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Research Article

Comparative study between laparoscopic and open omentoplasty repair of perforated duodenal peptic ulcer

Ayman Helmy Ibrahim, M.D.
Department of General Surgery, Faculty of Medicine, Al-Azhar University, Cairo, Egypt

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Abstract

Background: Laparoscopic treatment of perforated peptic ulcers is still a matter of discussion; some authors propose laparoscopy in most patients even in high-risk cases while others use strict policy for patient selection for laparoscopy and large number of surgeons refuse it. **Aim of the study:** Comparison between outcomes of laparoscopic and open approaches to detect advantages of laparoscopy over laparotomy. **Materials and Methods:** Comparative non-randomized study done on 24 patients with perforated duodenal ulcer allocated into 2 groups, group A (16 patients) selected for laparoscopic omentoplasty and group B (8 patients) underwent open repair. Data collected and compared between groups. **Results:** All patients were males except one female in group A. mean age was significantly higher in laparotomy group. Risk factors for perforation as ulcer symptoms as smoking, NSAID long-term use were positive in most patients. Air under diaphragm in X-ray was positive only in 87.5% of patients. Mean operative time was significantly shorter in group A, 106.2±8.7 versus 166.4±4.5 minutes in group B. Mean blood loss was less in laparoscopy but difference was insignificant 85.5±7.2 ml in group A and 168.7±10.3 ml in groups B. 3 patients (18.7%) in laparoscopy group were converted to laparotomy. Mean hospital stay was significantly shorter in group A; 5.2±0.8 days with 9.4±2.8 days in group B. 4 patients (25%) in group A reported postoperative complications, 2 patients were re-operated. In group B, 5 patients (62.5%) showed complications, 2 patients were re-explored and one case of mortality due to septic shock. No cases of mortality reported after laparoscopy. Laparoscopy group reported success rate of 68.75% (11 patients). **Conclusion:** Laparoscopic management in perforated peptic ulcers had shorter operative time, less hospital stay and fewer complications than laparotomy so, it could be used in selected patients. However, larger studies are required to assess outcomes.

Keywords: perforated peptic ulcer, laparoscopic repair, omentoplasty

Introduction

Although rates of incidence of peptic ulcer disease (PUD) has dramatically decreased in last decades since proton pump inhibitors (PPI) and drugs for eradication of helicobacter pylroi (H Pylori) infection introduced for treatment, PUD still affects up to 4 million of population globally. However, this decrease in incidence is not accompanied by a similar reduction in complications as the rate of perforation is raging from 2-14% according to different studies with high rates of morbidities (10-30%) and mortality up to 50%.[1,2,3] Perforated peptic ulcer (PPU) is considered as the 2nd commonest cause of bowel perforation & most frequent indication of emergency gastric surgery.[3,4]

Identified risk factors for PPU includes use of non-steroidal anti-inflammatory drugs (NSAID), H. Pylori infection, smoking, steroid use, stress and chemotherapy. PPU is more common in young males and smokers, and commonest site is 1st part of duodenum. The 1st laparoscopic PPU repair was reported in Mouret et al. study in 1989.[5]

Since then and with recent advancement in laparoscopy, surgeons started to widely use laparoscopic approach for PPU repair. Most literatures as Sabiston textbook mentioned that omentopexy is the repair of choice in perforation < 1 cm and reported that it could be done laparoscopically. Laparoscopy gives diagnostic and therapeutic advantages over laparotomy, laparoscopic exploration of the abdomen allows confirmation of diagnosis, detection of perforation site and extent, associated pathology and peritonitis beside common advantages of laparoscopic surgery as less pain, faster healing and earlier mobilization than open approach.[6,7]

This study aimed at reporting an early experience of laparoscopy in treatment of PPU with certain patient selection criteria to evaluate advantages, success and outcomes in comparison to laparotomy.

Patients and methods

This comparative non-randomized study was conducted in General Surgery Department, Mouwasat Hospital, Saudi Arabia between May 2021 and April 2024, on patients attended to emergency room in the hospital with perforated duodenal ulcer and treated surgically by the same surgeon; the author. Twenty-four patients were included in the study and, 16 patients underwent laparoscopy and 8 patients underwent open repair of perforated duodenal ulcer disease. Patients were allocated in 2 groups, group A; laparoscopic repair patients & group B; open repair patients. Study was approved by institutional ethics committee and consents were taken from patients before participation in the study after all information given about their condition, planned procedure and possible outcomes, any patient refused to be in the study was excluded.

Inclusion criteria: All patients came to emergency with acute abdominal pain and diagnosed as perforated peptic ulcer by plain X-ray with high clinical suspicion and CT scan was done to confirm diagnosis except in hemodynamically unstable patients, those were confirmed later on during surgery.

Exclusion criteria: Patients indicated for other procedures than repair as gastrectomy, those refused to be involved the study and patients with discovered other pathology during surgery (non-PPU bowel perforations) were excluded from the study.

Preoperative diagnosis and preparation: In Emergency Room, patient with suspected PPU was evaluated by clinical, lab tests and radiology. Plain chest, abdomen and CT scan with oral contrast were done to assess perforation size and location. In 3 cases of laparoscopy group, patients came with acute abdominal pain and clinically suspected PPU but CT did not show exact perforation site, diagnostic laparoscopy was done which confirmed duodenal PPU then all cases treated lapaorscopically.

Patients were assessed according to history of symptoms start, vital and clinical signs, American Society of Anesthesiologists physiological status (ASA) class **(Table 1)**.[8] Surgical procedure was decided according to variable factors involving basically Boey's classification risk score of patient clinical condition which is used to assess severity of the disease and morbidity at admission. It is consisted of 3 criteria: shock (diagnosed if systolic BP < 90 mm Hg), associated severe illness (ASA class III-V) and delayed presentation > 24 hours of symptoms.[9] Each patient was given score from 0-3 **(Table 2)**; laparotomy was decided for patients with score 3. Patients with score 0-2 were operated by laparoscopy or open surgery according to discretion of the surgery team with

involvement of patient in decision making after all information given to him/her. [8,9,10]

16 patients were planned for laparoscopy (group A). 8 patients were planned for laparotomy (group B); two patient was in septic shock at admission, other one patient refused laparoscopy and asked for open approach, five patients were unfit for laparoscopy due to cardiopulmonary diseases and hemodynamic instability.

Surgical technique for laparoscopy repair (LR): Patients were in Lloyd-Davies with reverse Trendelenburg position with 1ry surgeon standing between patient's legs and the cameraman on the left side. Pneumoperitoneum with 12-14 mm Hg pressure was created with Hasson's technique in the infra-umbilical region. Diagnostic laparoscopy was done for confirmation of diagnosis, then two 5mm working trocars were placed on both lumbar regions, abdominal cavity explored and perforation site located and prepared for repair **(Figure 1)**. Repair done with absorbable PDS 3-0 sutures tied over an omental Graham's patch **(Figures 2-4)**. In some cases additional fibrin glue was used for fixation of patch. Leak test was done using diluted methylene blue injected in nasogastric tube (NGT) then by injection of air in NGT and saline in the operative bed to insure water and air tight repair. 3-4 liters of normal saline was used to irrigate the abdominal cavity with repeated suction, abdomen is explored again and two drains were inserted in operative bed and pelvis, hemostasis insured, deflation and wounds closure done. In 3 patients planned for laparoscopy, 3 cases were converted to open surgery due to technical difficulties.

Surgical technique for laparotomy patients: Upper midline incision was done for laparotomy, diagnosis confirmed, abdomen drained and explored. Omentoplasty repair was done using omental patch tied over PDS 3-0 suture as usual standard technique. Peritoneal toilet with saline done and 2 drains inserted in sub-hepatic bed and pelvic cavity and left for 3-4 days postoperative.

Postoperative care: After surgery, patients kept NPO, received IV fluids, PPI, pain killers and broad-spectrum antibiotics. Drains and NGT were removed after 3 or 4 postoperative days after Gastrografin study in 4th postoperative day to detect leak. Patient with leak detected by drain output and confirmed by CT or Gastografin were re-operated by laparotomy (2 patients in group A and 2 patients in group B), revision of repair site and repair were re-done. One case died after 5 days of re-operation due to sepsis without evidence in CT for leak again. Data collected as surgery time, blood loss, conversion to open, re-operation, hospital stay days, severity postoperative pain, complications, mortality, morbidity and other outcomes.

Statistical analysis:
Demographic, preoperative, operative and postoperative data were collected and analyzed with the SPSS and IBM® statistical software programs, quantitative data results had been expressed in the form of mean and standard deviation. Qualitative data was demonstrated in frequency and percentage. Chi square, Bonferroni and *t* tests were used for comparison between group variables, significance was considered if P value < 0.05.

Results

The Majority of patients in the study were males; group A has 15 male patients (93.7%) and 1 female patient (6.3%) and in group B all patients were males. Mean age of group A patients was 42.5±3.6 years (range 32-64 years) while mean age in group B was 48.1±4.2 years (range 45-67), there was statistical significance in age between groups (p=0.023). Previous abdominal surgery was recorded in 3 (18.7%) patients of laparoscopy group (laparoscopic cholecystectomy in 2 patients and open appendectomy in one patient) and 4 patients of laparotomy patients (exploration after trauma in one

patient, hernioplasty for paraumbilical hernia in 2 patients open splenectomy in the remaining patient). As regard preoperative risk factors for PPU, in group A 13 (81.2%) patients were smokers, 10 (62.5%) were using NSAID for long time, 12 (75%) patients had history of PU symptoms. In group B, smokers were 6 patients (75%), long-term use of NSAID was reported in 6 (75%) patients and previous PU symptoms were positive in 7 patients (87.5%). In the study, positive air under diaphragm was reported in 21 patients; 87.5% of the study patients and CT was needed for diagnosis of perforated bowel in the remaining patients. Demographic and preoperative data were shown in **table 3**.

Mean operative time was 106.2±8.7 minutes in group A (range 92-185 minutes) versus 166.4±4.5 minutes (range 118-194 minutes), time was significantly shorter in laparoscopy cases; p= 0.002 **(Figure 5)**. Mean blood loss was 85.5±7.2ml and 168.7±10.3ml in groups A&B respectively, p=0.075; non-significant difference. 3 patients (18.7%) in laparoscopy group were converted to laparotomy. Mean hospital stay after laparoscopy was 5.2±0.8 days (range 3-9 days) and all patients improved on IV analgesics in the 2nd postoperative day. On the other group (laparotomy), mean hospital stay was 9.4±2.8 (range 8-15 days) and pain killers were needed to control pain beyond 2nd day, p=0.041 **(Figure 6)**. These findings were presented in **table 4**.

As regard postoperative complications, 4 patients (25%) in group A reported complications; 1 patient had leakage, 1 patient had port wound infection, 1 patient showed peritonitis and 1 patient showed intra-abdominal abscess collection, patients with leakage and peritonitis were re-operated (12.5%) and abscess collection was drained under U/S guidance. No cases of hemorrhage, sepsis or mortality reported in laparoscopy group. While in laparotomy group, 5 patients (62.5%) showed complications; 1 patient had leakage, 3 patients had wound infection and one patient had peritonitis, re-exploration was done in 2 patients (leakage and peritonitis), one of the re-operated patients had septic shock after 2nd operation and died after 5 days **(Table 5 & Figure 7)**. Laparoscopy group in the study showed 11 patients (68.75%) with successful repair, 3 patients (18.7%) converted to open and 2 patients (12.25%) re-explored due to complications **(Figure 8)**.

Table (1): American Society of Anesthesiology (ASA) Physical Status Classification [8]

	Patient physiological status
ASA I	Normal health
ASA II	Mild systemic disease
ASA III	Severe systemic disease
ASA IV	Severe systemic disease that is constant threat to life
ASA V	Moribund, not expected to survive without operation
ASA VI	Declared brain-dead

Table (2): Boey's risk score for PPU [10]

Risk factor	**Points**
- Time between perforation & admission >24 hours	1
- SBP at admission <90 mmHg	1
- Any one or more systemic illness: DM, cardiac disease, renal disease, liver disease	1
***Mortality: Score 0 = 0% 1 = 10% 2 = 33% 3 > 38%**	

Table (3): Demographic and preoperative risk factors

		Group A (*n*=16)	Group B (*n*=16)	P value
Age		42.5±3.6	48.13±4.2	0.023
Gender	**Males**	15 (93.75%)	8 males	
	Females	1 (6.25 %)	0	
Smoking		13 (81.25%)	6 (75%)	
NSAID		10 (62.5 %)	6 (75%)	
History of PU		12 (75%)	7 ((87.5%)	
Previous surgery		3 (18.7%)	4 (50%)	
Air under diaphragm		14 (87.5%)	7 (87.5%)	

Table (4): Operative findings & hospital stay

	Group A (n=16)	Group B (*n*=16)	P value
Operative time (min.)	106.2±8.7	166.4±4.5	0.002
Blood loss (ml.)	85.5±7.2	168.7±10.3	0.075
Conversion to open	3 (18.7%)	-	
Hospital stay (days)	5.2 ± 0.81	9.4±2.82	0.041

Table (5): Postoperative complications

	Group A (n=16)	Group B (*n*=16)
Leakage	1	1
Re-operation	2	2
Wound infection	1	3
Peritonitis	1	1
Abdominal abscess	1	0
Mortality	0	1

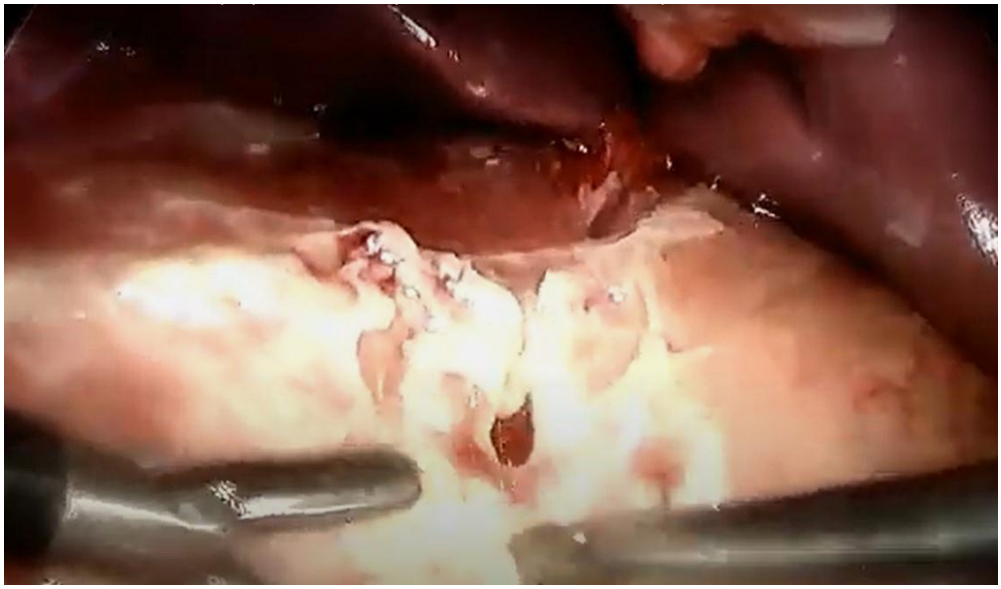

Figure (1): Location of perforation site

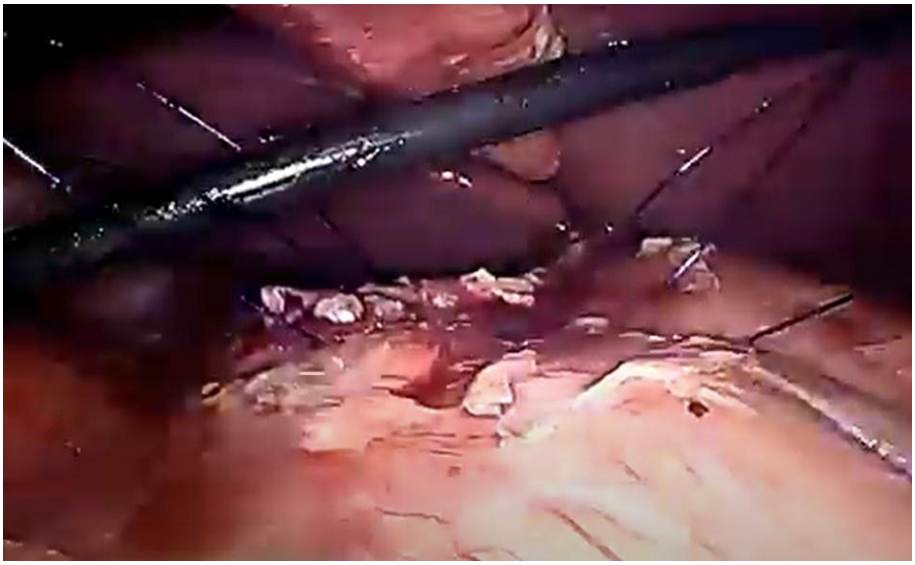

Figure (2): PDS sutures inserted

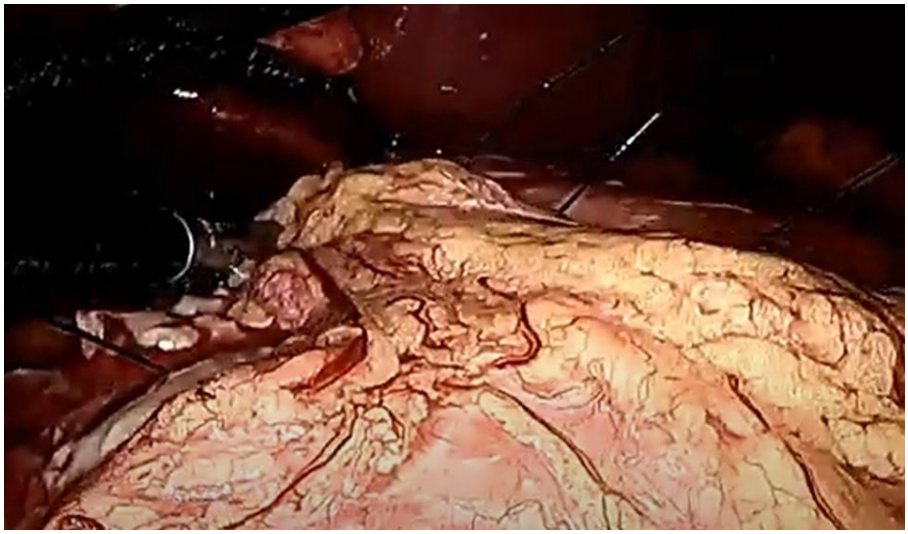

Figure (3): Omental patch prepared to cover perforation

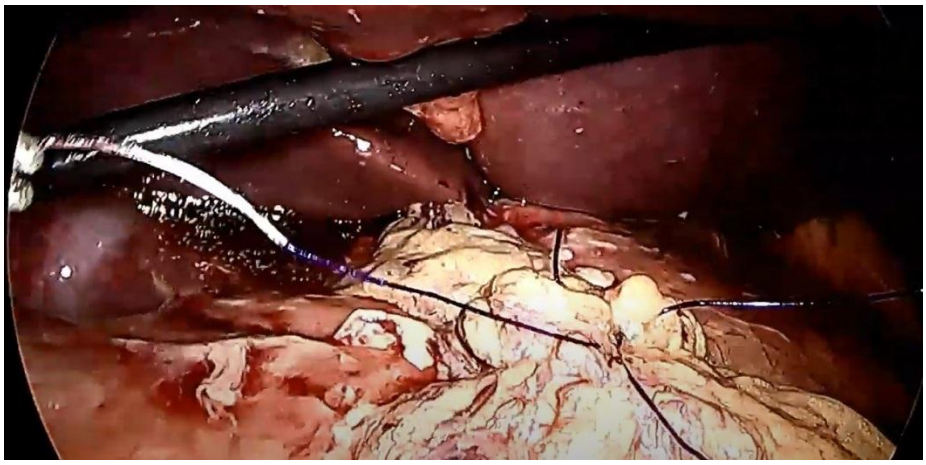

Figure (4): Omental patch tied over perforation site

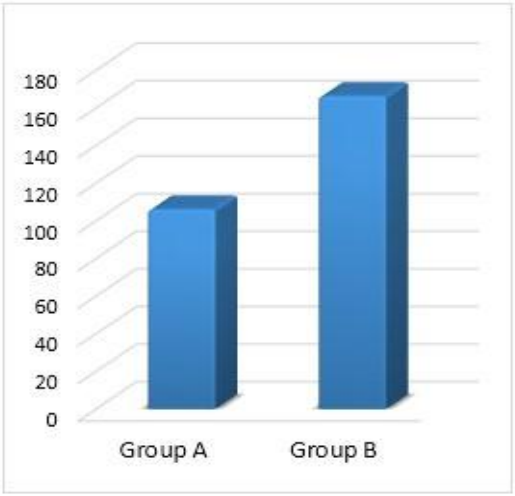

Figure (5): Operative time (minutes)

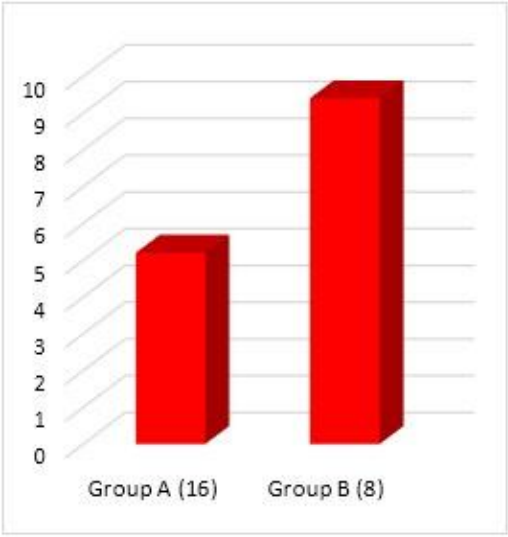

Figure (6): Hospital stay (days)

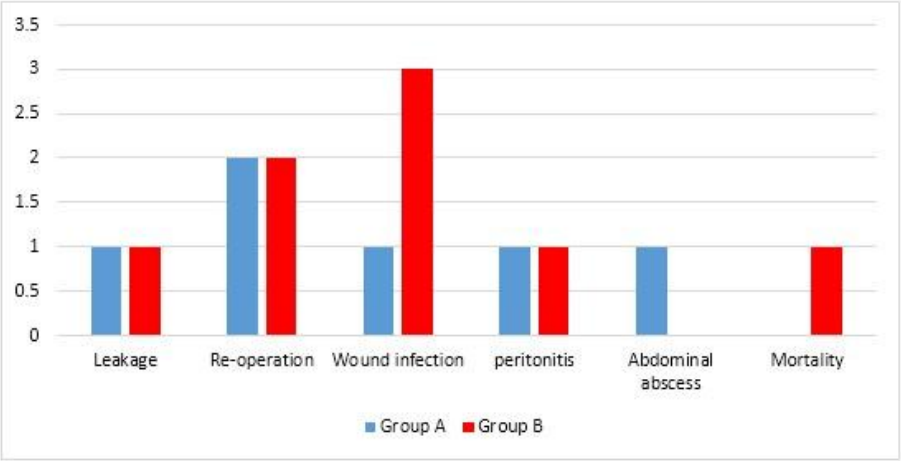

Figure (7): Postoperative complications

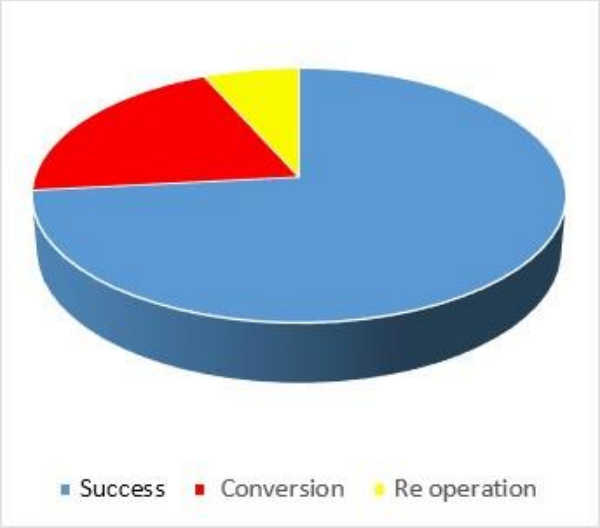

Figure (8): Results of laparoscopy group

Discussion

Simple repair with omentoplasty is the most widely accepted technique for perforated peptic ulcer repair. Open surgery was the standard approach but since 1990s, laparoscopy was incorporated in this surgery.[5] However, exploratory laparotomy is still more widely done, studies mentioned that less than 20% of USA surgeons were using laparoscopic approach till 2017.[3,11] Some early reports did not support significant differences in compli-cations in comparison with laparotomy. Also, in a meta-analysis of Tan et al., there were insignificant differe-nces in overall complications, re-operation rate and mortality. Cirocchi et al., study showed less postoperative pain and wound infections with no significant differences in other outcomes. These reports may explain preference of most surgeons to open surgery.[12,13,14,15]

On other hand, in meta-analysis of Zouh et al. and other recent studies, laparoscopic technique presents significantly less complications, lower hospital stay, mortality and low re-operation rate with similar operative time to open surgery.[16,17,18]

In current study, the aim was to assess outcomes of both approaches in non-randomized pattern with patient selection done mainly upon Boey's risk scale score which is used in many studies as an indicator of fitness for laparoscopy and most surgeons prefer to avoid laparoscopy in Boey's score 3 patients.[10,19]

The mean age of patients in laparotomy group was significantly higher which is mostly related to selection criteria. In general, elder patients have fragility or comorbidities which may be confounding as regard higher complications, Bertleff and Lange excluded old age patients from there study but age was included in other studies and was not a contraindication for laparoscopy despite the risk involved in these cases, and Giordano et al. studied laparoscopy versus open repair exclusively in elderly with mean age of 75 years.[19,20] Some surgeons avoid laparoscopy in patients with comorbidities but others use it in high-risk patients, but there is agreement that laparoscopy is contrain-dicated in hemodynamic instability.[10,21]

Many risk factors were reported in patients of both study groups as history of PU symptoms, prolonged use of NSAID, and smoking and this correlates with findings in many literatures that study risk factors for PPU.[2,7] Approximately 80% of patients came to hospital < 12h after onset of pain, Boey et al.[9] mentioned that 24 h is a cutoff time limit for more worse scenario. Surapaneni et al. reported no mortality < 24, more morbidity > 24 h and high mortality > 48 h of the onset of the abdominal pain. Buck et al. found that every 1 hour of delay of surgery was associated with 2.4% increase in morbidity when compared with previous hour.[22,23] In this study, positive air under diaphragm was not constant finding in all patients, 3 patients had clinical suspicion and negative X-ray diagnosed later with CT scan. Similarly, in Pansa et al. study, X ray was negative for air under diaphragm in 30% of cases CT scan was used as it has 98% accuracy in perforated gut diagnosis.[1]

Mean operative time was significantly shorter in laparoscopy than laparotomy in this study (mean of 106.2 versus 185 minutes in groups A&B respectively) while mean blood loss was less in laparoscopy but difference was insignificant. Earlier studies as Tan et al. & Odisho et al. reported no difference in operative parameters as regard operative time.[12,24] Operative time was longer with laparoscopy in Minutolo et al., but other studies as Stepanyan et al. showed shorter laparoscopy time and less blood loss. This variability may be related to learning curve of laparoscopic surgeon, many authors believe that at least 20-25 cases are required for surgeon to improve his experience.[25,26]

Hospital stay in the study was also significantly shorter after laparoscopy, similar findings reported in other studies. This could be explained by faster recovery form pain and early return of bowel motility due to less visceral trauma as well as absence of large abdominal wound that is associated with longer and more severe morbidity.[17,18,26]

Conversion rate in laparoscopic patients was 18.7% (3 patients), in some studies it varies between 6.9–21.5%. Reported common causes of conversion include: size >1 cm, friability of edges, technical difficulties, difficult approach to ulcer site, hemorrhage and failure of identification of perforation.[26,27,28]

Complication rate in this study was 37%, more incidence was in open repair patients, according to chung et al. study, postoperative complications usual rate is around 30% of cases. Li et al. reported less operative morbidity after laparoscopic repair and the study of Pelloni et al. showed complication incidence of 40%, but 9% were serious, also in this study less than ½ of complications were serious as peritonitis and leakage.[3,29,30] Like current study, similar lower rates of surgery site infection reported in other studies in laparoscopy group which is one of common advantages of laparoscopy over open surgery.[29,30,31] 4 cases in the study were re-operated, 2 in each group for the same reasons; peritonitis and proven leak in drain output, CT scan and clinical findings. Many studies as Agaba et al. mentioned that the most frequent indication for re-operation after repair is suture dehiscence.[32]

One patient mortality was recorded in the study, this patient was 61 years old male, heavy smoker admitted 65 hours after onset of pain, he had uncontrolled DM (RBS was 456 mg/dl and HbA1c was 14), ASA was class III, patient was hypotensive and in sepsis at admission, planned for emergency laparotomy, intraoperative findings showed that the duodenal ulcer was 1.8 mm with edematous thick edges and septic peritonitis found, simple repair and peritoneal toilet was done then shifted to ICU, after 48 hours there was bile in drain around 50-100 CC for 2 successive days, CT done and revealed minor leak, re-exploration done and repair done then shifted again to ICU, signs of sepsis developed after 2 days and drain was empty, CT confirmed that no leak and

minimal pelvic collection, patient deteriorated clinically and died in the 5th postoperative day. Reported mortality for perforated ulcers in other series usually ranges from 1.3-10%, it is rarely > 4.5% but in Lolle et al., study it was 24% and pelloni et al., reported 1.2% mortality.[3,30,33,34]

In the large recent nationwide Danish analytic study of Zogovic et al., they did not find a lower mortality rate in laparoscopy patients, but in the English population-
based Leusink et al. meta-analysis, they demonstrated lower mortality after laparoscopy.[16,35]

The current study supports that, experienced surgeon should start management with laparoscopy except for patients of Boey's 3 score.[1,21,30,35] However, current study had limitations included being non- randomized, small study sample and depending on surgeon experience in choice of procedure. So, further larger studies are required for more study of both approaches' outcomes.

Conclusion

This study supports that laparoscopic repair of perforated peptic ulcer is a safe technique that provides significant advantages as regard operative time, post-operative complications and better outcomes.

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