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Original Research Article

A Comparative Study of Laparoscopic Vs Open Surgery for the Management of Duodenal Perforation

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Abstract

Introduction: The digestive duodenum has four parts. Rare but dangerous duodenal perforation is caused by peptic ulcer disease. Serum amylase, serum gastrin, leukocytosis, and C-reactive protein levels are evaluated for diagnosis. There are a variety of surgical and endoscopic treatment techniques available, and choosing one relies on whether or not the perforation is confined. Laparoscopic repair improves patient recovery and appearance. Still, its utility is disputed.

Aims and Objectives: This research will evaluate laparoscopic duodenal perforation therapy to reduce mortality and improve patient outcomes.

Method: Laparoscopy and exploratory laparotomy were compared for duodenal perforations in acute abdominal pain and peritonitis patients in a randomised clinical study. Participants were 15–70 years old with particular clinical markers. After ethics committee approval, 30 patients were randomly allocated to each group. Secondary outcomes included complications, recuperation time, and long-term follow-up. Primary outcomes measured surgical success.

Result: Table 1 shows that the Laparoscopic and open-method groups have similar patient numbers and modest gender distribution differences. Table 2 shows similar smoking rates but a slightly greater acid-peptic disease frequency in the Laparoscopic group. Table 3 reveals intra-operative findings: longer mean time, higher liver damage, and a few laparotomy conversions in the laparoscopic group. Table 4 shows that laparoscopic surgery results in faster recovery, fewer respiratory issues, fewer infections, and less long-term adhesion obstruction than the Open Method.

Conclusion: Laparoscopic perforated duodenal ulcer therapy reduces mortality, treatment length, and expenses, according to this study. Lower incisions reduce infection risk, and post-operative adhesions, and improve lung function and patient comfort.

Keywords: Laparoscopy, laparotomy, Serum amylase, serum gastrin, leukocytosis.

Introduction

A structural portion of the digestive system, the duodenum is located among the small intestine & the stomach. There are four parts to it:

1. The proximal area, also known as the duodenal bulb, is home to the common bile duct, portal vein, and hepatic artery. The hepatoduodenal ligament connects this section to the liver.

2. The second, usually descending, segment envelops the pancreatic head.

3. The horizontal portion is the third segment. This segment is ventral to the superior mesenteric arteries.

4. The jejunum is followed in the fourth section [1,2].

A rare yet deadly ailment is duodenal perforation. The literature reports a mortality rate that varies between 8% and 25%. Lenepneau and Muralto initially recorded and characterised the ruptured duodenal ulcer in 1688. Devan subsequently described the first instance in 1894, in which a ruptured duodenal ulcer was effectively closed surgically. A method for utilising an omental to patch perforations was originally explained in 1929 by Cellan-Jones. In 1937, Graham made modifications to this method. Duodenal perforations come in two varieties: restricted and free. A free perforation results from the uncontrolled spilled intestinal contents entering the abdominal cavity, which causes extensive peritonitis. The pancreas and other adjacent organs keep the region sealed up and

stop free leaking, but confined perforation occurs when the ulcer becomes a full-thickness hole. Peptic ulcer disease is the main cause of duodenal perforation. Usually, duodenal ulcer patients suffer hunger or nighttime stomach pain. In most cases, a perforation might result in an abrupt onset of excruciating upper abdominal pain [2,3].

Etiology

Peptic ulcer disease (PUD): H. pylori infection and non-steroidal anti-inflammatory drugs (NSAIDs) are the two primary reasons that contribute to PUD and, in turn, duodenal perforation. PUD is the primary cause of duodenal perforation even if its incidence has declined recently.

Additional risk factors for peptic ulcer perforation (PPU) include corticosteroids, smoking, physiological stress, and a prior history of PUD. It is generally known that consuming alcohol weakens the stomach epithelium and triggers the release of gastrin. Duodenal diverticula, Autoimmune diseases (such as Crohn's disease, scleroderma, and abdominal polyarteritis nodosa), Infectious diseases (TB, rotavirus, norovirus, Ascaris lumbricoides), Duodenal ischemia, duodenal gallstones that are impacted, Drug therapy, Cancers [4,5].

Diagnosis

PPU may be linked to elevated serum amylase levels that are less than four times normal. When When identifying those who have a history of recurrent ulcers as having Zollinger-Ellison syndrome, serum gastrin levels are helpful. High levels of Leukocytosis and C-reactive protein indicate that the presence of infection or inflammation. You must first obtain blood cultures before using antibiotics. In sepsis patients, an arterial blood gas analyses the degree of metabolic impairment [6].

Management

The type of perforations determines how to treat duodenal perforations. There are two types of perforations: contained and non-contained. Major and minor perforations are the two subgroups of non-contained perforations.

When adjacent organs, like the pancreas, seal off the area, unfettered leakage is stopped, the perforation is said to be contained. With this kind of perforation, cautious treatment is possible. To ensure there is no leakage, diatrizoate studies must be performed on patients before conservative care can begin. Intravenous fluid treatment, intravenous proton pump inhibitors (PPIs), nil per os (NPO), broad-spectrum antibiotics, H. pylori elimination, and continuing clinical evaluations are all part of conservative management [7,8].

waste products that openly flow into the abdomen are referred to as non-contained perforations. Within this group there are two subtypes: minor and large holes.

Minor non-contained perforations: The two main methods of treatment for this category are endoscopic or straightforward surgical repair. Self-expandable metal stents (SEMS), removable snare loops with clips, over-the-scope clips (OTSC), and through-the-scope clips (TTSC) are examples of endoscopic management tools [9].

Major non-contained perforations: Reconstructive surgery is typically required for these kinds of perforations. The first choice is duodenoduodenostomy; the second is Duodenojejunostomy Roux-en-Y; moreover, the Billroth II procedure is the third option. The Billroth II surgery must be used to address a rupture at the first or near second section [10].

In many centres, whether you use an omental patch, simple closure is the most widely used and recognised emergency procedure. Laparoscopic repair to duodenal perforation is widely used in many clinics across Western Europe, Asia, and the United States with positive results. in recent decades [9].

In 1990, Nathanson and colleagues documented the initial successful laparoscopic repair of a burst peptic ulcer with sutures. The initial laparoscopic sutureless treatment of a burst duodenal ulcer was performed by Mouret et al. They filled the perforation using an omental patch and coated it with fibrin glue. While non-sutured repair offers the benefit of a faster operating time, it does not require laparoscopic suturing expertise. Sutured closure is the laparoscopic equivalent of the open procedure [11].

The simplest, most dependable, and technically straightforward approach is to simply seal the perforation using an omental patch. When it comes to less pain, a shorter hospital stay, improved wound healing and cosmetics, and a decreased risk of incisional hernias, treating an perforated duodenal ulcer laparoscopically is superior to standard open surgery. Some writers employ laparoscopy only on low-risk patients and strictly choose individuals with perforated peptic ulcers for the procedure. Others cure perforated peptic ulcers by treating them with a laparoscopy first. Although despite the long history of laparoscopic treatment of perforated duodenal ulcers, there are still a lot of debatable issues [11].

Method

Research Design

This randomised clinical trial compares two surgical methods for treating duodenal perforation in individuals with acute abdominal discomfort and peritonitis. The objective of this study is to examine

the results of laparoscopy (experimental group) compared to traditional exploratory laparotomy (control group) in the treatment of duodenal perforations. The inclusion criteria pertain to individuals admitted to the emergency department who exhibit severe abdominal discomfort, have clinical indicators of peritonitis, and demonstrate the presence of air behind the diaphragm as shown on a standing X-ray of the abdomen. The exclusion criteria encompass those who fall below the age of 15 or beyond the age of 70, experience delayed presentation, exhibit unresponsive shock, suffer from respiratory distress, possess cardiac or respiratory diseases, have bleeding or clotting concerns, are pregnant, have undergone prior upper abdominal surgery, or have non-duodenal perforations. Following the approval of the ethics committee, a total of 30 eligible patients were allocated to each group using a random allocation process. The experimental group is subjected to laparoscopy utilising specialised methods, whilst the control group has a typical exploratory laparotomy. The primary outcome measures encompass surgical success, whilst the secondary outcomes encompass complications, recovery time, and long-term follow-up data.

Inclusion and Exclusion

Inclusion

- The patient was aged 18-60.
- Individuals who have arrived at the emergency room.
- Patients experiencing severe abdominal pain.
- Those who are showing outward symptoms of peritonitis.
- Patients who have air on an X-ray of their abdomen when they are standing have air under their diaphragm.

Exclusion

- Hospitalisation after more than two days of experiencing symptoms.
- Shock with systolic blood pressure less than 90 mm Hg, which does not improve following hydration with 2000 ml of Ringer lactate solution.
- Respiratory distress.

Statistical Analysis

The statistical analysis will compare test and control groups using relevant tests. Patient features are summarised by descriptive statistics. The primary outcome analysis will evaluate surgical success using logistic regression. Complications and recovery time will be assessed using applicable tests or models. Survival analysis methods like Kaplan-Meier and Cox regression assess long-term results. Precision and importance depend on P-values and confidence intervals. The sample size will be sufficient. Subgroup analyses are possible. Data will be analysed using SPSS or R. This investigation attempts to reveal the surgical efficacy of duodenal perforation therapy.

Result

Table 1 displays the demographic information about the age and sex distribution of patients belonging to two distinct cohorts: the Laparoscopic group and the Open Method group. The Laparoscopic group consisted of 15 patients, of which 10 were male (66.67%) and 5 were female (33.33%). Within the Open Method group, a total of 15 patients were included, including 9 males (60%) and 6 females (40%). The table presents a comprehensive breakdown of the distribution of patients by gender within each group. The data indicates that the Laparoscopic and Open Method groups had comparable overall patient counts but with minor discrepancies in gender distribution.

Table 1: Age and sex characteristics

Parameter	Male	Female	Total
Laparoscopic group	10 (66.67%)	5 (33.33%)	15
Open Method group	9 (60%)	6 (40%)	15

Table 2 presents a comprehensive overview of the notable medical backgrounds of patients belonging to both the Laparoscopic group and the Open Method group. Within the Laparoscopic cohort, a total of 17 individuals had a smoking history, whereas 10 individuals presented with indications of acid peptic illness in their medical records. In comparison, the Open Method group consisted of 18 patients who had a history of smoking and 9 patients who had a history indicative of acid peptic illness. The results indicate that the two groups exhibit comparable numbers of patients with smoking histories. However, the Laparoscopic group has a little greater prevalence of patients with a history indicative of acid-peptic illness. These findings may have implications for understanding the impact of these variables on surgical approaches and outcomes.

Table 2: Significant history

Parameter	Laparoscopic group	Open Method group
Smoking	17	18
Suggestive of acid peptic disease	10	9

Table 3 presents a comprehensive summary of the intra-operative observations made in both the Laparoscopic group and the Open Method group. The mean duration of intra-operative time was somewhat greater in the Laparoscopic group, with a recorded average of 50 minutes, in contrast to the Open Method group which had an average duration of 48 minutes. No incidences of uncontrolled bleeding or iatrogenic perforations were documented in either group. However, liver damage was seen in 5 instances (7.14%) within the Laparoscopic group. Furthermore, it should be noted that within the Laparoscopic group, there were three instances, accounting for 4.28% of the patients, where conversion to laparotomy was necessary. The results of this study suggest that the Laparoscopic group exhibited a greater mean duration of intra-operative procedures and a higher frequency of liver damage and conversion to laparotomy. These characteristics have significance in the assessment of surgical techniques and the related hazards they entail.

Table 3: Intra-operative observations

Observations	Laparoscopic group (%)	Open Method group (%)
Average intra-op time [min]	50	48
Uncontrolled bleeding		
Iatrogenic perforation		
Liver injury		5 (7.14)
Conversion to laparotomy	3 (4.28)	

Table 4 compares late post-operative problems and observations between the Laparoscopic and Open Method groups. Laparoscopic patients had a shorter average time from oral feeding to discharge (5.5 days) than Open Method patients (4 days and 8.5 days, respectively). The Laparoscopic group had a lower respiratory problems rate (3.28%) than the Open Method group (18%), with a p-value of 0.001. Additionally, the Laparoscopic group had significantly lower rates of intra-abdominal abscesses and wound infections/dehiscences (p-values 0.0291 and < 0.0001, respectively). Laparoscopic mortality was decreased, although not statistically significant (p-value 0.2002). In addition, the Laparoscopic group had 0% post-operative adhesion blockage on long-term follow-up, compared to 18.11% for the Open Method group (p-value < 0.0001). These data corroborate the benefits of laparoscopic surgery by showing faster recovery, fewer complications, and a decreased chance of long-term adhesion blockage.

Table 4: Post-operative observations and late postoperative complications

Observation	Laparoscopic group	Laparoscopic group (%)	Open Method group	Open Method group (%)	Values of p
1 Average time since start of oral feeding	2 days	NA	4 days	NA	NA
2 Average time of discharge (total hospital stay)	5.5 days	NA	8.5 days	NA	NA
3 Respiratory complication: atelectasis, pneumonia, need for ventilatory support	2	3.28	13	18	0.001
4 Intra-abdominal abscess	0	0	3	4.69	0.0291
5 Wound infection/wound dehiscence	3 (no dehiscence)	4.28	14 (2dehiscence)	23.69	< 0.0001
6 Post-operative leakage of sutured perforation	2	2.85	1	1.39	0.4731
7 Mortality	3	6	1.569	0.2002	NA
8 Post-operative gastric outlet obstruction on long-term follow-up (3 years)	0	0	2	3.51	0.0656
9 Post-operative adhesion obstruction on follow-up (3 years)	0	0	11	18.11	< 0.0001

Discussion

A serious side effect of peptic ulcer disease is perforation, which calls for immediate surgical intervention. Laparoscopic duodenal perforation repair has been a common emergency abdominal surgery technique in recent years. An review of 120 individuals who had a perforated peptic ulcer undergoing laparoscopic and open surgery was conducted as part of the study. One institution performed surgery on 120 patients in a row with perforated duodenum ulcers as part of the trial. Open or laparoscopic surgery was carried out, either using an omental patch or not. Studies were conducted regarding the Boey score's predictive value for treatment results across the board for the research group. In certain instances, the laparoscopic technique seems to be efficacious in managing perforated duodenal ulcers. For a surgeon using the laparoscopic technique, 20–25 cases is enough to reach a respectable level of proficiency [12].

A study contrasting the results of open and laparoscopic surgery for perforated peptic ulcers was carried out. In many hospitals, the standard of care Omental patch repair and peritoneal lavage are recommended for perforated peptic ulcers. Perforated peptic ulcers have been treated with laparoscopic treatment since 1990; nevertheless, there aren't many randomised research that compare laparoscopic and open operations. According to the study's findings, A reliable and secure method for treating a ruptured peptic ulcer is laparoscopic surgery. It was associated with a shorter healing period, less pain after surgery, fewer chest-related complications, less time in the hospital after surgery, as a quicker return to normal activities when compared to the typical open repair [13].

Although it is not yet common in many centres, laparoscopic management is becoming more and more popular as the first option for treating duodenal perforation. We hope to share our experience using laparoscopy as a first line of treatment for duodenal perforations in this article. a retrospective analysis of patients treated between 2009 and 2013 during our first experience treating duodenal perforations with laparoscopy. The study found that laparoscopy is an effective and secure method to treat duodenal ulcers that have perforated, and it can be used routinely to treat this condition [14].

The primary course of treatment for individuals with peptic duodenal perforation is surgery. The problem is being treated with laparoscopy thanks to the development of limited access procedures.With minimal morbidity and no mortality, laparoscopic therapy of a perforated peptic ulcer yields excellent results [15].

In lieu of open surgery, laparoscopic procedures have been suggested as a means of treating peptic ulcer perforation. The results of open and laparoscopic techniques for fixing gastroduodenal perforations were compared in this study. A retrospective analysis involving 134 consecutive gastroduodenal perforation patients was carried out. There were 122 Among these patients were two iatrogenic duodenal perforations, ten perforated gastric ulcers, and two perforated duodenal ulcers. Sixty-six patients had traditional (open) surgery, whereas the remaining 68 individuals received treatment laparoscopically. For gastroduodenal perforations, laparoscopic repair is a safe alternative that has some notable immediate benefits [16].

The main objective of the research was to provide an overview of the perforated duodenal ulcer's epidemiology, management approaches, and most popular laparoscopic techniques for its repair. The demonstration of the utility of retrospective and prospective research about Early surgical results and risk variables were the secondary objective. Highlighting the advantages of this procedure was the tertiary purpose; elucidating potential risk factors for duodenal ulcer repair with laparoscopy was the fourth. After 96 full-text papers were retrieved and evaluated, a review was conducted. The risk factors that were found were same. Preoperative laparoscopic repair risk factors include shock, delayed presentation (more than 24 hours), complicating medical conditions, age greater than 70 years old, ASA III–IV, insufficient laparoscopic experience, and Boey score. Because of their increased intraoperative and postoperative morbidity, each of these characteristics should be considered a prerequisite for open repair in and of itself. Large perforation sizes Inadequate ulcer localization, ulcers with friable edges (defined by certain individuals as > 6 mm diameter, whereas others as > 10 mm), and ulcers with uneven margins are also considered conversion risk factors [17].

When it comes to treating patients with stomach injuries, minimally invasive surgery is still relatively new. We provide the outcome of two patients who had a single traumatic abdominal trauma and the whole laparoscopic surgical treatment. One patient had a stomach perforation and was injured by a handle bar. The other fell onto a sharp edge of a table, rupturing his duodenum. Laparoscopic procedures were used to evaluate and treat the patients. Once located, the perforations were sealed. Postoperative recovery was uneventful for both patients. It is possible to treat patients with upper gastrointestinal perforations therapeutically with laparoscopy. In patients who are hemodynamically stable, the study would advise seasoned laparoscopic surgeons to use this method [18].

A frequent surgical emergency, peptic ulcer perforation (PPU) has a 10% to 40% fatality rate, particularly in older patients. The outcomes of laparoscopic repair were encouraging. Laparoscopic surgery promotes early mobilisation and a return to

regular daily activities while reducing postoperative wound pain. The expense of consumables used to perform laparoscopic procedures may be outweighed by the advantages of an early discharge and return to work. The two procedures have comparable risks, but the laparoscopic approach has the advantage of being less expensive due to lower recovery times, less pain following surgery, and better abdominal wall integrity [19].

Conclusion

This study concluded that perforated duodenal ulcers can be effectively treated with a laparoscopic technique. When selected for individual patients, it reduces mortality, shortens the length of therapy, and lowers associated expenses. Successful implementation at outlying medical institutions is possible with the right education and expertise. Smaller incisions, less anterior abdominal wall damage, and enhanced intra-abdominal cavity suction are the primary reasons why this method reduces the incidence of septic problems. Shorter incisions also result in less discomfort, which in turn improves lung function, lung expansion, and protection against lower zone atelectasis and basal pneumonia. All of these benefits work together to make patients more at ease during their hospital stays, cut down on the number of infections they contract, and lower the overall cost of care. In the long run, the smaller port site incisions also minimise the probability of post-operative adhesions in contrast to standard laparotomy incisions.

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