LESS
Laparosc Endosc Surg Sci 2024;31(2):45–49
DOI: 10.14744/less.2024.08216

Original Article

Laparoscopic versus open repair for perforated peptic ulcer: A single-center analysis

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ABSTRACT

Introduction: The aim of this study was to evaluate and compare the early postoperative outcomes of patients who underwent laparoscopic and open repair for perforated peptic ulcer disease in our clinic.

Materials and Methods: An observational single-center study was conducted at the Marmara University Pendik Training and Research Hospital between June 2018 and June 2023. Demographic characteristics, comorbidities, preoperative laboratory tests, surgical technique, duration of operation, ulcer location (duodenal, gastric, prepyloric), postoperative length of hospital stay, readmission, and complications were analyzed. Patients were divided into two groups, open and laparoscopic operations, and compared.

Results: We compared 99 patients who underwent open surgery (OS) with 23 who underwent laparoscopic surgery (LS). The median age of the entire cohort was 42.5 years (IQR 30.3–62). There was no difference between the two groups in terms of ulcer location. The operative time was longer in the laparoscopic group (45 min OS vs. 60 min LS, p<0.001). Although the median length of hospital stay was three days between the two groups, there was a significant difference in favor of the laparoscopic group. There were no significant differences in postoperative complications or 30-day mortality between the two groups (0.754 and 0.684, respectively).

Conclusion: Compared with the open method, the laparoscopic method can be safely applied in the surgical treatment of peptic ulcer perforation without increasing complications. In suitable patients, advantages such as shorter hospital stays can be utilized.

Keywords: Emergency Surgery, Laparoscopic Repair, Minimally Invasive Surgery, Outcomes, Peptic Ulcer Disease, Perforated Ulcer

Introduction

Peptic ulcer disease is a widespread disease that affects a considerable number of patients worldwide, with an annual incidence ranging from 0.10% to 0.19%. Although the incidence of this disease has been on the decline due to improved medical treatment options, the occurrence of perforated peptic ulcer (PPU) has been steadily increasing over the last few decades, particularly in the elderly pop-

Received: 08.06.2024 **Revision:** 04.07.2024 **Accepted:** 04.07.2024
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ulation. PPU has a high mortality rate, ranging from 1.3% to 20%, and is an acute surgical emergency that necessitates prompt identification and management for positive outcomes. Once preoperative resuscitation is complete, emergency surgery is crucial to fix the visceral perforation and thoroughly clean the peritoneum.[1-5]

The World Society of Emergency Surgery (WSES) guidelines recommend operative treatment for patients with perforated peptic ulcers with significant pneumoperitoneum, extraluminal contrast extravasation, or signs of peritonitis. Repair can be accomplished in most patients with simple suturing of the ulcer margins and optional omental patch repair, while gastrectomy is rarely necessary. Minimally invasive techniques and advances in training have made it possible to use laparoscopy in perforated peptic ulcer surgery, which has several advantages over open repair, including reduced morbidity, such as a lower risk of postoperative wound infection, less postoperative pain, and a shorter length of stay. It is recommended that a laparoscopic approach be used in hemodynamically stable patients, whereas an open surgical approach is recommended if laparoscopic skills and equipment are not available.[1-4,6]

The aim of this study was to evaluate and compare the early postoperative outcomes of patients who underwent laparoscopic and open repair for perforated peptic ulcer disease in our clinic.

Materials and Methods

An observational single-center study was conducted at the Marmara University Pendik Training and Research Hospital between June 2018 and June 2023. The study analyzed the data of patients who underwent surgery for PPU.

The study was conducted in accordance with the Declaration of Helsinki. The study was approved by the Marmara University School of Medicine Clinical Research Ethics Committee (Number: 09.2023.1095).

The data of patients over 18 years of age who underwent surgery for intraabdominal perforation were analyzed. Patients who underwent surgery for a prediagnosis of peptic ulcers were included in the study. Patients with perforations secondary to malignant ulcers or trauma and patients with intestinal perforation were excluded.

During the study period, perioperative data were gathered from clinical records, pathology, and radiology reports through the hospital's electronic health record system.

Demographic characteristics, comorbidities, preoperative laboratory tests (white blood cell count (reference range: 4-11×103/μL), C-reactive protein (reference range: 0-5 mg/L)), surgical technique, duration of operation, ulcer location (duodenal, gastric, prepyloric), postoperative length of hospital stay, readmission, and complications were analyzed. Patients were divided into two groups, open and laparoscopic operations, and compared.

Surgical Techniques

The operations employed the pedicled omental patch technique, also known as Graham omentoplasty.[7,8] All open repairs were conducted via midline laparotomy. After identifying the perforation site, an omental patch was created and sutured with 2-0 silk sutures, ensuring three points of fixation. The abdominal cavity was then irrigated with an adequate amount of saline solution. Following hemostasis, one drain was positioned in the operative area, and another was placed in the pelvis.

In laparoscopic repairs, a 10 mm laparoscope with a 10 mm trocar and two 5 mm trocars were used. The initial 10 mm trocar was introduced into the peritoneal space through an umbilical incision, and pneumoperitoneum was established with carbon dioxide at a pressure of 12-14 mmHg. The two 5 mm trocars were placed at the umbilical level along the right and left midclavicular lines. Once the perforation site was identified, an omental patch was created and sutured with 2-0 silk sutures at three fixation points. The abdominal cavity was then irrigated with an adequate amount of saline solution. After achieving hemostasis, a drain was placed in the operative area. The fascia defect created by the 10 mm trocar was sutured.

The primary aim of this study was to examine the early postoperative outcomes of patients who underwent surgery in the PPU and, second, to compare the effects of open and laparoscopic operations.

Statistical Analysis

We conducted the statistical analysis using the Statistical Package for Social Sciences (SPSS) (version 25 for Mac; IBM Corp., Armonk, NY, USA). Continuous variables are described using either median values and interquartile ranges (IQRs) or means and standard deviations. Categorical variables were analyzed using frequency. The Kolmogorov–Smirnov test was used to evaluate the homogeneity of the data. The categorical variables were

compared using either two-tailed chi-square tests or Fisher's exact tests. The study utilized either independent two-sample t-tests or Mann–Whitney U tests to compare ordinal data. The statistically significant confidence interval was set at 95%, and the two-sided p value was 0.05.

Results

During the study period, 127 patients who underwent surgery for a prediagnosis of peptic ulcer perforation were included, two patients who experienced perforation secondary to malignancy, three patients who were excluded due to missing information, and 122 patients who were included and analyzed.

We compared 99 patients who underwent open surgery (OS) with 23 who underwent laparoscopic surgery (LS). The median age of the entire cohort was 42.5 years (IQR 30.3-62). Patient ages ranged from 20 to 90 years.

Age, sex, comorbidities, white blood cell count, and C-reactive protein level are shown in Table 1. There was a significant difference between the OS and LS groups in terms of parameters other than sex.

A comparison of postoperative outcomes is shown in Table 2. There was no difference between the two groups in terms of ulcer location. The operative time was longer in the laparoscopic group (45 min OS vs. 60 min LS, p<0.001). Although the median length of hospital stay was three days between the two groups, there was a significant difference in favor of the laparoscopic group. There were no significant differences in postoperative complications or 30-day mortality between the two groups (0.754 and 0.684, respectively).

Discussion

Laparoscopic surgery has been applied in many fields, and more advantageous results have been reported than those of open surgery.[9-14] The use of laparoscopy in peptic ulcer surgery is associated with lower morbidity and a shorter total length of hospital stay. There was no significant difference in mortality, postoperative sepsis, abscess, or reoperation rate between the open and closed methods. Although the WSES guidelines recommend using a laparoscopic approach in hemodynamically stable patients, some studies have shown that LS can be used as an alternative option even for hemodynamically unstable patients when performed by experienced surgeons.[3,6,15]

No single factor alone can easily identify patients at high risk for poor outcomes, but older age, the presence of comorbidities, and a delay in surgery have consistently been associated with a greater risk of death. The most widely used disease-specific prediction rule for PPU patients is the 'Boey score', which is based on major medical illness, preoperative shock, and duration of perforation longer than 24 hours before surgery. However, other predictive scores have been proposed.[16-18] The search for the ideal descriptor to select the right patient and use the appropriate surgical method is ongoing.

A delay in surgery has been consistently associated with mortality. Closure of the perforation by laparotomy and suturing the closure with or without overlying the omental pedicle has been the main approach for many years. Endoscopic treatment options and sutureless surgical options such as fibrin sealant are available, but there are no strong recommendations. Laparoscopic repair of perforated ulcers is increasingly used.[6,16,18-20] However, as in

Table 1. Comparison of preoperative features

Variables	All patients n=122	Open surgery n=99	Laparoscopic surgery n=23	p
Age (years) (median, IQR)	42.5 (30.3-62)	45 (32-62)	36 (26-43)	0.003
Sex (n, %)				
Female	20 (16.4)	14 (14.1)	6 (26.1)	0.209
Male	102 (83.6)	85 (85.9)	17 (73.9)	
White blood cell count (×10^3/μL) (mean±SD)	13±5	13.6±5.16	10.5±3	0.006
C-reactive protein (mg/L) (median, IQR)	8.6 (3.2-26.1)	10.3 (3.2-26.4)	3.8 (1.6-11.3)	0.015
Comorbidities (n, %)	0.024			
Absent	97 (79.5)	75 (75.8)	22 (95.7)	
Present	25 (20.5)	24 (24.2)	1 (4.3)	

Table 2. Comparison of postoperative outcomes

Variables	All patients n=122	Open surgery n=99	Laparoscopic surgery n=23	p
Surgical technique (n, %)				<0.001
Graham patch	75 (61.5)	69 (69.7)	6 (26.1)	
Modified Graham patch	47 (38.5)	30 (30.3)	17 (73.9)	
Frequencies of ulcer location (n, %)				0.776
Duodenal	62 (50.8)	50 (50.5)	12 (52.2)	
Prepyloric	44 (36.1)	35 (35.4)	9 (39.1)	
Gastric	16 (13.1)	14 (14.1)	2 (8.7)	
Duration of operation (min) (median, IQR)	45 (41.3-60)	45 (40-57.5)	60 (57.5-80)	<0.001
Complications (n, %)				0.688
Absent	111 (91)	89 (89.9)	22 (95.7)	
Present	11 (9)	10 (10.1)	1 (4.3)	
Complications (n, %)				0.754
Postoperative ileus	4 (3.3)	4	0	
Abdominal Evisceration	2 (1.6)	2	0	
Leakage at repair site	2 (1.6)	1	1	
Wound infection	1 (0.8)	1	0	
Pulmonary embolism	1 (0.8)	1	0	
Sepsis	1 (0.8)	1	0	
Length of hospital stay (days) (median, IQR)	3 (3-4)	3 (3-4)	3 (2-3)	0.002
Readmission (n, %)				0.161
Absent	118 (96.7)	97 (98)	21 (91.3)	
Present	4 (3.3)	2 (2)	2 (8.7)	
30-day mortality (n, %)	6 (4.9)	5 (5.1)	1 (4.3)	0.684

our study, there may be a bias in favor of laparoscopic repair in patients with better general conditions. With the increasing experience of laparoscopy in peptic ulcer perforation surgery, it can be applied in patients with worse baseline values, and the results can be improved.

In meta-analyses comparing patients with open and laparoscopic omental patches, the incidence of postoperative leakage, reoperation, intra-abdominal collection, wound dehiscence, and incisional hernia were comparable between the two methods. Surgical site infection and pneumonia were less common in the laparoscopy group. Laparoscopic techniques resulted in shorter hospitalization and lower postoperative pain scores. The operative duration was longer in the laparoscopy group.[1,3] In our study, similar to the literature, there was no difference between the two groups in terms of postoperative complications. There was no difference in terms of readmission. Patients in the laparoscopy group had a longer operative time and shorter hospital stay.

There are studies reporting postoperative mortality rates of up to 30% for patients in the PPU. According to a meta-analysis, the 30-day mortality rates were 3.8% and 6.8% in the laparoscopy and open groups, respectively, and were significantly lower in the laparoscopy group.[1,16,18] In our study, there was no significant difference in mortality between the two groups.

Our study has several limitations. This was a single-center and retrospective study. The number of patients who underwent laparoscopic surgery was small. Laparoscopy was preferred for younger patients in stable condition, which may have affected the results.

Conclusion

Compared with the open method, the laparoscopic method can be safely applied in the surgical treatment of peptic ulcer perforation without increasing complications. In suitable patients, advantages such as shorter hospital stays can be utilized.

Disclosures

Ethichs Committee Approval: This study was performed in line with the principles of the Declaration of Helsinki. This study was approved by the Marmara University Faculty of Medicine Clinical Research Ethics Committee (Number: 09.2023.1095).

Peer-review: Externally peer-reviewed.

Conflict of Interest: The authors have no relevant financial or nonfinancial interests to disclose.

Funding: All authors have declared that they have no financial relationships at present or within the previous three years with any organizations that might have an interest in the submitted work. This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

Availability of Data and Material: The datasets generated during and/or analysed during the current study are available from the corresponding author on reasonable request.

Authorship Contributions: Concept – Ş.K., M.E.; Design – Ş.K., M.E., G.F.K., M.C., S.Ç.E.; Supervision – Ş.K., M.E., G.F.K., M.C., S.Ç.E.; Materials – Ş.K., M.E., G.F.K., M.C., S.Ç.E.; Data collection and/or processing – Ş.K., M.E., G.F.K., M.C., S.Ç.E.; Analysis and/ or interpretation – Ş.K., M.E., G.F.K., M.C., S.Ç.E.; Literature search – Ş.K., M.E., G.F.K., M.C., S.Ç.E.; Writing – Ş.K., M.E., G.F.K., M.C., S.Ç.E.; Critical review – Ş.K., M.E.

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