



EVALUATE SURGICAL EFFICACY IN PEPTIC ULCER PERFORATION - OPEN VS LAPAROSCOPIC APPROACH.

General Surgery

Dr Vishal Yelke Assistant Professor, SVNGMC, Yavatmal

Dr Anup Shaha Senior Resident, SVNGMC, Yavatmal

Dr Kalpesh Shirsath Senior Resident, SVNGMC, Yavatmal

ABSTRACT

Background: Perforated peptic ulcers are a surgical emergency that can be repaired using either laparoscopic or open surgery. The present study aimed to compare the surgical efficacy of laparoscopic versus open repair for perforated peptic ulcer (PPU). **Method:** A total of 60 patients with PPU were divided into two equal groups. The laparoscopic (Group I) or open surgery (Group II) was performed after clinical examination. Preoperatively Boeys score and Mannheim Peritonitis Index and post-operatively VAS scoring was done. **Results:** There were more males than females within both groups with a mean age of 52.4 ± 17.6 years in group I and 55.8 ± 15.8 years in group II. The perforation size of group I was greater as 16.4 ± 5.6 mm than group II patients (15.9 ± 6.3 mm). Site of perforation was Juxta-pyloric in majority of cases in both the groups (63.33% vs. 70%). The mean operation time was higher in group I (110.6 minutes) in comparison with group II (84.7 minutes) while the post-operative stays in group I (4.5 ± 3.5 days) was much lesser than in group II (7.4 ± 6.4 days). Maximum patients in group II (36.66%) had complications versus 5 patients (16.66%) in group I, ($p=0.005$). There were significantly lower pain scores in the laparoscopic group compared with the open group from Day 1 to Day 4 ($p=0.044$, $p=0.013$, $p=0.038$, and $p=0.031$, respectively). Mortality was similar in both groups (open- 2 patients vs. laparoscopic, 1 patient, $p<0.553$). **Conclusion:** Laparoscopic repair of PPU is a simple and safe procedure in experienced hands. It is associated with longer operating time, less postoperative pain, less post-operative complications, a shorter postoperative hospital stay, and earlier returns to normal daily activities.

KEYWORDS

Perforated peptic ulcers; Juxta-pyloric; Laparoscopic; Open surgery; Boeys score; Mannheim Peritonitis Index; VAS score

INTRODUCTION

Peptic ulcer disease is a common medical condition worldwide with a reported annual incidence between 0.03% to 0.19% [1]. The incidence of peptic ulcer disease has decreased with the use of appropriate treatment strategies against the most common etiologies, which are *Helicobacter pylori* and the use of NSAID drugs [2]. Although the use of proton pump inhibitors has contributed to curing the disease and prevention of complications such as bleeding and perforation. Perforation is the second most common complication of peptic ulcer. Approximately 10-20% of patients with peptic ulcers suffer a perforation of the stomach or duodenum in which a chemical peritonitis develops initially from the gastric and duodenal secretion but in a few hours bacterial contamination is superimposed [3].

Perforated peptic ulcer (PPU) is a common abdominal emergency and the surgical treatment is essential in most cases. Despite the advances in medical treatments for peptic ulcer disease, PPU incidence has not significantly decreased, it remains a significant cause of severe complications and death [2]. Spillage of gastric contents with bile acid into the intraperitoneal space causes localized or generalized peritonitis, which quickly leads to sepsis and a life-threatening condition. Early surgery using laparoscopic or open repair of the perforated site with proper sepsis management is essential for a good outcome [3, 4].

Open surgery (OS) has been used to treat PPU for the past decades. Laparoscopic treatment of PPU has been introduced as an alternative procedure or is an attractive option to open surgery. Not only is it possible to identify the site and pathology of the perforation, but the procedure also allows closure of the perforation and peritoneal lavage, just like in open repair but without a large upper abdominal incision [5]. Since the first report of laparoscopic repair of PPU in 1990, [6] emerging evidence in the literature have confirmed the feasibility and efficacy of the laparoscopic approach [7, 8]. Previous meta-analysis and systemic review have even reported that it should be the procedure of choice in low-risk patients [5, 9]. However, the retrospective studies found acceptable outcomes of LS use for PPU, but because of inconsistent results surgeons select a procedure based on personal preference [10, 11].

Laparoscopic repair confers benefits including reduced postoperative pain, less pulmonary infection, shorter hospital stays, and earlier return to normal activities. But the adoption of laparoscopy in the emergency setting such as in the management of PPU has been slow and limited. There remains much debate regarding the benefits of laparoscopic

repair with most literature showing that although feasible, there is no significant benefit [12]. Hence the present study aimed to compare the safety and efficacy of laparoscopic versus open repair for perforated peptic ulcer disease.

MATERIALS AND METHODS

This prospective randomized study was conducted in the Department of Surgery, at Tertiary Care Centre, during the period from December 2020 to December 2021. Patients aged between 16-70 years, with provisional diagnosis PPU (based on signs of generalized peritonitis and pneumo-peritoneum) were counselled to participate in the study and an informed consent was taken from them. Patients with delayed presentation (>48 hours), absolute contraindication for laparoscopy (uncorrectable coagulopathy, severe cardiopulmonary disease), malignant ulcers (detected by postoperative pathology), and other complications with perforated peptic ulcer (bleeding or stenosis) were excluded from the study.

The number of patients admitted as study participants was 60. All these patients were assessed by careful and complete history taking, full clinical examination, laboratory and radiological investigations. The surgical risk assessed according to Boey score. The Boey score depends on the sum of three risk factors: Pre-operative shock (SBP <24 mmHg), Boey score 0, 1 is considered low surgical risk while increasing score means increasing surgical risk [13]. The study enrolled patients were further divided into two groups. Group I had those patients which underwent laparoscopic surgery for their correction while Group II had those patients on which open surgery protocol was opted for treatment. Randomization was performed by a computer-generated schedule, and the results were sealed into envelopes. The number of patients in both groups was decided in accordance with their clinical presentation and complications in addition to the age and comorbidities presented as well as their informed consent deliverance.

Age, gender, duration of symptoms, co-morbidities, ulcer disease history (positive or negative), NSAIDs intake history, presence of shock. Operative data included: site and size of perforation, type of repair, operative time, conversion rate and cause of conversion. The Mannheim Peritonitis Index (MPI) scoring was applied with a score from 0-47 for assessing prognostic factors with scoring >26 was lined with mortality rate high while Boey scoring sum of 3 independent risk factors was also used with scoring based on severity of medical illness, shock state on admission and delay in symptoms presenting greater than 24 hours. VAS scoring was used for describing pain. Post-operative data included: Analgesia requirement, complications

(leakage, wound infection, wound dehiscence, pulmonary complications, ileus and intra-abdominal collection), hospital stay, time to start oral intake and mortalities. All data were collected and recorded in a preformed sheet.

Statistical analysis:

The statistical analysis of the data in this study was performed using the SPSS (statistical package of social science) Version 26. Continuous variables/ data was expressed as means $\pm$ Standard Deviation (SD) and comparisons between groups were done using One-Way ANOVA. Categorical variables were described using frequency distributions and comparisons between groups were done using chi-square test. The difference was considered statistically significant if p-value ≤ 0.05 .

OBSERVATIONS AND RESULTS

A total of 60 patients were included in the study and were randomly divided into two groups of 30 patients in each. Both the groups were comparable and found no significant difference with respect to demographic data of patients, and comorbidities ($p > 0.05$). Also, there was no significant difference presented in Boey scoring or MPI between both the groups as shown in table 1.

Table 1: Demographic profile and clinical presentation at admission within Group I and II

Variables		Group I	Group II	P value
Age in years	Mean	52.4 $\pm$ 17.6	55.8 $\pm$ 15.8	0.434
Gender	Male	25 (83.33%)	26 (86.66%)	0.717
	Female	05 (16.66%)	04 (13.33%)	
BMI (kg/m ²)	Mean	21.4 $\pm$ 4.5	22.6 $\pm$ 5.3	0.348
Comorbidities	Diabetes	03 (10%)	04 (13.33%)	0.687
	Hypertension	02 (6.66%)	02 (6.66%)	1.000
	Renal impairment	00 (0.0%)	01 (3.33%)	-
	Cardiovascular	03 (10.0%)	03 (10.0%)	1.000
	Respiratory	03 (10.0%)	02 (6.66%)	0.640
	Total	11 (36.66%)	12 (40.0%)	0.790
				0.000
Boey score	0	10 (33.33%)	10 (33.33%)	1.000
	1	12 (40.0%)	12 (40.0%)	
	2 or 3	08 (26.66%)	08 (26.66%)	
Mannheim Peritonitis Index	Score < 27	28 (93.33%)	22 (73.33%)	0.0832
	Score ≥ 27	02 (6.66%)	08 (26.66%)	
Shock on presentation	Yes	03 (10.0%)	04 (13.33%)	0.687
Duration of symptoms > 24 h	Yes	19 (63.33%)	18 (60.0%)	0.790

The operative details for laparoscopic and open repair group are presented in Table 2. There was no significant difference was observed between the two groups in terms of perforation size (16.4 mm vs. 15.9 mm, $p = 0.746$) and site of perforation (juxtapyloric, 63.33% vs. 70%, $p = 0.583$) while significant difference seen in operating time (110.6 minutes vs. 84.7 minutes, $p = 0.048$). The length of postoperative stay was significantly shorter in the laparoscopic repair group than open group (4.5 $\pm$ 3.5 days vs. 7.4 $\pm$ 6.4 days, $p = 0.034$).

Table 2: Comparative operational data between group I and group II

Variables		Group I	Group II	P value
Perforation size (mm)		16.4 $\pm$ 5.6	15.9 $\pm$ 6.3	0.746
Perforation Site	Juxta-pyloric	19 (63.33%)	21 (70.0%)	0.583
	Duodenum	06 (20.0%)	08 (26.66%)	0.541
	Stomach	05 (16.66%)	01 (3.33%)	0.085
Operation time (min)		110.6 $\pm$ 53.5	84.7 $\pm$ 45.3	0.048*
Post-operative stay (days)		4.5 $\pm$ 3.5	7.4 $\pm$ 6.4	0.034*

Figure 1 shows the overall complication rates and the incidence of specific complications in both laparoscopic and open repair group. The most common complication in both groups was respiratory.

Overall, more patients in the open repair group (11 patients, 36.66%) had complications versus 5 patients (16.66%) in the laparoscopic group ($p = 0.005$). There was no conversion in the laparoscopic group. Mortality was similar in both groups (open- 2 patients vs. laparoscopic, 1 patient, $p < 0.553$).

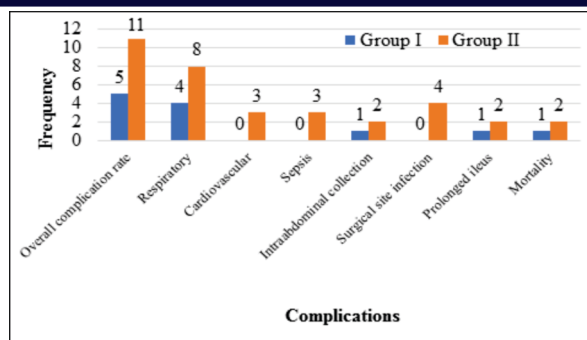


Figure 1: Comparison of complication rates or surgical outcomes in both the groups

Postoperative pain scores for both groups were assessed using the visual analogue scale (VAS) from day 1 to day 4 as depicted in Table 3. There were significantly lower pain scores in the laparoscopic group compared with the open group from Day 1 to Day 4 ($p = 0.044$, $p = 0.013$, $p = 0.038$, and $p = 0.031$, respectively).

Table 3: Comparison of VAS pain scores in post-operative group I and group II

Post-op Days	Group I	Group II	P value
Day 1	2.4 $\pm$ 1.8	3.5 $\pm$ 2.3	0.044*
Day 2	1.2 $\pm$ 1.3	2.4 $\pm$ 2.2	0.013*
Day 3	0.6 $\pm$ 1.0	1.3 $\pm$ 1.5	0.038*
Day 4	0.3 $\pm$ 0.5	0.9 $\pm$ 1.4	0.031*

DISCUSSION

In the present study, the patient demographic characteristics, comorbidities, Boey scores, and Mannheim Peritonitis Indices were well matched in both the groups. These findings are in accordance with the study done by Siow SL et al [11] and Ahmed Negm et al [14]. The majority (61.66%) of our patients presented late with symptoms > 24 hours prior to arrival to our institution which is comparable with the study conducted by Siow SL et al [11]. The perforation size of group I was greater as 16.4 $\pm$ 5.6mm than group II patients which was 15.9 $\pm$ 6.3 mm as similar to Siow SL et al [11] and Kumar D et al study [15]. The most common site of perforation was at the juxtapyloric region, this finding is correlated with the other studies [11, 16, 17].

Operation time is a featuring parameter in the studies comparing laparoscopic and open surgery. Varied results are available in literature regarding operation time. Mean operative time of laparoscopic repair group was higher (110.6 $\pm$ 53.5 min) in comparison to open repair group (84.7 $\pm$ 45.3 min). The difference was statistically significant ($p < 0.05$). This is similar to findings shown by Ahmed Negm et al [14], Bertleff MJ et al [17], Nicolau AE et al [18] and Srivastava V et al [19]. Laparoscopy had significantly prolonged the operative time in current study which can be explained by the large volume of warm saline (2-6 liters) used for peritoneal lavage and the intra-corporeal stitching which consumed more time than in the open repair.

Post-operative pain score was assessed in each and every patient using Visual analogue scale. Like several previous studies, current study demonstrated that post-operative pain in the laparoscopic group was significantly lower than that in the open group as a result of the minimally invasive nature of laparoscope with little tissue trauma [11, 14, 15, 20]. However, few studies had reported no difference between the two techniques as regard post-operative pain especially in the first few days due to the inflammatory nature of the pathology which affected the general condition of the patients [21, 22].

The duration of hospital stay (in days) was 4.5 $\pm$ 3.5 and 7.4 $\pm$ 6.4 in the laparoscopic and open repair group respectively. The difference was statistically significant (p -value <0.05). Thus, the hospital stay in current study was significantly shorter in the laparoscopic group. This was comparable to the results of multiple previous studies [11, 14, 15, 20]. On the other hand, other studies had reported nearly equal hospital stay in both groups due to the old age of the patients with multiple comorbidities which necessitate prolonged hospital stay for improving the general condition [5, 23].

Surgery related complications was also significantly lesser in

laparoscopic repair method. Lau et al [5] and Kumar D et al [15] also reported similar findings and stated that lesser incidence of pulmonary complications in laparoscopic group in contrast to open-surgery and the difference was significant. In current study, fewer pulmonary complications were reported in laparoscopic group while it was more in open repair group. Earlier return to home and normal activities are some of the key benefits of laparoscopic surgery [17]. Likewise, result of systematic review also supports the same findings and reported significant difference between both the groups [24]. Furthermore, in existing study, no patient who underwent laparoscopic repair required immediate or delayed conversion to open surgery. Mortality was similar in both the groups (open- 2 patients vs. laparoscopic, 1 patient, $p < 0.553$). These findings are comparable to previous studies [11, 23].

Many authors have concluded that both open and laparoscopic repair of perforated peptic ulcer are both effective treatments [25]. Although present study corroborates, this we suggest that laparoscopic offers improved patient outcome with significantly less morbidity. The benefit and early return to work after laparoscopic surgery for perforated peptic ulcer may offset the cost incurred in performing laparoscopic repair.

Limitations of the study

The present study had a few obstacles. It was a single-center, prospective randomized study with a small sample size, which may not be able to show extensive differences and generalizability.

CONCLUSION

Laparoscopic repair of PPU is a simple and safe procedure in experienced hands. It maintains the benefits of the minimally invasive approach. Even though laparoscopic repair of PPU was associated with longer operating time, it had no impact on the outcome. Laparoscopic approach for repair of perforated peptic ulcer may offer significant advantage over open repair approach with lesser post-operative pain, lesser postoperative complications, a shorter postoperative hospital stay, and earlier returns to normal daily activities.

We recommend a further large number of prospective multicentric studies focusing on the laparoscopic repair of PPU to determine its efficacy and safety in both low- and high-risk patients while accepting higher rates of conversion. The availability of laparoscopic equipment and high expertise in emergencies are some of the obstacles that should be overcome.

REFERENCES

1. Sung JY, Kuipers EJ, El-Serag HB. Systematic review: the global incidence and prevalence of peptic ulcer disease. *Aliment Pharmacol Ther* 2009;29:938–946.
2. Thorsen K, Soreide JA, Kvaloy JT, Glomsaker T, Soreide K. Epidemiology of perforated peptic ulcer: age- and gender-adjusted analysis of incidence and mortality. *World J Gastroenterol*. 2013;19(3):347–54.
3. Kim CW, Kim JW, Yoon SN, Oh BY, Kang BM. Laparoscopic repair of perforated peptic ulcer: a multicenter, propensity score matching analysis. *BMC Surg*. 2022;22(1):230.
4. Soreide K, Thorsen K, Harrison EM, Bingener J, Moller MH, Ohene-Yeboah M, Soreide JA. Perforated peptic ulcer. *Lancet* (London, England). 2015;386(10000):1288–98.
5. Lau H. Laparoscopic repair of perforated peptic ulcer: a meta-analysis. *Surg Endosc* 2004;18:1013–1021.
6. Nathanson LK, Easter DW, Cuschieri A. Laparoscopic repair/- peritoneal toilet of perforated duodenal ulcer. *Surg Endosc*. 1990;4:232e233.
7. Naesgaard JM, Edwin B, Reiertsen O, Trondsen E, Faerden AE, Rosseland AR. Laparoscopic and open operation in patients with perforated peptic ulcer. *Eur J Surg*. 1999;165:209e214.
8. Siu WT, Leong HT, Law BK, et al. Laparoscopic repair for perforated peptic ulcer. A randomized controlled trial. *Ann Surg*. 2002;235:313e319.
9. Lunevicius R, Morkevicius M. Systematic review comparing laparoscopic and open repair for perforated peptic ulcer. *Br J Surg*. 2005;92:1195e1207.
10. Agaba EA, Klair T, Ikedilo O, Vemulapalli P. A 10-year review of surgical management of complicated peptic ulcer disease from a single center: is laparoscopic approach the future? *Surg Laparosc Endosc Percutan Tech*. 2016;26(5):385–90.
11. Siow SL, Mahendran HA, Wong CM, Hardin M, Luk TL. Laparoscopic versus open repair of perforated peptic ulcer: Improving outcomes utilizing a standardized technique. *Asian J Surg*. 2018;41(2):136–142.
12. Sarosi GA, Jaiswal KR, Nwariaku FE, et al. Surgical therapy of peptic ulcers in the 21st century: more common than you think. *Am J Surg* 2005;190:775–9.
13. Graham RR. Technical surgical procedures for gastric and duodenal ulcer. *Surg. Gynecol. Obstet* 1938;66: 269–87.
14. Ahmed Negm, E. A. M., Magdy Basheer, M. S. M., Abd El-Rahman El-Bahy, H. E. M., Ashraf Abbas, A. A. E. M., Ibrahim Dawoud, M. A. M. Laparoscopic versus Open Repair of Perforated Peptic Ulcer: Comparative Study. *The Medical Journal of Cairo University*, 2018; 86: 1767–1775.
15. Kumar D, Ali MT, Mirani SH, Memon MH, Zai AR, Abaidullah K. Comparison of clinical outcome of laparoscopic with open repair surgery for duodenal ulcer perforation. *PJMHS* 2022;16(5): 314–316.
16. Lohsiriwat V, Prapasrivorakul S, Lohsiriwat D. Perforated peptic ulcer: clinical presentation, surgical outcomes, and the accuracy of the Boey scoring system in predicting post-operative morbidity and mortality. *World J Surg*. 2009;33: 80e85.
17. Bertleff MJ, Halm JA, Bemelman WA, et al. Randomized clinical trial of laparoscopic versus open repair of the perforated peptic ulcer: the LAMA Trial. *World J Surg*. 2009;33: 1368e1373.

18. Nicolau AE, Merlan V, Veste V, Micu B, Beuran M. Laparoscopic suture repair of perforated duodenal peptic ulcer for patients without risk factors. *Chirurg*. 2008;103(6):629–33.
19. Srivastava V, Singh G, Singh SK. Laparoscopic repair of perforated peptic ulcers without omental patch versus conventional open surgery. *Int Surg J* 2018;5:927–30.
20. Singh G, Meena D, Bhavi V, Singh JK. Comparative study of laparoscopic and open surgical method in management of peptic ulcer perforation. *International Journal of Medical and Biomedical Studies* 2021;5(9):29–31.
21. Johansson B, Hallerback B, Glise H, Johns-Son E. Laparoscopic suture closure of perforated peptic ulcer. A nonrandomized comparison with open surgery. *Surg. Endosc*. 1996;10: 656–8.
22. Naesgaard JM, Edwin B, Reiertsen O, Trondsen E, Faerden AE and Rosseland AR. Laparoscopic and open operation in patients with perforated peptic ulcer. *Eur. J. Surg*. 1999;165: 209–14.
23. Kirshtein B, Bayme M, Mayer T, Lantsberg L, Avinoach E and Mizrahi S. Laparoscopic treatment of gastroduodenal perforation: Comparison with conventional surgery. *Surg. Endosc*. 2005; 19 (11): 1487–1490.
24. Bertleff MJ, Lange JF. Laparoscopic correction of perforated peptic ulcer: first choice? A review of literature. *Surg Endosc* 2010;24: 1231e1239.
25. Lunevicius R, Morkevicius M. Comparison of laparoscopic versus open repair for perforated duodenal ulcers. *Surg Endosc* 2005;19:1565–1571