ORIGINAL ARTICLE

Clinical Outcomes of Minimally Invasive and Traditional Approaches in Perforated Peptic Ulcer Management

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Abstract

Background: Laparoscopic surgery has emerged as a promising alternative to traditional open repair for perforated peptic ulcer (PPU). **Objective:** This retrospective comparative study aimed to evaluate the clinical outcomes of laparoscopic and open surgical repairs in a tertiary care setting. **Methods:** Eighty-two patients with perforated gastric or duodenal ulcers were included, with 32 undergoing laparoscopic surgery (Group I) and 25 undergoing open surgery (Group II) based on stringent inclusion criteria. Laparoscopic repair involved a diagnostic laparoscopy, ulcer closure with single-layer sutures, and omentopexy, which was performed. Open surgery was performed through midline laparotomy with a similar ulcer closure. Postoperatively, both groups received antibiotics, pain relief, and early mobilization therapy. **Results:** Group I had a significantly shorter hospital stay (3.8 ± 0.38 days vs. 6.9 ± 0.75 days, $P < 0.001$) and quicker oral intake resumption (1.6 ± 0.5 days vs. 2.8 ± 0.8 days, $P = 0.002$) than Group II. The incidence of post-operative complications was lower in Group I (3.1% vs. 12.0%, $P = 0.03$). No surgical site infections, pneumonia, reoperations, or mortality occurred in Group I. **Conclusion:** These findings suggest that laparoscopic repair is a safe and effective alternative to open surgery for PPUs in selected patients, offering shorter hospital stays, fewer complications, and faster recovery. However, careful patient selection based on perforation size, location, presentation time, and comorbidities is crucial for successful outcomes. Further prospective multicenter studies are needed to confirm these results and establish guidelines for wider clinical applications, particularly in resource-limited settings.

Key words: Laparoscopic repair, open surgery, perforated peptic ulcer, post-operative complications tertiary care

INTRODUCTION

Peptic ulcer disease remains a major global health issue, with complications such as perforation causing significant morbidity and mortality, particularly in low- and middle-income countries.[1] Perforation occurs in 5–10% of peptic ulcer disease cases and requires immediate surgical treatment to prevent peritonitis and septic shock.[2] Despite advancements in medical treatments, including proton pump inhibitors and Helicobacter pylori eradication, the rate of ulcer perforation has remained relatively unchanged.[3]

The standard treatment for perforated peptic ulcers (PPUs) is open surgical repair through laparotomy. This method is associated with considerable post-operative discomfort, extended recovery periods, and a higher likelihood of wound complications, particularly in older patients or those with health issues.[4] Consequently, minimally invasive procedures, especially laparoscopic surgery, have attracted interest because they minimize

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surgical trauma, reduce hospital stays, and enhance recovery while maintaining safety.[5,6]

Initial reports on the feasibility of laparoscopic repair emerged in the early 1990s, and research has shown its effectiveness in patients with minor perforations and early-stage conditions.[7] However, discussions continue regarding the wider use of laparoscopy, especially in resource-limited environments or when patient selection criteria are not clearly established.[8]

The findings indicate that laparoscopic closure is technically achievable and offers outcomes comparable to or better than traditional methods, with fewer post-operative complications, quicker return to eating, and reduced surgical site infections.[9,10] However, diversity in study designs, selection bias, and varying surgical technique criteria limit the broad applicability of the current evidence.[11]

This study aimed to compare the clinical outcomes of laparoscopic versus open surgical repair for PPUs in tertiary care, using stringent inclusion criteria. We propose that laparoscopic repair serves as a safe and effective alternative to open surgery in suitable patients.

METHODS

This retrospective comparative study was conducted at a tertiary surgical center from January 2019 to December 2024. This study assessed the clinical outcomes of patients who underwent surgical repair for PPUs, comparing laparoscopic and open surgical methods. This study adhered to the Declaration of Helsinki (2013) and was approved by the Bioethics Committee of the I.K. Akhunbaev Kyrgyz State Medical Academy (Protocol No. 58 dated April 16, 2014).

During the study period, 82 patients with perforated gastric or duodenal ulcers underwent surgical treatment and were included in the study. For analysis, patients were selected based on the following criteria: perforation present for 24 h or less, ulcer size ≤10 mm, ulcer location on the anterior wall of the duodenum or gastric antrum, and compensated comorbidities, such as controlled hypertension, type 2 diabetes, or chronic gastritis. Based on these criteria, 32 patients were placed in the laparoscopic surgery group (Group I), and 25 were assigned to the open surgery group (Group II). The remaining 25 patients were excluded due to delayed presentation, larger ulcer size, posterior wall location, or decompensated systemic disease.

In Group I, laparoscopic repair was performed under general anesthesia. After diagnostic laparoscopy and identification of the perforation, the ulcer was closed with single-layer interrupted sutures. The greater omentum was spread and secured over the repair site (omentopexy) using sero-serous sutures. The abdominal cavity was washed with ozonized saline or decasan solution and drained using a micro-irrigator.

In Group II, patients underwent open surgery through midline laparotomy. The perforated area was sutured similarly, followed by peritoneal lavage with saline and installation of a conventional drainage system.

Both groups received post-operative care, including intravenous antibiotics (ceftriaxone and metronidazole), pain relief, fluid management, and encouragement to start moving early. Oral feeding began with the return of bowel function, usually within 48–72 h after surgery. The data collected included patient demographics, ulcer details, surgical specifics, post-operative complications, time until oral intake, hospital stay duration, reoperation rates, and in-hospital mortality. Observations included surgical site infections, respiratory issues such as pneumonia, and localized infiltrates.

Statistical analyses were performed using Statistica v8.0 (StatSoft, Inc., Tulsa, OK, USA). Continuous data are presented as mean ± standard deviation and were analyzed using the independent *t*-test. Categorical data are presented as frequencies and percentages and were compared using the Chi-square or Fisher's exact test, as appropriate. Statistical significance was set at $P < 0.05$.

RESULTS

From 2019 to 2023, our hospital admitted 82 patients with PPUs who required surgery. Of these, 32 patients were selected for laparoscopic surgery (Group I) based on pre-operative evaluations and inclusion criteria, while 25 underwent open surgery (Group II). The remaining 25 patients were excluded from the comparative study because they presented after 24 hours of symptoms, had ulcers larger than 10 mm, had ulcers on the posterior wall, or had severe systemic comorbidities.

The two groups had similar demographics. In Group I, the mean age was 44.6 ± 11.6 years, whereas in Group II, it was 46.9 ± 12.8 years. Most participants were male, accounting for 68.7% of Group I and 72.0% of Group II [Table 1]. All patients had ulcers on the anterior wall of the duodenum or gastric antrum and sought treatment within 24 h of perforation. Both groups included patients with comorbidities such as hypertension, controlled diabetes, or chronic gastritis in compensated stages.

In Group I, the laparoscopic approach involved diagnostic laparoscopy, perforation site localization, and closure with single-layer interrupted sutures. This was reinforced by omentopexy using the greater omentum. The peritoneal cavity was flushed with ozonized saline or decasan solution and drained using a micro-irrigator. In Group II, open surgery was performed using midline laparotomy. The perforated ulcer was sutured similarly, followed by saline irrigation and conventional drainage of the abdominal cavity.

Table 1: Clinical outcomes comparison for patients in Groups I and II after PPU repair surgery

Parameter	Group I (*n*=32) (%)	Group II (*n*=25) (%)	*P*-value
Age	44.6±11.6	46.9±12.8	0.42
Male sex	22 (68.7)	18 (72.0)	0.78
Ulcer size ≤10 mm	32 (100)	25 (100)	-
Perforation ≤24 h	32 (100)	25 (100)	-
Ulcer location (anterior wall)	32 (100)	25 (100)	-
Compensated comorbidities	20 (62.5)	16 (64.0)	0.89
Mean hospital stay (days)	3.8±0.38	6.9±0.75	<0.001*
Time to oral intake (days)	1.6±0.5	2.8±0.8	0.002*
Post-operative complications	1 (3.1%) - infiltrate	3 (12.0) - pneumonia, SSI×2	0.03*
Surgical site infection	0 (0)	2 (8.0)	0.11
Pneumonia	0 (0)	1 (4.0)	0.26
Reoperation rate	0 (0)	0 (0)	-
Mortality	0 (0)	0 (0)	-

SSI: Surgical site infection. Values are expressed as then (%) and mean±standard deviation. *P<0.05. PPUs: Perforated peptic ulcers

Hospital stay was shorter for Group I, averaging 3.8 ± 0.38 days, compared to 6.9 ± 0.75 days for Group II (P < 0.001). This reflects reduced physiological stress, quicker mobilization, and fewer post-operative complications in patients undergoing laparoscopic surgery. In Group I, one patient (3.1%) experienced a post-operative complication, developing a subcutaneous infiltrate at the port site.

Examination of baseline and clinical variables showed that compensated comorbidities, such as managed hypertension, type 2 diabetes mellitus, and chronic gastritis, were found in 62.5% of patients in the Group I (n = 20) and 64.0% in the Group II (n = 16), with no significant difference (P = 0.89). The time to oral intake was shorter in the Group I (1.6 ± 0.5 days) than in the Group II (2.8 ± 0.8 days; P = 0.002), indicating improved gastrointestinal recovery [Table 1]. Surgical site infections occurred in 2 patients (8.0%) in the Group II, whereas none were observed in the Group I. One case of hospital-acquired pneumonia (4.0%) occurred in the Group II, with no respiratory complications in this group. There were no cases of post-operative mortality or reoperation in either group, demonstrating the safety and efficacy of both methods under appropriate conditions.

DISCUSSION

These results contribute to the growing evidence that laparoscopic surgery is a viable and safe alternative to traditional open surgical repair for treating PPUs in carefully selected patients. Our findings showed that laparoscopic procedures led to shorter hospitalizations, reduced post-operative complications, and quicker resumption of oral intake compared with open surgery. These outcomes align with previous studies highlighting the advantages of minimally invasive methods.[6,12]

The Group I experienced fewer post-operative complications (3.1%) than the Group II (12.0%). This aligns with Bertleff and Lange, who noted that laparoscopic procedures result in fewer surgical site infections and better wound healing because of reduced tissue injury.[5] Katkhouda *et al*. indicated that minimally invasive techniques are associated with a lower risk of intra-abdominal abscesses and respiratory issues, which are common in open abdominal surgeries.[13]

Our findings of shorter hospital stay in the Group I (4.1 ± 0.42 days) versus the Group II (7.2 ± 0.86 days) align with studies by Siu *et al*. and Stepanyan *et al.,* which showed quicker mobilization and reduced pain after laparoscopic procedures.[12,14] This is crucial for elderly or comorbid patients, as extended immobility can lead to complications such as pneumonia and venous thromboembolism.[8]

This study used stringent inclusion criteria, focusing on ulcers 10 mm or smaller, located on the anterior wall, and presented within 24 h, to ensure uniformity and patient safety. These criteria are supported by the existing literature. Lunevicius and Morkevicius and Svanes found that delayed presentation and larger perforation sizes are linked to worse outcomes, irrespective of the surgical method.[15,16]

This study showed no mortality or reoperation, which is consistent with the meta-analysis results of Sanabria *et al*. and Thorsen *et al*.[3,17] These studies suggest that when performed by skilled practitioners with careful patient selection, laparoscopic techniques do not increase the risk of adverse outcomes. Our data indicate better gastrointestinal recovery, as shown by earlier oral intake resumption in the Group I, consistent with the enhanced recovery after surgery protocols outlined by Kehlet and Wilmore.[18]

Laparoscopic repair offers advantages but also has drawbacks. It requires specialized training and equipment, and the procedures may take longer if the surgeon lacks experience. Research suggests that open surgery may be more suitable for large ulcers, significant contamination, or hemodynamic instability.

This study provides insights into a low- to middle-income environment in which laparoscopic resources vary. This highlights the need to enhance surgical capacity and implement training programs to broaden the use of safe, minimally invasive techniques in emergency abdominal surgeries.

CONCLUSION

This study adds to the evidence that laparoscopic repair is a viable and safe alternative to open surgery for certain patients with PPUs. The laparoscopic method showed benefits, including shorter hospitalizations, fewer complications, quicker oral intake resumption, and no mortality or need for additional surgery. These advantages were achieved without compromising surgical safety or effectiveness, endorsing its use as a primary option in facilities with the required expertise. The results of this study indicate that, under strict criteria, such as small perforation size, anterior wall location, early presentation, and managed comorbidities, laparoscopic surgery can provide better outcomes than traditional repair. However, patient selection is crucial, and open surgery remains the standard for cases involving hemodynamic instability, delayed diagnosis, or complex pathology.

As the incidence of emergency abdominal conditions increases and the demand for minimally invasive procedures grows, our findings highlight the need to enhance laparoscopic capabilities and surgical education, especially in resource-limited areas. Additional prospective multicenter research is needed to confirm these results and improve guidelines for wider clinical use.

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