males were affected (77.5% of the study population). This gender prevalence concurred with other reports in the previous literature.^{9,10} Some authors advocated the high incidence of perforated duodenal ulcer among males to smoking and excessive alcohol consumption which are prevalent amongst this gender.^{11,12} In the current work, these demographic features revealed no statistically significant differences across the two groups; patients were allocated in the study groups upon the surgeon decision.

In the present study, 55% of the patients diagnosed with perforated duodenal ulcer mentioned a positive history of NSAIDs intake. Lund et al., 2021,²² reported a strong evidence of association between NSAIDs intake and peptic ulcer disease. Chung et al., 2017,¹³ elucidated that NSAIDs act by inhibiting the COX-II enzyme and thus limiting its gastro-protective effect. Studies have elaborated that the deleterious effect of NSAIDs on duodenal mucous membrane is aggravated by the synergism of NSAIDs intake, alcohol intake and smoking.

In the current work, 45 % of the study population reported positive history of smoking. Vakayil et al., 2019,²³ and Pansa et al., 2020,²⁴ reported a strong association between smoking and perforated duodenal ulcer. Smoking is a proved risk factor for peptic ulcer disease and its complications. Smoking leads to a decrease in pancreatic Na bicarbonate secretion leading to increased duodenal acidity and ulceration.

In the present work, 15% of the study population reported previous episodes of peptic ulcer disease. In agreement with that Vakayil et al., 2019,²³ and Pansa et al., 2020,²⁴ reported similar results stated that eradication of H.pylori in cases of perforated duodenal ulcer after surgical management significantly decrease ulcer relapse in one year.

In this case-control study, outcomes for open repair and laparoscopic repair for perforated duodenal ulcer were compared in several perspectives.

In our study the laparoscopic groups mean operation length was determined to be 81 ± 11 , while the open group's was 75.5 ± 12 ; nevertheless, there was no statistically significant difference between the two groups (P value > 0.05).

Siu et al., 2002,¹⁶ found that the mean operation duration was significantly shorter in the laparoscopic group than in the open group, contrary to the claims made by Abdul Latif et al., 2022,¹⁴ that the mean operation duration was significantly longer in the laparoscopy group than in the open group . Operative time is dependent on the hand skills of the authorized surgical team, which is variable from center to the other.

Statistical analysis of our work revealed that 2.5% of patients were complicated with postoperative leakage; all of them in the open group. Laparoscopic repair showed a non-significant decline in the incidence of postoperative leakage (P value > 0.05), compared to open repair. Re-exploration was done and gastro-jejunostomy with pyloric exclusion was established in the complicated case with leakage.

Regarding postoperative leakage, Abdul Latif et al., 2022,¹⁴ reported similar findings and found no significant difference between open and laparoscopic group in the incidence of postoperative leakage. However, Murad et al., 2020,⁶ and Sonal et al., 2021,⁷ reported a significant difference in favor of laparoscopic group regarding postoperative leakage.

In the present study, mean postoperative hospital stay was significantly shorter in laparoscopy group (4.85 ± 0.7 days), versus open group (6.2 ± 0.6 days), P value < 0.05. Jamal et al., 2019,¹⁴ and Abdul Latif et al., 2022,²¹ have all deduced that patients who received laparoscopic management of perforated

duodenal ulcer showed shorter hospital stay, than those who had open repair. While Lunevicius et al., 2005,¹⁵ reported there was no significant value between the two groups regarding postoperative hospital stay.

In the current study, surgical site infection was compared between the two groups and it was found that the incidence was lower in laparoscopic group than the open group but no significant difference was found (P value > 0.05). In agreement with our work Siu et al., 2002,⁴ and Davenport et al., 2019,¹⁶ have reached similar findings to our study that there was no significant difference between the two groups regarding surgical site infection. While Sanabria et al., 2013,¹⁷ and Tan et al., 2016,¹⁸ have found that there is a significant difference between the two groups regarding surgical site infection in favor of laparoscopic group.

Statistical analysis of our work revealed that there was no statistical significance between the two groups regarding readmission of patients as only 1 case of the open group was readmitted for burst abdomen in comparison to 0 cases in the laparoscopic group (P value > 0.05). Davenport et al., 2019,⁴ and Saleh et al., 2019,¹⁹ have agreed with our results regarding readmission of the cases and reported no statistical significance between the two groups.

Other studies compared between the laparoscopic repair and open surgical repair regarding the postoperative outcomes in other perspectives than our studies. They compared between them regarding postoperative respiratory complications, postoperative ileus, the mean time for immobilization of the patients postoperatively, postoperative need of analgesia and intra-abdominal collections.

Several studies as Jamal et al., 2019,¹⁴ and Abdul Latif et al., 2022,²¹ found a decline in postoperative respiratory complications, precisely lung atelectasis in laparoscopic group than the open group which was treated conservatively with intravenous fluids, oxygen mask and chest physiotherapy.

Although some authors, as Stepanyan et al., 2019,²⁵ reported higher incidence of pneumonia and chest infections in laparoscopic repair, compared to open repair. The influence of surgical positioning, as well as the pneumoperitoneum induced for laparoscopic surgery on respiratory mechanics, may predispose to lung atelectasis and ARDS.

Most of the studies as Murad et al., 2020,⁷ reported significant decrease in the meantime needed for immobilization of the patients postoperatively in favor of the laparoscopic group which led to a faster regain of the bowel movement in the laparoscopy group and less predisposition to DVT.

Studies also as Lunevicius and Morkovicius,¹⁵ 2005 found a significant decline in postoperative ileus in the laparoscopic group than the open group. Bowel rest and intravenous fluid therapy with correction of hypokalemia were enough to resolve the complicated cases with postoperative ileus.

Some author reported a significant reduction in the consumption of opiate analgesia in the laparoscopic group while some authors reported a non-significant difference between the two groups in usage of postoperative analgesia.^{12,14}

Summary and conclusion

Perforated duodenal ulcer is one of the most common presentations in emergency department and it can lead to death if not properly managed. Management can be done through open conventional surgery or laparoscopy.

In our study we compared between open surgical repair and laparoscopic repair of perforated duodenal ulcer in terms of mean operative time and postoperative outcomes as leakage, mean postoperative hospital stay, surgical site infection and readmission.

We found that operative time was less in open group but of no significant difference while mean postoperative hospital stay was significantly less in laparoscopic group. Also postoperative leakage, readmission and surgical site infection could be less in laparoscopic group.

In summary, laparoscopic repair of a perforated duodenal ulcer is a safe and dependable surgery that should be considered for all patients providing that the necessary expertise is available, Based on the length of stay in the hospital, the current study concluded that laparoscopic treatment of a perforated duodenal ulcer is preferred than open surgery. Based on a statistical examination of the available data, laparoscopic repair resulted in lower rates of surgical site infection, less incidence of postoperative suture leakage, and less need for readmission compared to open group.

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