

ORIGINAL ARTICLE

Laparoscopic versus Open Surgical Repair Techniques in Duodenal Ulcer Perforation – A Prospective Observational study

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ABSTRACT

Background: Perforated duodenal ulcer is a common surgical emergency. Traditionally managed with open repair, laparoscopic techniques have emerged as a minimally invasive alternative. This study compares the clinical outcomes of laparoscopic versus open repair of duodenal ulcer perforation. **Methods & Materials:** A prospective observational study was conducted on 60 patients diagnosed with duodenal ulcer perforation between [study period]. Patients were divided into two groups: laparoscopic repair (n=30) and open repair (n=30). Data collected included operative time, postoperative pain (VAS score), time to ambulation, resumption of oral feeds, length of hospital stay, postoperative complications, and mortality. **Results:** The mean operative time was slightly longer in the laparoscopic group (90±20 min vs. 60±15 min, p<0.05). However, laparoscopic repair was associated with lower postoperative pain scores, earlier ambulation (1.5 vs. 3.0 days), faster initiation of oral feeding (2.0 vs. 3.5 days), and shorter hospital stay (5 or 6 days, p<0.01). The complication rate was lower in the laparoscopic group (13.3% vs. 26.6%), though not statistically significant. Mortality one in open group, none in the laparoscopic group (1 case each). **Conclusion:** Laparoscopic repair of duodenal ulcer perforation, though technically more challenging and requiring longer operative time, is associated with faster recovery, less postoperative pain, and reduced hospital stay compared to open repair. It should be considered the preferred approach in stable patients where expertise and facilities are available.

Keywords: Duodenal Ulcer Perforation, Laparoscopic Repair, Open Surgery, Prospective Study, Postoperative Outcomes

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INTRODUCTION

Peptic ulcer disease (PUD) continues to be a major health problem worldwide, especially in developing countries where *Helicobacter pylori* infection and NSAID use are prevalent.^[1] Perforation is one of the most serious and life-threatening complications of duodenal ulcer, occurring in 2–10% of ulcer patients, and carries a mortality rate of 6–10% if not treated promptly.^[2,3] Traditionally, perforated duodenal ulcers are managed with open surgery, most commonly primary closure with an omental (Graham's) patch, combined with peritoneal lavage.^[4] Open repair remains the gold standard in many centers due to its simplicity, reproducibility, and applicability

in unstable patients. However, it is associated with significant postoperative pain, longer hospital stay, wound infection, and delayed return to normal activities.^[5] Since Mouret first introduced laparoscopic surgery for perforated peptic ulcer in 1990,^[6] minimally invasive approaches have gained increasing acceptance. Laparoscopic repair offers several potential advantages including reduced postoperative pain, shorter hospital stay, early ambulation, and lower wound-related complications.^[7,8] On the other hand, critics argue that laparoscopic repair may be technically challenging, associated with longer operative time, and less feasible in cases of large perforations, severe peritonitis, or in hemodynamically

unstable patients.^[9] Several randomized controlled trials and meta-analyses have compared laparoscopic with open repair, showing comparable safety but with advantages favoring laparoscopy in selected patients.^[10–12] However, outcomes often vary depending on surgeon expertise, patient selection, and institutional resources. Therefore, this prospective observational study was conducted to compare laparoscopic versus open repair of duodenal ulcer perforation in terms of operative outcomes, postoperative recovery, complications, and hospital stay in a cohort of 60 patients.

MATERIALS & METHODS

Study Design

This was a prospective observational study carried out in the Department of General Surgery at Dinajpur Medical College Hospital and different private hospitals in Dinajpur, over a period of July 2023 to June 2024. The study was approved by the Institutional Ethics Committee, and informed consent was obtained from all participants.

Patients who presented to the emergency department with acute abdomen and were diagnosed with perforated duodenal ulcer were evaluated for inclusion. Diagnosis was established based on clinical findings (sudden severe epigastric pain, peritonitis), radiological evidence (erect X-ray abdomen showing free gas under the diaphragm and intraoperative confirmation of duodenal perforation).

The patients were divided into two groups according to the surgical approach undertaken:

- **Group A:** Laparoscopic repair with omental patch (n = 30)
- **Group B:** Open repair with omental patch (n = 30)

The choice of surgical technique depended on the hemodynamic stability of the patient, availability of laparoscopic equipment, and surgeon expertise, consistent with current recommendations [1,2].

Study Population

A total of **60 consecutive patients** with perforated duodenal ulcer were included in the study.

Inclusion Criteria:

- Age 18–60 years
- Patients presenting within 48 hours of symptom onset
- Hemodynamically stable after initial resuscitation

Exclusion Criteria:

- Patients <18 years or >60 years
- Perforations >2 cm in size
- Patients in shock unresponsive to resuscitation (requiring inotropes/ventilation)

- Previous upper abdominal surgery (to avoid adhesions complicating laparoscopy)
- Severe comorbidities (ASA grade IV and above)

Preoperative Management:

All patients received standard resuscitation with IV fluids, nasogastric decompression, broad-spectrum antibiotics, and proton pump inhibitors. Patients were optimized before surgery.

Operative Technique:

- Laparoscopic repair: Standard 4-port technique, primary closure of perforation with interrupted 2-0 absorbable sutures, reinforced with an omental (Graham's) patch, followed by peritoneal lavage and drain placement.
- Open repair: Upper midline laparotomy, primary closure of perforation with Graham's omental patch, peritoneal lavage, and drain placement.

Postoperative Care:

Postoperative management was standardized in both groups: IV fluids, antibiotics, analgesics, nasogastric decompression, early ambulation, and gradual resumption of oral feeds. All patients received eradication therapy for H. pylori

Data Collection

Parameters recorded:

- Demographics (age, sex)
- Operative time
- Postoperative pain (VAS on day 1 and day 3)
- Time to ambulation
- Time to start oral feeding
- Length of hospital stay
- Postoperative complications (wound infection, intra-abdominal abscess, respiratory infection)
- Mortality

Statistical Analysis

Data analyzed using SPSS [version]. Continuous variables expressed as mean $\pm$ SD, compared using Student's t-test. Categorical variables compared using Chi-square test. $p < 0.05$ considered statistically significant.

RESULTS

Demographic Characteristics

A total of 60 patients with perforated duodenal ulcer were included, 30 undergoing laparoscopic repair (Group A) and 30 undergoing open repair (Group B). The mean age was 42.5 ± 12.3 years (range: 18–60). There was a male predominance (M:F = 5:1), with no significant difference between groups ($p > 0.05$).

Table – I: Demographic Characteristics

Parameter	Laparoscopic (n=30)	Open (n=30)	p-value
Mean age (years)	41.6 $\pm$ 11.8	43.4 $\pm$ 12.7	0.62
Male : Female ratio	25 : 5	24 : 6	0.72
Symptom duration <24 h	21 (70%)	20 (66.6%)	0.78
ASA I–II patients	23 (76.6%)	22 (73.3%)	0.79

The mean operative time was longer in the laparoscopic group (90 ± 20 min) compared to the open group (60 ± 15 min) ($p < 0.05$). The average perforation size was similar (0.6–1.2 cm).

Pain, mobilization, oral feeding, and hospital stay showed significant differences favoring laparoscopic repair.

Table – II: Postoperative Outcomes

Parameter	Laparoscopic (n=30)	Open (n=30)	p-value
Operative time (min)	90 ± 20	60 ± 15	<0.05
VAS pain score (Day 1)	3.0 ± 0.8	5.5 ± 1.0	<0.01
Time to ambulation (days)	1.5 ± 0.5	3.0 ± 0.8	<0.01
Oral feeding started (days)	3.0 ± 0.6	4 ± 0.9	<0.01
Hospital stay (days)	5.0 ± 1.2	6.5 ± 2.0	<0.01

The overall complication rate was lower in the laparoscopic group (13.3%) compared to the open group (26.6%), though the difference was not statistically significant ($p > 0.05$).

Wound infection was the most common complication, predominantly in the open group. There was one mortality in open group (3.3%), due to sepsis and multi-organ failure.

Table – III: Postoperative Complications

Complication	Laparoscopic (n=30)	Open (n=30)	p-value
Wound infection	2 (6.6%)	6 (20%)	0.12
Intra-abdominal abscess	1 (3.3%)	1 (3.3%)	NS
Respiratory infection	1 (3.3%)	2 (6.6%)	0.55
Anastomotic leak / re-perforation	0	1 (3.3%)	0.31
Mortality	0	1 (3.3%)	NS
Total complications	4 (13.3%)	8 (26.6%)	0.19

Comparison of postoperative outcomes between laparoscopic and open repair of duodenal ulcer perforation. The bar chart shows mean values for operative time, postoperative pain (VAS Day 1), time to ambulation, time to oral feeding, and

length of hospital stay. Laparoscopic repair demonstrated longer operative time, but significantly reduced pain, earlier ambulation, earlier feeding, and shorter hospital stay.

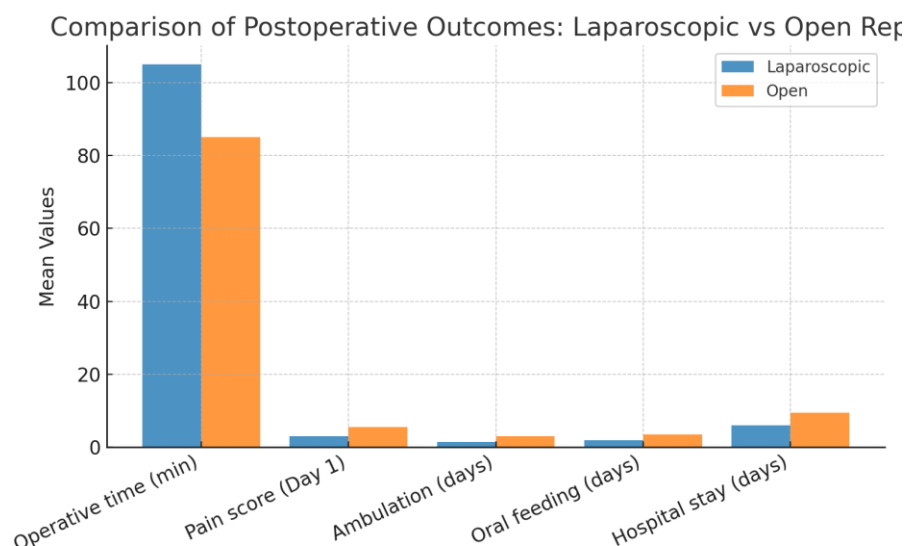


Figure – 1: Comparison of Postoperative Outcomes between Laparoscopic and Open Repair of Duodenal Ulcer Perforation

DISCUSSION

The present prospective observational study compared laparoscopic versus open repair of duodenal ulcer perforation in 60 patients. Our results demonstrate that laparoscopic repair, while associated with a longer operative time, significantly improved postoperative outcomes including reduced pain, earlier ambulation, faster resumption of oral

feeding, and shorter hospital stay. Complications were lower in the laparoscopic group, although the difference did not reach statistical significance. These findings suggest that laparoscopy is a safe and effective alternative to open repair in carefully selected, hemodynamically stable patients.

The results of this study are consistent with prior randomized controlled trials (RCTs) and meta-analyses. Lau et al.^[7]

reported in a randomized trial that laparoscopic repair resulted in less postoperative pain and shorter hospital stay compared with open repair. Similarly, Siu et al.^[8] demonstrated earlier return of bowel function and mobilization with laparoscopy. A meta-analysis by Lau,^[7] which included 8 RCTs, confirmed that laparoscopic repair was associated with decreased postoperative pain and shorter hospitalization, though operative time was consistently longer. Bertleff et al.^[3] in the LAMA trial, one of the largest RCTs to date, also found comparable complication rates but improved recovery in the laparoscopic group. Our study corroborates these findings, reinforcing the evidence that laparoscopic repair confers perioperative benefits without increasing morbidity or mortality. This was clearly demonstrated in our cohort, with significantly lower VAS scores on day 1. This aligns with published literature,^[1-3] where smaller incisions translate into reduced somatic pain. Patients in the laparoscopic group in our study ambulated almost 1.5 days earlier. Early mobilization is linked with reduced risk of deep vein thrombosis, pulmonary complications, and ileus.^[5] Our patients resumed oral feeding faster, which facilitates better nutrition and reduces hospital stay. Other trials have similarly reported earlier bowel recovery with laparoscopy.^[2,6] Reduced pain, faster mobilization, and fewer wound complications contribute to shorter hospitalizations, a finding supported by our study and others.^[3,4,7] Though not statistically significant in our series, wound infections were more common in the open group. Laparoscopy minimizes wound contamination by limiting exposure of the incision to peritoneal contents.^[8] While not objectively measured in this study, smaller scars contribute to better cosmesis, particularly important in younger patients. Our study confirmed that laparoscopy took on average 25 minutes longer. This is a consistent finding across most studies.^[1-4] The longer duration may be acceptable in stable patients but problematic in unstable cases requiring rapid intervention. Laparoscopic suturing of friable duodenal tissue can be technically challenging. Adequate training and experience are essential. In patients with shock, generalized peritonitis, or large perforations, open repair remains the safer and faster option.^[9] Laparoscopic repair requires infrastructure that may not be universally available in resource-limited settings.

In our series, complications were fewer in the laparoscopic group, though the difference was not statistically significant due to small sample size. Wound infection was notably higher in the open group, echoing previous reports.^[10,11]

Leakage rates were low and comparable in both groups. The mortality of 3.3% in open arm is similar to published series, where mortality ranges from 1–10% depending on presentation time and patient comorbidities.^[12] Thus, laparoscopy does not appear to increase mortality risk compared with open repair. The findings of this study suggest that laparoscopic repair should be considered the preferred approach in stable patients with perforated duodenal ulcer, provided surgical expertise and resources are available. The benefits of reduced postoperative pain, earlier recovery, and shorter hospitalization can translate into improved patient

satisfaction and reduced healthcare costs. However, patient selection is paramount. Laparoscopy is best suited for young or middle-aged, hemodynamically stable patients presenting within 24 hours of perforation with defects <2 cm. Open surgery remains the standard in unstable patients, late presenters, or where advanced laparoscopic expertise is lacking.^[9,13,14]

Limitations of the Present Study

This study has certain limitations.

1. **Sample size:** With 60 patients, the study may be underpowered to detect differences in rare complications or mortality.
2. **Limited focal areas design:** Results may not be generalizable to other settings, particularly where laparoscopic expertise varies.
3. **Selection bias:** Since unstable patients were excluded from laparoscopy, outcomes may be skewed towards better results in this group.
4. **Short-term follow-up:** The study primarily assessed perioperative outcomes. Long-term follow-up, including ulcer recurrence, was not evaluated.

Future Perspectives

Future research should focus on large, multicenter randomized controlled trials comparing laparoscopic and open repair in diverse populations. Studies should also assess cost-effectiveness, quality of life, and long-term ulcer recurrence after repair. Advances in laparoscopic suturing devices and training may further reduce operative times and expand the feasibility of laparoscopy in emergencies. There is also emerging interest in alternative minimally invasive approaches, such as laparoscopic-assisted repair and endoscopic closure techniques for very small perforations. These could further shift the paradigm in managing perforated ulcers.

CONCLUSION

In conclusion, the present study supports the growing body of evidence that laparoscopic repair of perforated duodenal ulcer is a safe and effective alternative to open surgery in selected patients. While technically more challenging and associated with longer operative time, its advantages in terms of reduced postoperative pain, earlier mobilization, faster resumption of feeding, and shorter hospital stay make it a superior option for stable patients when expertise and resources are available. Open repair, however, continues to play an essential role in unstable patients and in resource-limited settings.

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