

A COMPARATIVE STUDY of LAPAROSCOPIC VERSUS OPEN APPROACH FOR THE SURGICAL TREATMENT OF PERFORATED DUODENAL ULCER

Haider Adnan Yassin¹, Issam Merdan², Falih Mohsin³

1.MBChB, Board candidate in general surgery, Al-Sader Teaching Hospital, Basrah, IRAQ

2.FICMS, CABS, Consultant Surgeon, Professor of Surgery, College of Medicine, University of Basrah, Basrah, IRAQ

3.CABS, FIBMS, MRCS, FACS, Consultant Bariatric and Metabolic Surgeon, Basrah, IRAQ

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Abstract

Background: Perforated duodenal ulcer disease is a surgical emergency that has undergone significant changes in its management over recent decades. The identification of *Helicobacter pylori* and its link to the development of peptic ulcers, the introduction of proton pump inhibitors, and the application of laparoscopy in conjunction with endoscopy have all significantly influenced new management strategies for peptic ulcer disease. However, despite these advancements, the frequency of ulcer perforations requiring surgery has not decreased as dramatically as the worldwide incidence of peptic ulcer disease has; thus, emergency surgery remains a common practice for addressing complications associated with peptic ulcer disease.

Aim: To compare the outcomes of patients who underwent laparoscopic and open repair for perforated duodenal ulcers regarding operative and postoperative factors.

Patients and Methods: A prospective observational study was carried out in Al- Sader teaching hospital and Al-Saadi private hospital in Basrah from February 2020 to April 2023 to compare the outcomes of patients who underwent laparoscopic and open repair for perforated duodenal ulcers regarding operative and post-operative factors, a total of 43 patients (27 males/ 16 females) with age range of (31-66) years divided into two groups, open method group (24 cases) and laparoscopic method group(19 cases) were included in the study. The statistical analysis was done using SPSS spreadsheet version 26, and the level of statistical significance was set to 0.05.

Results: This comparative study showed significantly shorter operation time in the laparoscopy group with less post-operative pain and shorter hospital stay. Postoperative complications, like as wound infections and incisional hernias, were much reduced in the laparoscopic group; however, there was no notable difference in respiratory infections.

Conclusion: Laparoscopic repair of perforated duodenal ulcers is both safe and effective compared to open repair, offering benefits like reduced operative time, fewer wound-related complications, and quicker recovery and return to everyday activities.

Keywords Duodenal ulcer, laparoscopic

Corresponding author:

Issam Merdan

 Email: issam.alnajjar@yahoo.com

Introduction

Duodenal ulcer disease remains one of the most prevalent diseases of the gastrointestinal tract with annual incidence ranging from 0.1% to 0.3% in western countries, there are well known two major precipitating factors: *Helicobacter pylori* infection and the use of nonsteroidal anti-inflammatory drugs (NSAIDs) ⁽¹⁾. In 1983 Warren/Marshall ⁽²⁾ identified the link between H.

pylori and duodenal ulcers, it is now well established that most instances of duodenal ulcers occur as a result of H. *pylori* infection and approximately 50% of the world population is infected with H. *pylori*. The prevalence of H. *pylori* varies with geography, age, race, ethnicity, socioeconomic status and seem to decrease with improved hygiene, in developing countries the infection rates range

from 13.4–24%, this rate increases with age ⁽²⁾.

Antibiotics and proton pump inhibitors are the basis of treatment for H pylori infections, which are responsible for over 90% of duodenal ulcers, according to studies conducted in 2019.

In order to reduce morbidity and mortality, duodenal ulcer perforation, which affects roughly 2-10% of patients with duodenal ulcers on average, requires special attention, including timely resuscitation and adequate surgical therapy ⁽³⁾.

Surgical delay is a known adverse prognostic factor, and minimizing surgical delay in patients with perforated peptic ulcers (PPU) appears to be of utmost importance ⁽⁴⁾. In Western literature, duodenal ulcer perforations are seven times more common than perforated gastric ulcers in both sexes. The incidence of mortality due to perforation is 5–10%, and mortality increases to 50% if the perforation has been present for more than 24 hours.

The spillage of duodenal contents into peritoneal cavity causing abdominal pain, marked tenderness, peritonitis, decreased liver dullness and shock offers little difficulty in diagnosis of perforations, the presence of gas under the diaphragm on erect chest X-ray is diagnostic in 75% of the cases ⁽³⁾.

A diagnostic laparoscopy or exploratory laparotomy was offered to patients who had peritoneal signs with air under the diaphragm on an erect chest X-ray. Those who did not have air under the diaphragm on an erect chest X-ray had their abdomens computed tomographically, and if they showed signs of perforation (air outside the bowel, free fluid, and thickened bowel), they were taken for a diagnostic or exploratory laparotomy. The treating surgeon, facilities, and certain factors (contraindication for laparoscopic surgery) would decide whether to perform a laparotomy or a laparotomy ⁽⁵⁾.

Currently, the most common method for managing perforated duodenal ulcers is laparoscopic surgery, which has been shown to reduce postoperative pain and the need for analgesics and to have no increased risk of intra-abdominal or pulmonary complications. Only 8% of cases require conversion to open surgery, with the main reasons being a large perforation greater than 6 mm, fragility of the duodenal edges, and associated bleeding or septic shock ⁽⁶⁾.

While Nathanson et al. were the first to describe suture repair of a perforated duodenal ulcer in 1990, Mouret ⁽⁷⁾ performed the first laparoscopic repair

for a perforated peptic ulcer in 1989 using fibrin glue and an omental patch. Despite initial enthusiasm, laparoscopic repair has only gained partial acceptance because its advantages over open repair are not very clear; some trials suggested laparoscopic repair but others were unable to show any real difference in outcome, and still others concluded that open repair is safer for patients with peritonitis brought on by a perforated duodenal ulcer ⁽⁷⁾.

AIM OF THE STUDY

The objective of this study is to compare the outcomes of patients who underwent laparoscopic and open repair for perforated duodenal ulcers regarding operative and postoperative factors (duration of surgery, post operative pain, post operative wound infection, hospital stay, respiratory complications and incisional hernia)

PATIENTS AND METHODS

This prospective observational study compared the operative and post-operative outcomes of patients who had laparoscopic and open repair for perforated duodenal ulcers at Al-Sader Teaching Hospital and Al-Saadi Private Hospital in Basrah between February 2020 and April 2023. A total of 43 patients (27 males/ 16 females) their age ranges from (31-66) years were included in this study. History was taken from them regarding their (age, gender, and history of chronic illnesses like (Diabetes mellitus, Hypertension, Coagulopathy), history of smoking, alcohol and NSAID ingestion, duration of the symptoms, any history of previous similar attack of abdominal pain or known case of peptic ulcer and history of previous abdominal surgery.

Upon examination, all patients had upper or widespread abdominal discomfort along with the tenderness, rebound tenderness, abdominal guarding, and rigidity that are signs of peritonitis. Every patient who was older than 40 years old was sent for a general investigation that included CBC, blood sugar, renal function test, serum electrolytes, and ECG to exclude cardiac cause for pain and erect chest x-ray for air under diaphragm). All patients were admitted to the surgical wards, intravenous fluid was started, intravenous antibiotic cover in form of Ceftriaxone and Metronidazole, omeprazole infusion and nasogastric tube was inserted.

The patients were divided into two groups, the open method group (24 cases) and laparoscopic method group (19 cases) depend on the availability of laparoscopic device at time of surgery and surgeon decision (if any contraindication for laparoscopic surgery).

Surgical technique for open repair:

A modified Graham patch was used to repair the perforated ulcer under GA. Two or three stitches of 2/0 vicryl suture were used to close the perforation, and then a viable omental patch was fixed with the same stitches. One or two abdominal drains (sub hepatic, pelvic) were inserted. An upper midline laparotomy incision was made, suction was completed, the perforation site was identified, and the peritoneal cavity was irrigated with 1000–1500 ml of saline and suction was performed.

Surgical technique for laparoscopic repair:

Under general anesthesia, CO₂ insufflation was performed through direct trocar insertion, and 3 to 4 ports were utilized based on the feasibility and location of the ulcer. The trocars were positioned as follows: a midline infra-umbilical (10mm) camera port and a right midclavicular (5mm) port at the level of umbilicus working port, left midclavicular (5mm) at the level of umbilicus another working port and epigastric port (5mm) for liver retraction if needed.

Following an exploration of the abdomen to locate the perforation and evaluate the extent of soiling, suctioning of spillage, identification of the perforation area, and use of the suction tube tip to measure the size of the perforation, irrigation and a thorough suction of intra-abdominal fluid using regular saline were performed. After cleaning each quadrant in a clockwise manner, the perforation was sealed using the traditional method.

A Graham patch was created using 2 to 3 stitches of absorbable sutures, after which a viable omental patch was secured in place; one or two abdominal drains were placed (subhepatic, pelvic). Post-operatively, all patients received ceftriaxone 1gm twice daily, metronidazole 500mg three times daily, an omeprazole infusion of 80mg daily, along with IV fluids and analgesics for a duration of 72 hours. Patients were kept NPO until positive bowel sounds were detected., then N/G tube were removed and sips of water were allowed, drains were removed when they were empty, after discharge all patients kept on oral antibiotic in form of

Augmentin tab. 1gm twice daily, metronidazole tab. 500gm three time daily and omeprazol tab. 40mg twice daily for five days apart from omeprazole. Stitches were removed in the 8th to 10th post-operative day if there were no complications

Post-operative pain was calculated to all patients according to the numerical rating scales (NRS) in the first 48 hours post operative and as below:

0 = No Pain

1-3 = Mild Pain (annoying, bothersome, and barely affecting ADLs)

4-6 = Moderate Pain (seriously interferes with ADLs)

7-10 = Severe Pain (disabling; unable to do activities of daily living)

DISCUSSION

A perforated peptic ulcer is a medical issue where laparoscopic repair presents a favorable choice; it enables the identification of the perforation site and facilitates closure of the perforation along with peritoneal lavage, similar to open repair but without the need for a large incision in the upper abdomen⁽⁸⁾. In this research, patients were categorized into two groups: the open group and the laparoscopic group, based on the method employed for management. them and we compare between them regarding some operative and postoperative factors.

The operative time is significantly less in laparoscopic repair with p value (0.0001) which is similar to a study done in Egypt by Hisham M. Hassan et al.⁽⁹⁾, in contrast to other studies that show the operative time is less in the open method^(8,10,11,12,13,14), while other studies show statically there is no difference in operative time between open and laparoscopic repair like Abutalib B Alluaibi et al.⁽¹⁵⁾. and Sze Li Siow et al.⁽¹⁶⁾.

The change of the laparoscopic closure technique was significantly responsible for the low surgical time in our study's laparoscopic repair. utilizing the same suture to fix the omentum after applying two to three stitches across the perforation. However, laparoscopic repair requires more technical skill, and surgeons must have specialized training in laparoscopic suturing, as show in other study like Siu WT et al⁽¹⁷⁾.

Regarding post-operative pain, this study show that postoperative pain was significantly less with laparoscopic surgeries similar to other studies

(8,10,11,13,14,15,18,19), the less post operative pain highly related to small size wound (ports site) in comparison to midline big laparotomy wound in open surgery.

Regarding hospital stay, this study show that laparoscopic surgery was associated with shorter postoperative hospital stay with p value (0.0001) similar to other studies (8,9,10,11,12,13,15,16,20,21,22), while there was no significant difference found in hospital stay showed by a study carried in UK done Ricky Bhoga et al. (14), the short post-operative hospital staying in laparoscopic surgery may be attributed to rapid recovery, less post-operative pain, early mobilization and early return to normal daily activity.

Postoperative respiratory complications in this study there is less respiratory complication (atelectasis) in laparoscopic surgery but statistically no significant difference with P value (0.695) similar to other studies (10,13,14,16,19), while a study done by A.V. Sazhin et al. in Russia show that the respiratory complications is less with laparoscopic surgery (20), the less respiratory complication mainly atelectasis highly related to less post operative pain and small wound in laparoscopic surgery in contrast to large upper abdominal incision that restrict the respiration and impair normal breathing.

Regarding wound infection in this study is significantly less in laparoscopic surgery with p value 0.025 similar to other studies (8,10,11,13,15,16,18,22). the reduction of wound infection rate in laparoscopic surgery may be attributed to the small size wound (ports site) and less possibility of contamination of the wound with the intraperitoneal collections.

Regarding postoperative incisional hernia this study show no cases of incisional hernia reported in laparoscopic group while 4 cases reported in open group so the risk of incisional hernia is less in laparoscopic method but statistically there is no difference with p value (0.062) similar to other studies like Khaled A. Elfekky et al. in Egypt (8), Ahmed Bahgat Abdul Latif et al. in Egypt (22), the reduction in incisional hernia rate in laparoscopic surgery related to the small size wound but still statistically not significant.

CONCLUSION

Comparison done regarding some operative and postoperative factors and showed significantly shorter operation time in laparoscopy group with less postoperative pain and shorter hospital stay,

While there was no significant difference in respiratory infections, the laparoscopic group experienced significantly fewer postoperative complications such as wound infection and incisional hernia. Laparoscopic repair of duodenal ulcer perforation is as safe and effective as open repair and offers the benefits of early recovery, reduced wound-related complications, and a return to normal activity.

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COMPARATIVE PAIN SCALE CHART (Pain Assessment Tool)












										
0 Pain Free	1 Very Mild	2 Discomforting	3 Tolerable	4 Distressing	5 Very Distressing	6 Intense	7 Very Intense	8 Utterly Horrible	9 Excruciating Unbearable	10 Unimaginable Unspeakable
No Pain	Minor Pain			Moderate Pain			Severe Pain			
Feeling perfectly normal	Nagging, annoying, but doesn't interfere with most daily living activities. Patient able to adapt to pain psychologically and with medication or devices such as cushions.			Interferes significantly with daily living activities. Requires lifestyle changes but patient remains independent. Patient unable to adapt pain.			Disabling; unable to perform daily living activities. Unable to engage in normal activities. Patient is disabled and unable to function independently.			

Table I: Age and sex of the study population

		Open surgery (N = 24)	Lap (N= 19)	P value
Sex (N%)	Male	16 (66.7%)	13 (68.4%)	0.903*
	Female	8 (33.3%)	6 (31.6%)	
Age (mean ± SD)		47.3 ± 10.7	45.1 ± 9.7	0.486**

*Chi squared test

**Student's t-test

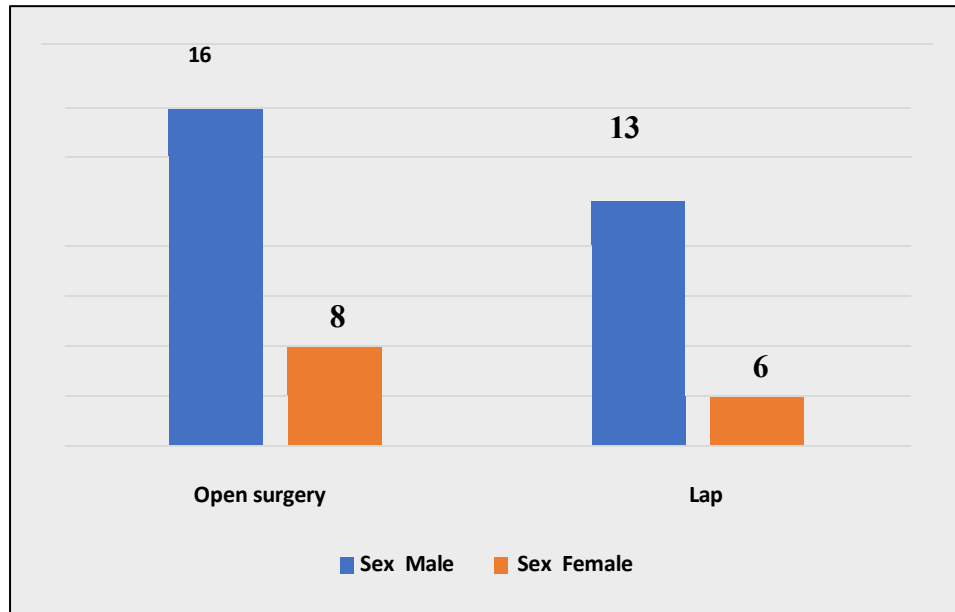


Figure 1 (sex of the study population)

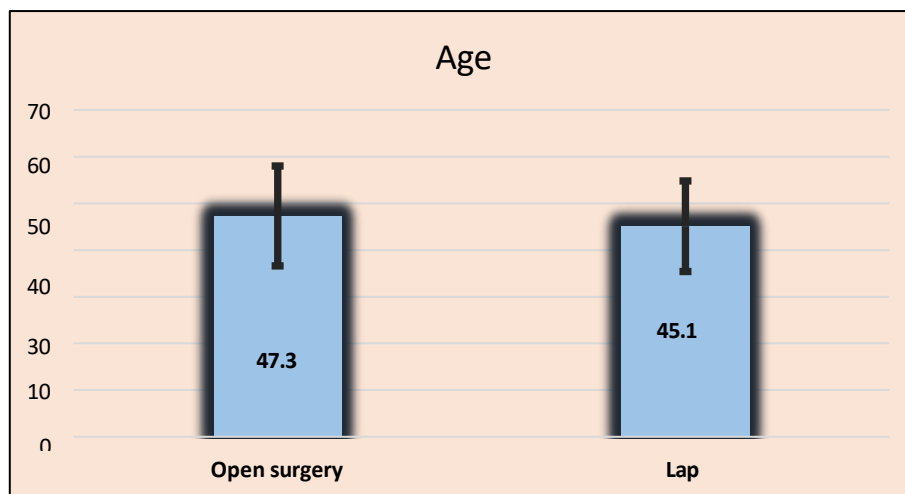


Figure 2 (age of the study population)

Table II: Smoking, alcoholism, NSAID and DM comparison in the study population

	Open surgery (N = 24)	Lap (N= 19)	P value*
Diabetes	5 (20.8%)	3 (15.8%)	0.673
Smoking	7 (29.2%)	9 (47.4%)	0.220
NSAIDs	9 (37.5%)	5 (26.3%)	0.437
Alcohol	3 (12.5%)	2 (10.5%)	0.841
None	2 (8.3%)	4 (21.1%)	0.182

*Chi squared test

Table III: Duration of symptoms, time of surgery, hospital stay and postoperative pain score comparison in the study population

	Open surgery (N = 24)	Lap (N= 19)	P value*
Duration of symptoms in hours (mean ± SD)	11.75 ± 7.83	8.52 ± 4.46	0.118
Time of operation	71.04 ± 9.96	43.05 ± 6.39	0.0001
Post-operative pain score	6.75 ± 1.42	4.74± 1.28	0.0001
Post-operative hospital stay (in days)	4.42 ± 0.50	2.47 ± 0.51	0.0001

*Mann Whitney's test

Table IV: Complications

	Open surgery (N = 24)	Lap (N= 19)	P value*
Respiratory complications	2 (8.3%)	1 (5.3%)	0.695
Wound infections	8 (33.3%)	1 (5.3%)	0.025
Incisional hernia	4 (16.7%)	0 (0.0%)	0.062

*Fisher's exact test