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Comparison of laparoscopic and conventional Graham's omentopexy in peptic ulcer perforation: A single center experience

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Abstract

Background/Aim: In recent years, laparoscopic repair has become common in the treatment of peptic ulcer perforation (PUP). In this study, we aimed to compare the advantages and disadvantages of laparoscopic and conventional graham omentopexy in the treatment of peptic ulcer perforation (PUP).

Methods: The files of the patients who underwent laparoscopic and conventional graham omentopexy were reviewed in this retrospective cohort study. The two groups were compared in terms of age, gender, comorbidities, ASA scores, location and diameter of perforation, Mannheim Peritonitis Index (MPI), operation times, VAS scores (4th and 24th hour), oral intake, flatus, length of hospital stay, postoperative complications, morbidity, and mortality.

Results: A total of 192 cases were included in the study, with 123 patients in the Laparoscopy Group and 69 patients in the Conventional Group. In the Laparoscopy Group, earlier oral intake, earlier bowel movements, less pain, shorter length of hospitalization, less pulmonary and total complications, and fewer secondary interventions were observed ($P=0.001$, $P=0.001$, $P=0.001$, $P=0.037$, $P=0.009$, $P=0.039$, respectively). In the Conventional Group, the mean operation time was significantly shorter ($P=0.002$). Other findings were similar.

Conclusion: We observed many advantages of laparoscopic repair in the treatment of peptic ulcer perforation. Longer operation time was the only disadvantage. Based on our results, we believe that laparoscopic approach is safe and superior to conventional surgery in the treatment of peptic ulcer perforation.

Keywords: Laparoscopy, Peptic ulcer perforation, Graham's omentopexy, Postoperative complications, Minimally invasive surgery

Introduction

Peptic ulcer disease (PUD) is commonly seen worldwide, with an incidence between 0.03%-0.19%. Approximately 50% of the global population is infected with *Helicobacter pylori*, which is a risk factor for the development of peptic ulcer. The incidence of H. Pylori infection decreased after the use of proton pump inhibitors (PPI). Due to the success of medical treatment, elective surgical treatment is almost abandoned. However, there was no decrease in the frequency of perforation, hemorrhage, and obstruction, which are among the complications of peptic ulcer [1-4]. Peptic ulcer perforation (PUP) is an important indication for emergency surgery, with 2-10% complication in peptic ulcer disease [5]. PUP is the second most common abdominal organ perforation that requires urgent surgery after appendicitis perforation [6].

Simply closing the PUP with an omental patch has become the preferred approach [7, 8]. Since 1990, laparoscopic repair is widely accepted in the effective treatment of PUP [9]. The laparoscopic approach overcomes the disadvantages of traditional open repair, including large upper abdominal incision, wound infection and separation, prolonged ileus and pulmonary complications, delayed healing times, and late complications such as incisional hernia [10-12]. However, the duration of laparoscopic surgery in PUP is generally longer than that of conventional surgery [13].

In this study, we aimed to compare the advantages and disadvantages of laparoscopic and conventional graham's omentopexy in PUP treatment.

Materials and methods

Patient

The files of 202 patients operated for PUP between January 2015 and January 2020 were analyzed retrospectively. Patients older than 18 years without previous abdominal surgery or septic shock, those with mean arterial pressure >65 mm Hg and benign ulcer perforation were included in the study. Patients with perioperative septic shock, tumor-induced perforation, mean arterial pressure <65 mm Hg, previous abdominal surgery, and patients requiring conversion to conventional surgery in the laparoscopy group (LG) were excluded from the study. A total of 192 patients were included in the study after exclusion criteria, 123 of which underwent laparoscopic and 69 of which underwent Graham's omentopexy, the routinely used method in PUP in our clinic. The two groups were compared in terms of age, gender, comorbidities, body mass index (BMI), American Society of Anesthesiology (ASA) scores, location and diameter of perforation, Mannheim Peritonitis Index (MPI), operation times, VAS scores (4th and 24th hour), oral intake, flatus, length of hospital stay, postoperative complications, morbidity, and mortality. The choice of laparoscopic vs conventional technique was at the surgeon's discretion.

Surgical technique

All surgeries were performed under general anesthesia. In laparoscopic Graham omentopexy technique, the screen was placed to the patient's right posterolateral side. The patient was placed in reverse Trendelenburg position and the surgeon performed the operation between the patient's legs. A 10 mm

horizontal incision was made sub-umbilically. Veress needle was inserted, and CO2 was insufflated until the intraperitoneal pressure reached 12 mmHg. A 30-degree camera was inserted through the trocar and two 5 mm working trocars were inserted in the right and left upper quadrants, on the midclavicular line. After the abdomen was explored, the perforation area was exposed. If the perforation area could not be exposed, methylene blue was administered from the nasogastric tube to identify its location. Then, two absorbable sutures (2/0 vicryl) were placed parallel to the location of perforation. To prevent the placed sutures from cutting through the ulcer site, at least 1 cm intact tissue was left between the sutures. The omentum was placed between these two sutures, which were knotted intracorporeally. Laparoscopic lavage was performed in four quadrants of abdomen and a drain was placed in the near the omentopexy site.

In the conventional Technique, a midline supraumbilical incision was made to enter the abdomen. After the abdomen was explored, the perforation area was exposed. As in the laparoscopic technique, two absorbable sutures (2/0 vicryl) were placed parallel to the perforation area, the omentum was placed between these two sutures and knotted. Four quadrants of the abdomen were washed out with physiological saline and aspirated. A drain was placed in the near the omentopexy site.

Postoperative medical follow-up

In the postoperative period, proton pump inhibitors were administered routinely to the patients for 4 weeks. Control upper GIS endoscopies were performed at the first postoperative month. Biopsies were obtained from the edges of the ulcer to exclude malignancy, especially in patients with pre-pyloric ulcers. In addition, the presence of H. pylori was investigated by endoscopic biopsy in all cases, and eradication was performed in H. pylori positive patients.

Statistical analysis

SPSS (Statistical Package for the Social Sciences) 24.0 program was used for statistical analysis. Mann-Whitney U and descriptive statistical methods were used for binary group comparisons of normally distributed parameters. Fisher's test and Pearson Chi-Square test were used to analyze qualitative data and developing complications. The results were considered statistically significant at $P<0.05$ and $P<0.01$.

Results

Between January 2015-2020, 202 patients were operated on due to PUP. Seven patients who met the exclusion criteria in the conventional group (CG) and three patients who required conversion to conventional laparotomy in the laparoscopy group (LG) were excluded from the study. Two of the seven patients excluded from the CG had tumor perforation and a distal subtotal gastrectomy was performed. Two patients had previously undergone abdominal surgery. Three patients were in the septic shock and their mean arterial pressures were <65 mmHg. All surgeons decided to treat these patients with conventional surgery, and they were excluded from the study so that the groups were homogenous when comparing the two techniques. Our conventional conversion rate was 2.38% (3/126). In all three patients, the reason for conversion was difficulty of exploration due to intra-abdominal adhesions. A total of 192 patients were included in the study after implementation of the exclusion

criteria, with 123 in LG, and 69 in CG. There were 105 males and 18 females in the LG, and 52 males and 17 females in the CG. There was no significant difference between the two groups in terms of demographic data, BMI, ASA scores and comorbidities (*P*>0.05) (Table 1).

Table 1: Demographic data and comorbidities

	Laparoscopic group (n:123)	Conventional group (n:69)	*P*-value
Sex			0.614
Female	18 (14.6 %)	12 (17.4 %)	
Male	105 (85.4 %)	57 (82.6 %)	
Mean Age (SD)	40.91 (16.75)	46.59 (19.41)	0.07
Min/max(med)	17-82 (37)	18-87 (47)	
Mean BMI (SD)	27.52 (2.87)	26.10 (2.33)	0.618
Comorbidity			
Yes	34 (27.6 %)	25 (36.3 %)	0.616
No	89 (72.4 %)	44 (63.7 %)	
Charlson comorbidity index (SD)	2.72 (02)	2.79 (0.3)	0.924
ASA Score			
1	17 (13.8 %)	13 (18.8 %)	
2	76 (61.8 %)	29 (42.1 %)	0.068
3	23 (18.7 %)	21 (30.4 %)	
4	7 (5.7 %)	6 (8.6 %)	

Location and diameter of perforation and MPI were similar between the two groups (*P*>0.05). However, the mean physiological saline volume used in peritoneal lavage was higher in the CG (*P*=0.001), and the mean operative time was shorter (*P*=0.002) (Table 2).

Table 2: Intra-operative and post-operative data

	Laparoscopic group (n=123)	Conventional group (n=69)	*P*-value
Size of perforation			
0-1 cm	81 (65.8 %)	38 (55 %)	0.673
1-2 cm	42 (34.2 %)	31 (45 %)	
Location of perforation			
Pre-pyloric	29 (23.57 %)	14 (20.28 %)	0.626
Post-pyloric	94 (76.43 %)	55 (79.72 %)	
Mean MPI (SD)	17.36 (4.61)	18.59 (5.04)	0.133
Min/max(med)	10-32(16)	10-31(17)	
Mean Volume of lavage (ml) (SD)	1820 (836)	2810 (1385)	0.001
Min/max(med)	1000-3000(2000)	1000-10000(3000)	
Mean Operating time (SD)	100.51 (30.70)	86.39 (27.84)	0.002
Min/max(med)	36-185(99)	40-160(80)	
Mean VAS 4th score (SD)	5.19 (1.29)	5.31 (1.28)	0.298
Min/max(med)	2-9 (5)	2-8(5)	
Mean VAS 24th score (SD)	3.20 (1.10)	4.53 (1.31)	0.001
Min/max(med)	1-6 (3)	2-8 (4)	
Mean Oral intake (day) (SD)	1.024 (0.20)	1.52 (0.96)	0.001
Min/max(med)	1-3 (1)	1-6 (1)	
Flatus (SD)	1.83 (0.68)	2.91 (1.26)	0.001
Min/max(med)	1-3 (2)	1-8 (3)	
Mean Length of hospital stay (SD)	3.45 (1.23)	5.55 (6.76)	0.001
Min/max(med)	2-12 (3)	2-50 (3)	

VAS scores were measured at the postoperative 4th and 24th hours. The 24th hour VAS score was lower in the LG compared to the CG (*P*=0.001) (Table 2).

Oral feeding began in 1.024 (0.20) days in the LG and 1.52 (0.96) days in the CG (*P*<0.001). On average, gas passage was observed in 1.83 (0.68) days and 2.91 (1.26) days in the LG and CG, respectively, indicating significantly earlier initiation of bowel movements in the LG (*P*=0.001). The mean length of hospital stay was shorter in the LG (*P*=0.001) (Table 2).

Postoperatively, superficial wound infection was observed in 7 (5.6%) patients in the laparoscopic group, and 10 (14.5%) patients in the CG (*P*=0.039). Pulmonary complications were observed less in the laparoscopic group (*P*=0.037). Postoperative leakage, separation of fascia, intra-abdominal abscess and prolonged ileus incidence were similar in both groups. However, when the total complications were compared excluding

the superficial wound infection, 10 complications were observed in the LG and 19 were seen in the CG (*P*=0.016) (Table 3).

Re-operation was performed in 3 patients in the LG and 6 patients in the CG. All patients in the LG were re-operated due to postoperative leakage, while four of the six patients in the open group were re-operated due to postoperative leakage and two, due to separation of the fascia. Although the number of patients re-operated in the CG was higher, there was no significant difference (*P*=0.073) (Table 3).

Table 3: Post-operative Complications

	Laparoscopic group (n=123)	Conventional group (n=69)	*P*-value
Superficial wound infection	7 (5.6 %)	10 (14.5 %)	0.039
Intraabdominal abscess	4 (3.25 %)	4 (5.8 %)	0,461
Separation of fascia	0	2 (2.9 %)	0.128
Prolonged ileus	0	2 (2.9 %)	0.128
Leakage	3 (2.43 %)	4 (5.79 %)	0.253
Pulmonary complications	3 (2.43 %)	7 (10.14 %)	0.037
Total complications	10 (8.13 %)	19 (27.50 %)	0.016
Interventional drainage	4 (3.25 %)	4 (5.8 %)	0.461
Re-operation	3 (2.43 %)	6 (8.69 %)	0.073
Total Secondary Intervention	7 (5.7 %)	10 (14.49 %)	0.039
Mortality	0	2 (2.9 %)	0.128

Interventional radiology placed drains for intra-abdominal abscesses in four patients in each group (*P*=0.461) (Table 3). The rate of secondary intervention was higher in the CG (*P*=0.039) (Table 3).

While there was no mortality in the LG, 2 (2.89%) mortalities occurred in the conventional group. Two patients who died were ASA 4E and followed up in the intensive care unit after surgery. One of these patients had a postoperative leak, while the other patient had no intra-abdominal complications. There was no significant difference in mortality between the two groups (*P*=0.128) (Table 3).

In the control endoscopies performed in the 1st month postoperatively, no evidence of malignancy was observed in any patient.

Discussion

PUP incidence changes between 1.5-3%, lifetime prevalence is 5% and mortality rate is between 1.3-20% [14]. It is a serious complication requiring urgent intervention, in which treatment consists of closing the perforation area. Conventional repair was the standard treatment for the past 10 years. In recent years, with advances in minimally invasive surgery, laparoscopic approach is increasingly preferred for the treatment of acute abdomen. Laparoscopic repair is widely used in PUP treatment today [15-16]. In the literature, simple closure, standard Graham's omentopexy, modified Graham's omentopexy, and fibrin glue closure techniques were used in the laparoscopic treatment of PUP [15, 17-21].

In this study, the demographic data were similar, but most patients were male in both groups. There were 85% males in the LG and 82% males in the CG. The results of many studies are similar to ours, and we observed that the patients operated with PUP were mostly male in the past studies [19, 22 ,23-25].

In our study, there was no difference between preoperative risk findings such as ASA scores and patient comorbidities, and intraoperative findings such as location and diameter of perforation, and MPI, making it meaningful to compare these two techniques.

Although the MPI were the same, less physiological saline was used to wash out the abdomen in LG. We think that this

was due to targeted irrigation and aspiration thanks to the better field of view in laparoscopy. Especially in the conventional group, the pelvic area was blindly washed out and aspirated because the incision was in the upper midline. Bertleff et al. [24] state that there was no evidence that irrigation reduces intra-abdominal sepsis. In our study, the mean fluid volumes used for irrigation in two groups did not affect the development of intra-abdominal sepsis.

In the present study, the mean operating time was longer in the LG, which was consistent with many studies and meta-analyses [8, 13, 20, 25-27]. In a prospective controlled study by Siu et al. [28], the mean operation time was significantly shorter in the LG. This was one of the rare contradicting studies in the literature. We think that the longer operation time in the LG may be caused by laparoscopic peritoneal lavage, since this procedure requires different patient positions to aspirate all quadrants.

One of the advantages of laparoscopic surgery is less postoperative pain. In a study by Siow et al. [22], VAS scores were measured for 4 days, which revealed that VAS scores were significantly lower in the LG. In the LAMA study, shorter VAS scores were found in the laparoscopy group on days 1, 3 and 7. However, there was no difference between the VAS scores investigated on the 28th day [24]. In a study by Kumar et al. [25], postoperative second day VAS score was lower in the LG. In another prospective study, VAS scores were similar between the groups within the first 12 hours, and significantly lower in the LG from the 24th hour onwards [29]. In another study, no difference was found within the first 24 hours [30]. In our study, 24th hour VAS score was lower in the LG. The literature and our study revealed that significantly low VAS scores were observed in the LG at 24 hours and later.

Our patients began oral feeding significantly earlier in the LG. In previous meta-analyses and studies, significantly early oral feeding tolerance was observed in the laparoscopy group, which is consistent with our results [12, 18, 25]. In laparoscopic surgery, less gastrointestinal intervention, less postoperative pain, and early mobilization may cause patients to return to the daily activities of the gastrointestinal tract earlier [18].

Passing gas was considered an indication of postoperative bowel movements, which began earlier in the LG. In the literature, there is no study comparing the time of bowel movements to return to normal.

There were many studies reporting that the length of hospital stay is shorter in the LG [12, 13, 20, 22, 25, 27], and others reporting no significant differences [24, 31, 32]. We found significantly shorter length of hospital stay in the LG. This may be explained by earlier oral feeding, normalization of bowel movements, and less post-operative pain.

In the literature, superficial wound infection was observed less in the LG [20, 25, 32]. Similarly, we observed significantly less superficial wound infection in the LG. In the meta-analysis of Gabriel et al. [33], as in ours, pulmonary complications were less in the LG. More postoperative pain in the CG causes patients to have difficulty in breathing exercises, while restricting mobilization, and leading to increased atelectasis. Postoperative leakage, prolonged ileus, separation of fascia and intra-abdominal abscess were similar in both groups. However, total complications were significantly less in the LG. In the

literature, there was no significant difference in terms of postoperative leakage, prolonged ileus, intraabdominal abscesses between the two groups [20, 26, 27, 32, 34]. However, in studies comparing total complications, significantly less complications were observed after LG [13, 18, 22].

In the previous studies, re-operation rates were similar between the LG and CG [18, 20, 26, 35]. In present study, the rates of reoperation and the number of patients undergoing interventional drainage were similar between the two groups; however, the total number of patients requiring secondary intervention was lower in the LG.

In a meta-analysis by Zhou et al. [18], there was no difference in mortality rates between the two groups in randomized controlled trials, whereas in nonrandomized studies, mortality was significantly higher in the CG. In another meta-analysis by Tan et al. [32], mortality rates were similar in both groups. In a review by Varcus et al. [36], mortality was higher in the CG. However, in this study, CG also included patients with preoperative septic shock and high ASA score. This may have caused the high mortality rates in the conventional group. In our study, mortality rates were similar between the two groups. This may be explained by the fact that patients in septic shock were excluded and there was no difference between the ASA scores.

Limitations

This is one of the studies with the largest number of patients comparing the results of the laparoscopic and conventional Graham's omentopexy procedure. However, the retrospective nature of the study may be considered as its limitation. Prospective randomized controlled studies are needed to support the results of this article.

Conclusions

Our case series reveals that laparoscopic repair for PUP results in earlier oral feeding and bowel movements, decreased postoperative pain, superficial wound infections, pulmonary and total complications, secondary intervention, and shorter length of hospitalization when compared with conventional repair. Longer operation time was its only disadvantage. With these results, we believe that laparoscopic approach in the treatment of PUP is superior to conventional surgery and can be used safely.

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