

## Original Research Article

# Clinical study of open versus laparoscopic management for gastroduodenal perforation

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### ABSTRACT

**Background:** This study was organized to compare the clinical efficacy of laparoscopic and open repair of gastroduodenal perforation, and to provide the impressive surgical method of treatment for gastroduodenal perforation.

**Methods:** The present study was conducted with 174 consecutive patients treated for gastroduodenal perforations. These patients included 121 with perforated gastric ulcers, 53 with perforated duodenal ulcers, Whereas 31 patients were treated laparoscopically, and 143 patients underwent conventional (open) surgery.

**Results:** A total of 174 patients were studied with men and women ratio of 4:1. This observational study revealed 80% male preponderance, with mean age of 48 years. Gastric perforations (n=77, i.e., 84.62%) were more common than duodenal perforations (n=14, i.e., 15.38%). Simple closure with omental patch (n=74, i.e., 81.32%) was the most common surgical method for duodenal perforation. While for gastric perforations were repaired primarily with two layered sutures. The mean operating time of open were 61 min and 86 min for laparoscopic surgery. Wound infection was the commonest post-operative complication which was seen in 31 (17.81%) patients.

**Conclusions:** Laparoscopic gastroduodenal perforation repair is safe and reliable, has good clinical efficacy, the incidence of complications compared with open surgery does not increase, and has less surgical trauma, less bleeding, advantages of fast recovery of gastrointestinal function and short hospitalization time, Thus it has great clinical significance and should be promoted in surgery.

**Keywords:** Complication, Laparoscopy, Operative surgical procedure, Peptic ulcer perforated, Simple closure

### INTRODUCTION

The incidence of perforation of gastroduodenal peptic ulcer ranges from seven to 10 cases per 100,000, remaining a public health problem in modern society and complicates from 2 to 11% of gastro-duodenal ulcers.<sup>1-3</sup> The mean age of patients with gastric and duodenal ulcers is now 56 with a one-to-one sex ratio.<sup>4,5</sup> The anterior surface of the duodenal bulb is the most common localization (60%) followed by the gastric antrum (20%) and the lesser curvature of the stomach (20%).<sup>6</sup> Globally, the incidence of peptic ulcer disease has fallen in recent

years.<sup>7</sup> Despite this and recent advances in both diagnosis and management of peptic ulcer disease, namely the improvement in endoscopic facilities, eradication of *H. pylori* and the introduction of the proton pump inhibitors, complications such as peptic ulcer perforation remain a substantial healthcare problem. This may be due to an increase in the risk factors for peptic ulcer complications.<sup>8,9</sup> Peptic ulcer perforation is a serious complication which affects almost 2-10% of peptic ulcer patients on the average.<sup>10</sup> Some authors report ranges between 1.3% and 20%.<sup>11,12</sup> The two principal causes of peptic ulceration and perforation are *Helicobacter pylori*

(*H. pylori*) infection and ingestion of non-steroidal anti-inflammatory agents (NSAIDs). Better understanding of the pathophysiology of *H. pylori* infection with improved therapies to eradicate infection in conjunction with the introduction of Histamine-2 receptor antagonists (H-2RA) and proton pump inhibitors (PPIs) has led to a marked decrease in the incidence of peptic ulcer disease.<sup>13,14</sup> The diagnosis of perforated PUD poses a diagnostic challenge in most of cases. The spillage of duodenal or gastric contents into peritoneal cavity causing abdominal pain, shock, peritonitis, marked tenderness and decreased liver dullness offers little difficulty in diagnosis of perforations.<sup>15</sup> The presence of gas under the diaphragm on plain abdominal erect X-ray is diagnostic in 75% of the cases.<sup>16</sup>

Ulcer perforation was a lethal disease until surgical treatment was introduced. Mikulicz was the first to suture a perforated gastric ulcer in 1880 (5) and suture is still the most common treatment for ulcer perforation.<sup>5</sup> This study was performed to assess the demographic distribution of peptic ulcer, to assess the clinical presentations of peptic ulcer perforation, to evaluate the site of perforation and effective method of treatment, and to study the complications of peptic ulcer perforation and its management.

## METHODS

### Study design and setting

The present study was conducted in Subei people hospital in the Department of General Surgery. A total of 174 patients treated for gastroduodenal perforations between 2014 to august 2016. These patients included 121 with perforated gastric ulcers, 53 with perforated duodenal ulcers, Whereas 31 patients were treated laparoscopically, and 143 patients underwent conventional (open) surgery and post-operative follow up was done till the discharge of the patient from the hospital.

### Study subject

The subjects of this study included all patients who were operated for perforated peptic ulcers at Subei people hospital. Patients with incomplete data were excluded

from the study. The details of patients who presented from 2014 to august 2016 were retrieved retrospectively from patient registers kept in the Medical record departments, the surgical wards, and operating theatre. A detailed history and thorough physical examination were followed by investigations like full blood count, blood grouping, serum urea, serum creatinine and random blood sugar. Radiological investigations like X-ray abdomen erect and chest X-ray were done in all patients. The diagnosis of perforated PUD was made from history, plain abdominal and chest radiographs, and confirmed at laparotomy. The choice between laparoscopic and open surgery depended on attendant. Both types of surgery were performed either by a consultant surgeon or a senior resident under the direct supervision of a consultant surgeon.

### Data collection

Data were collected using a preformed questionnaire. variables included in the questionnaire were; patient's demographic data (age, sex), associated medical premorbid illness, duration of illness, previous history of PUD, NSAID use, alcohol use and cigarette smoking, HIV status, timing of surgical treatment, site of perforation, size of perforation, type of surgical procedure, postoperative complication, length of hospital stay. The duration of symptoms was defined as the time span between the initial pain perception due to perforation and the operation. After surgery site of perforation type of surgery along with any complications and outcome of treatment were recorded. Patients were followed-up for 30 days.

## RESULTS

A total of 174 patients (Table 1) were enrolled in this study. Laparoscopy were (31 i.e. 17.81%) and open were (143 i.e. 82.18%), 140 were male, i.e., 78.02% while 34 were female, i.e. 21.98%, with a male to female ratio of 4:1. Their ages ranged from 15 to 80 years. The majority of our patients were in the age group 61-80 (n=88 i.e. 50.57%) followed by age group less than 20 (n=10 i.e. 5.74%), 21-40 (n=28 i.e. 16.09%), and 41 to 60 were (n=49 i.e. 28.16%) respectively, with mean age being 48 years (Table 1).

**Table 1: Distribution of patients by age groups, gender, and site of perforation.**

Site of perforation	age group (years) and gender								Total	
	Less than 20 (n=10)		21-40 (n=28)		41-60 (n=48)		61-80 (n=88)		(n=174)	
	M	F	M	F	M	F	M	F	M	F
Duodenal perforation	2	-	4	1	15	2	19	6	40	9
Gastric perforation	7	1	19	4	26	5	47	16	99	26
Total (n=174)	9	1	23	5	41	7	66	22	139	35

M= male, F= female, n= number.

**Table 2: Comorbid conditions, clinical feature and investigations.**

Symptoms	Frequency	Percentage
Abdominal pain	174	100
Abdominal distension	155	89.14
Abdominal tenderness	149	85.89
Nausea/vomiting	141	81.11
Constipation	86	49.60
Oliguria	50	29.12
<b>Signs</b>		
Abdominal rigidity	167	96.2
Rebound tenderness	149	85.89
Elevated temperature	144	83.12
<b>Investigations</b>		
Leukocytosis	147	84.4
Gas under diaphragm in X-ray abdomen erect	136	78.18
<b>Comorbid conditions</b>		
Heart disease	18	10.34
Respiratory disease	12	6.89
Diabetes mellitus	25	14.36
Renal disease	14	8.04
Hypertension	35	20.11

Duration of symptoms before presentation at the hospital was from 6 hours to 48 hours with a mean duration of  $3.7 \pm 1.4$  days. Nineteen (11.1%) patients presented within

24 hours of the onset of symptoms. The rest presented between 2 and 6 days after the onset of symptoms. One hundred twenty two (70.11%) patients had a history of dyspepsia or were a known cases of peptic ulcer disease (PUD), while 51 (29.31%) of the patients had no previous history of peptic ulcer disease or any history of dyspepsia while eighty (45.97%) patients had been on non-steroidal anti-inflammatory drugs (NSAIDs). 114 (65.51%) were known smokers while 74 (42.52%) patients were admittedly alcoholics. 28 (16.09%) patients presented at the hospital for the first time with no prior history of PUD or NSAID ingestion. The most common presenting complaints were epigastric pain (100%), abdominal distension (89.14%), and nausea and vomiting (81.11%). Absolute constipation was present in 49.60% of the patients while 29.12% of the patients presented with oliguria (Table 2).

As for clinical signs 96.2% of the patients in this study had abdominal rigidity or guarding. Rebound tenderness could be elicited in 85.89% of the patients while 83.12% had elevated temperature. In total, 147 (84.4%) patients had leukocytosis ( $>10 \times 10^9$  per liter). All of the patients were subjected to erect X-ray abdomen erect posture out of these One hundred thirty five (78.18%) patients showed radiological sign of gas under diaphragm while 30 (16.74%) patient did not show any radiological signs of perforation (Table 2).

**Table 3: Perioperative comparison between open and laparoscopic and complications.**

Characteristics	Open (n=143)	Laparoscopic (n=31)	P
Median age (SD)	58.8 ( $\pm 16.7$ )	46.1 ( $\pm 18$ )	0.058
Male (%)	114 (79.72)	26 (83.87)	0.597
Female (%)	29 (20.27)	5 (16.12)	
BMI ( $\text{kg}/\text{m}^2$ ) (SD)	28.05 ( $\pm 4.5$ )	24.7 ( $\pm 3.6$ )	0.065
Gastric	96 (67.13)	25 (80.64)	0.138
Duodenal	47 (32.86)	6 (19.35)	
Median operation duration (min)	61	86	
Estimated blood loss (mL), median (IQR)	121.5 ( $\pm 25$ -200)	20 (20-57.5)	0.025
Median hospitalization (days), (IQR)	7 (6.5-8.5)	5.5 (4-8)	0.019
<b>Complications</b>			
Wound complication	12 (8.39)	4 (12.90)	0.431
Ileus	3 (2.09)	1 (3.22)	0.704
Leakage	1 (0.69)	-	0.641
Sepsis	8 (5.59)	2 (6.45)	0.853
Intra-abdominal abscess	1 (0.69)	-	0.641
Pulmonary infection	4 (2.79)	3 (9.67)	0.077
Re-perforation	7 (4.89)	5 (16.12)	0.025

SD: standard deviation, IQR: interquartile range

After adequate resuscitation, all the patients had emergency exploratory laparotomy. During surgery it was observed that duodenal perforations (n=53 i.e.

31.45%) surpassed prepyloric and gastric perforations (n=121 i.e. 69.54%) by a huge margin. Simple closure with omental patch was the most common surgical

method employed especially for duodenal perforation repair. All 121 patients with gastric perforations were repaired primarily with two layered sutures. All the patients were placed on triple regimen which included a proton pump inhibitor, metronidazole and amoxicillin.

Wound infection was the commonest post-operative complication, which affected (n=16 9.19%) patients. Other post-operative complications were as shown in Table 3. The duration of hospital stay ranged from 5 to 30 days.

## DISCUSSION

A total of 174 cases of perforated peptic ulcer disease were treated in our Subei people hospital over a 3 year period giving an average of 58 cases per year. 140 were male, i.e. 80.45% while 34 were female, i.e. 19.54%, with a men and women ratio of 4:1. This was similar to the observation in Ile-Ife and other Centres.<sup>17-19</sup> Everett et al in their study of 136 patients observed sex ratio of 6.5:1 with only 18 female patients, this study agrees with the result of present study of men predominance in perforated peptic ulcer cases and this was in agreement with the findings of other studies where the male to female ratio ranged from 3.3:1 to 9:1.<sup>20-22</sup> Svanes was of the view that in men, ulcer perforation incidence increased until about 1950 and declined thereafter.<sup>23</sup> In women the incidence was low and fairly stable until about 1950, from which time it slowly increased. Increasing age among ulcer perforation patients has been observed during this time span, with declining incidence among the young and increasing incidence among the elderly. Most of this temporal variation could be attributed to changing rates of duodenal perforation in men, whereas rates of gastric perforation appear to have been fairly stable. Thorsen et al in their study found a men and women ratio of 1:1.42 with a slight women predominance which is contradictory to our and other authors findings of men predominance.<sup>24</sup> It was concluded that this may be due to regional variations.

From this study, perforated peptic ulcer disease the majority of the patients were above 60 years. Where the commonest age at presentation was between 41 and 80 years. In present series, it was observed that the majority of our patients were in the age group of above 61-80 (n=88 i.e. 50.57%) followed by age group less than 20 (n=10 i.e. 5.74%), 21-40 (n=28, 16.09%), and age group 41-60 (n=49, 28.16%) respectively, with mean age being 36 years (Table 1). Everett et al in their study of 136 patients observed that two-third of patients in the study belonged to age group 40-60 which is almost concordance with the findings of present study.<sup>20</sup>

In this study, most (n=98 i.e. 56.32%) of our patients presented late between 24 and 48 h of onset of symptoms. This is in agreement with other studies from in most developing countries.<sup>7,18</sup> Late presentation in present study may be attributed to poverty and lack of awareness

of the disease by the patient and relatives. A mean period of 22.15 hours between perforation and surgical intervention was reported in 156 patients by Bin-Taleb et al.<sup>27</sup> Total 30 (32.97%) patients presented within 24 h of onset of symptoms while 26 (28.57%) presented after 48 h of onset. In fact from the Danish Clinical Register of Emergency Surgery, a cohort study including 2668 patients showed that every hour of delay from admission to surgery was associated with an adjusted 2.4% decreased probability of survival compared with the previous hour.<sup>27</sup> In present study patients presented late which is contradictory to what was observed by Everett et al is probably because of lack of awareness and education among our population.<sup>20</sup> Also the fact that the first medical personnel these poor people come across are usually quacks or paramedical staff which leads to delay in diagnosis and proper referral.

Most of our patients (n=64 i.e. 70.33%) had past history of dyspepsia or were a known cases of peptic ulcer disease. Similar observations were made by Nuhu et al from Maiduguri and Lawal et al from Ile-Ife who recorded previous history of PUD in 71 and 47% of their patients respectively.<sup>26,28</sup> This is in contrast to some other African studies where more than 60% of their patients had no past history suggestive of PUD.<sup>7,28</sup> The reason for this difference is not quite apparent. While in present study 27 (29.67%) patients had no previous history of peptic ulcer disease or any history of dyspepsia. Similarly, use of NSAIDS is an important cause of perforated PUD in the west.<sup>28</sup> Use of NSAIDS was seen in (n=42 i.e. 46.15% of our patients. Smokers were (65%), while 39 (42.86%) patients were admittedly alcoholics (Table 4).

**Table 4: Pre-operative patient demographics.**

Characteristics	Number	Percentage
Male	140	80.45
Female	34	19.54
<b>Risk factor</b>		
NASID	80	45.97
Alcohol	72	42.52
Smoking	114	65.51
Previous PUD	122	70.11

(NSAID = non-steroidal anti-inflammatory drug; PUD = Peptic ulcer disease).

Svanes was of the opinion that Smoking seem to be a risk factor of major importance for ulcer perforation.<sup>23</sup> The risk was increased by a factor of 10 in smokers among both men and women. It was estimated that smoking might account for 77% of all ulcer perforations in the age group younger than 75 years. NSAIDs are another well-known risk factor for peptic ulcer perforation. Five to eight times increased ulcer perforation risk has been reported for NSAID users.<sup>30</sup> Everett et al observed that 43% of patients of peptic ulcer perforation were alcoholics.<sup>20</sup> In present series it was observed that most of the patients were either smokers or alcoholics or both and

a fair number had a history of NSAID abuse. These were in agreement with other authors that smoking, alcoholism, and NSAID abuse are important etiological factors. The most common presenting complaints were abdominal pain (100%), abdominal distension (89.14%) and nausea, vomiting (81.11%) while abdominal rigidity or guarding were the most common clinical sign present (97.8%). Rebound tenderness could be elicited in 89.01% of the patients while 81.32% had elevated temperature (Table 2). Everett et al in their study of 136 patients observed that the most constant manifestation of perforation was the abrupt onset of agonizing and disabling abdominal pain (90 %) while vomiting was present in 43% cases.<sup>20</sup> Bansod et al also observed that 100% of patients presented with abdominal pain and all of them had abdominal guarding and rigidity.<sup>31</sup> Present finding is in concordance with the findings of other authors.

All of our patients were subjected to erect X-ray abdomen, out of these 143 (78.18%) patients showed radiological sign of gas under diaphragm (Table 2). Briefly, 6 (3.44%) patients showed elevated amylase levels. Everett et al observed that 65% patients had leukocyte count of more than 10,000.<sup>20</sup> They observed elevated amylase levels in 2.2% of cases. Mehboob et al were of the opinion that the presence of gas under the diaphragm on plain abdominal erect X-ray is present in 75% of the cases.<sup>16</sup> Phillipop et al in their study of 84 patients observed that Pneumoperitoneum was present on X-ray abdomen erect view in 65.8% of cases.<sup>33</sup> Salomone Di Saverio et al opined that free air under the diaphragm found on an upright chest X-ray is indicative of hollow organ perforation and mandates further work-up and/or exploration.<sup>34</sup> In the setting of an appropriate history and peritonitis on examination, free air on X-ray is sufficient to justify exploration. Patients without Pneumoperitoneum at admission on plain chest radiograph should be evaluated further by computed tomography (CT) scanning with oral contrast. Present findings are in concordance with that of other authors and it was agreed that plain X-ray abdomen erect view is mainstay of diagnosis of peptic ulcer perforation. Patients of hollow viscera perforation who do not show gas under diaphragm will require CT scan. In this study, gastric perforation (n=121 i.e. 69.54%) were much more common than duodenal perforations (n=53 i.e. 31.45%) seen with a gastric perforation to duodenal ulcer perforation ratio of 2.6:1. Kenneth et al also agree to our findings in their study of 172 patients observed that gastric perforation were more common than duodenal perforation.<sup>24</sup> In present series simple closure with omental patch (n=53 i.e. 31.45%) was the most common surgical method employed especially for duodenal perforation repair. While other (n=121 i.e. 69.54%) patients with gastric perforations were repaired primarily with two layered sutures.

Mikulicz was the first to suture a perforated gastric ulcer.<sup>31</sup> The current treatment of perforated peptic ulcer is

primary closure, covered by omentoplasty. The classical Graham patch technique, described by Graham in 1937 can be applied.<sup>32</sup> The idea in closing the perforation not only by sutures but also with an omental plug is the sealing and tamponade effect of the plug. Other authors also used Grahams patch as treatment of choice.<sup>30,32</sup> Joshi et al in their study concluded that laparoscopic repair of perforated peptic ulcer is a safe and reliable procedure and it reveals lesser morbidity and complication rate when compared with open group.<sup>33</sup> In present study laparoscopic repair of peptic ulcer perforations provides a safe alternative treatment that offers certain significant advantages over open surgery in terms of short-term outcome (Table 3). The best parameters to compare the two different surgical techniques are morbidity and complications. Peptic ulcer perforation exhibits high morbidity with problems of wound infection, sepsis, and high morbidity noted in open group. Wound infection (n=16 9.19%) was the most common complications. In total, 7 (4.02%) patients developed chest infection, 10 (5.74%) complicated with sepsis, ileus in 4 (2.29%), while 12 (6.89%) patients developed re-perforation (Table 3). Which is consistent with previous studies. The analgesic requirement was significantly less in laparoscopic group, and the time to return to normal diet was shorter as well. This was significantly reflected on duration of hospital stay, which was shorter in laparoscopic group. Laparoscopic surgery minimizes postoperative wound pain and encourages early mobilization and return to normal daily activities. The mean operating time of laparoscopic patch repair was significantly longer than the open procedure, which corresponds to open studies. Present study are in concordance with results published globally.

## CONCLUSION

Perforation of peptic ulcer remains a frequent clinical problem in our environment predominantly affecting males. Simple closure with omental patch followed by *Helicobacter pylori* eradication was effective with excellent results in majority of cases despite patients' late presentation in our center. Laparoscopic repair of gastroduodenal perforations provides a safe alternative treatment to perforated gastroduodenal peptic ulcers. Laparoscopic repair for peptic ulcer perforation in our study was associated with less estimated blood loss, less complication, faster return to diet and shorter hospital length of stay. Results in present study are in concordance with results published globally.

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