

# Laparoscopic Repair of Perforated Duodenal Ulcer (Series of 50 Cases)

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## Abstract

**Background:** Perforated peptic ulcer is a common surgical emergency. The classic treatment is the mid-line laparotomy. However, laparoscopic treatment has been shown to be reliable. Few studies have evaluated its overall utility. The aim of this study is to assess the efficacy of laparoscopic repair of perforated duodenal ulcer. **Patients and Methods:** This study included 50 patients presented by perforated peptic ulcer between July 2009 and August 2014. They were submitted to laparoscopic omental patch repair with thorough peritoneal wash. Patients' demographics, diagnostic techniques, management and outcome were evaluated. **Results:** The mean age was 38.6 years with male to female ratio being 1.6:1. The perforation was diagnosed by plain X-ray abdomen in erect position in 43 patients and by abdominal CT scan in 7 patients. The laparoscopic repair of the perforation was successful in 48 patients while in 2 patients mid-line laparotomy was needed for proper control of the severe intra-abdominal sepsis. Post-operatively, all patients tolerated soft diet on the 3<sup>rd</sup> post-operative day and full diet on the 4<sup>th</sup> post-operative day. The mean duration of hospital stay was 4.5 days. Two patients developed post-operative intra-abdominal collection that was treated by ultrasound guided drainage, three patients developed umbilical port site wound infection while only two patients developed leakage, one of them reoperated after failed conservative surgery. No mortality was encountered in the study. **Conclusion:** Laparoscopic repair of perforated peptic ulcer is a safe and reliable technique with accepted morbidity and mortality rates with all the advantages of the minimally invasive surgery.

## Keywords

Laparoscopy, Perforation, Peptic Ulcer, Omental Patch

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## 1. Introduction

Peptic ulcer perforation is one of the common surgical emergencies which need immediate surgical intervention [1]. For many years, the routine upper laparotomy still seems to be the routine treatment of perforated peptic ulcer [2]. The improvement of technology and an increase in laparoscopic experience have been central to the development of laparoscopic surgery. Laparoscopy has fast gained wide acceptance by surgeons for elective cases, as well as for emergency situations, such as acute cholecystitis, appendicitis

Laparoscopic repair for perforated duodenal ulcer was first described in 1990 [3]. It has not only allowed identifying the site and pathology of perforation, but also allowed closure of the perforation with better peritoneal lavage than in the open repair. Laparoscopic repair of perforated duodenal ulcer has many advantages as less post-operative pain without long incision, faster recovery and shorter hospital stay [4] [5]. However, Laparoscopic repair for perforated duodenal ulcer has gained only partial acceptance among many surgeons [6]. So, we conducted this study to assess the efficacy of laparoscopic approach in perforated peptic ulcer repair.

## 2. Patients & Methods

Between July 2009 and August 2014, eighty-seven patients diagnosed with perforated peptic ulcer in Hamad Medical Corporation (HMC), Doha, Qatar. The study protocol was fully approved by legal ethical approval number: HMC 41020007. We excluded from this study patients presented with septic shock, hemodynamic instability, gastric ulcer perforation and patients with symptoms duration more than 24 hours. So only 50 patients were enrolled in this study and they were consented for laparoscopic repair of the perforation.

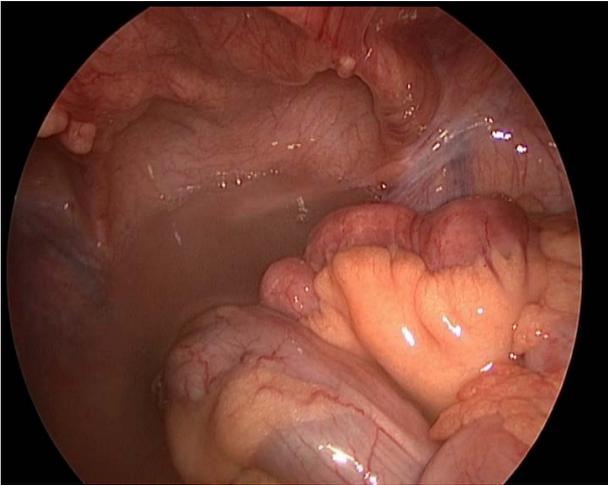
All the patients were submitted to full history taking, laboratory investigations (complete blood count, liver & kidney function tests and serum electrolytes level), plain X-ray of the abdomen in an erect position and pelvi-abdominal CT in some cases. All the patients were initially treated by intra-venous fluid resuscitation, nasogastric tube insertion for gastric decompression, parenteral analgesics, I.V. ranitidine 50 mg every 12 hours and I.V. antibiotics in the form of cefotaxime sodium 1 gm every 12 hours and metronidazole 500 mg every 8 hours. Informed consent was taken from all the patients for diagnostic laparoscopy and laparoscopic perforated peptic ulcer repair with possibility of conversion to open laparotomy.

## 3. Surgical Procedure

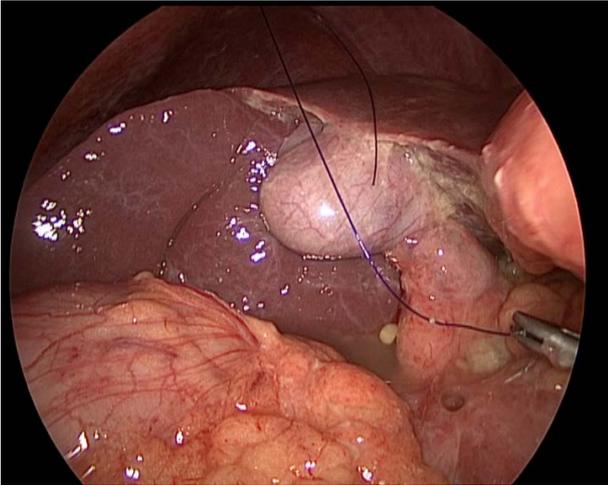
Once the patient was stabilized, surgery was done. Under general anesthesia with muscle relaxation, the patient was placed in Liyod-Davis' (French) position with reverse Trendelenberg tilt and the operating surgeon stood between the patient's thighs. Ten mm port was introduced through a longitudinal supra-umbilical incision using the open technique. A 30 degrees scope was introduced through this port for abdominal exploration and the whole abdominal cavity is thoroughly explored. If the preliminary diagnosis is not rejected, the additional trocars are placed under laparoscopic control. Two 5 mm working ports were introduced on the right and left mid-clavicular lines just above the level of the umbilicus.

The first step was to do laparoscopic exploration to confirm the diagnosis and to assess the degree of the peritoneal soiling. The pre-pyloric and the duodenal regions were inspected to localize the perforation, if omental reaction found, the omentum was gently pulled away from the site of the perforation. Then, thorough peritoneal irrigation and suction of all abdominal compartments was done with special attention paid to sub-phrenic, sub-hepatic and pelvic regions with obtaining samples of the intra-peritoneal fluid for cultures (**Figure 1**). An average of 6 - 8 liters of saline was needed to accomplish this irrigation. Then, the perforation was repaired using intra-corporeal 3/0 polyglactin stitches (**Figure 2**) that were tied over a pedicled omental patch (**Figure 3**, **Figure 4**). The number of stitches depends on the size of the perforation. At the end of the procedure, metilene blue test was used in all patients to rule out leak from the repair. Then, the incisions were closed. Duration of surgery was recorded from the time of skin incision to the time of skin closure.

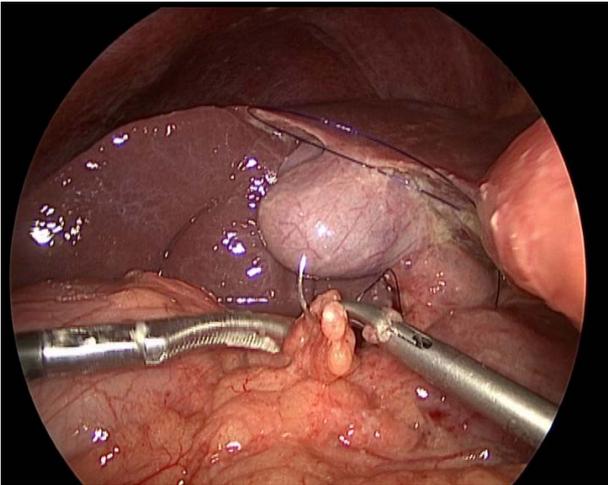
Post-operatively, the patients were kept on parenteral narcotics (pethidine 50 mg IM every 12 hours) for pain relief. Intravenous antibiotics and ranitidine were continued for 5 days. We recorded the degree of post-operative pain by the Visual Analogue Scale (VAS) ranging from 0 (no pain) to 10 (severest pain) and by the number of days during which the patient was in need for narcotics. In the normal postoperative course, the nasogastric tube was removed after 24 h and oral fluids were resumed when bowel sounds become positive, whereas solid foods were allowed after toleration of oral fluids. Post-operative complications were recorded in the form of ileus,



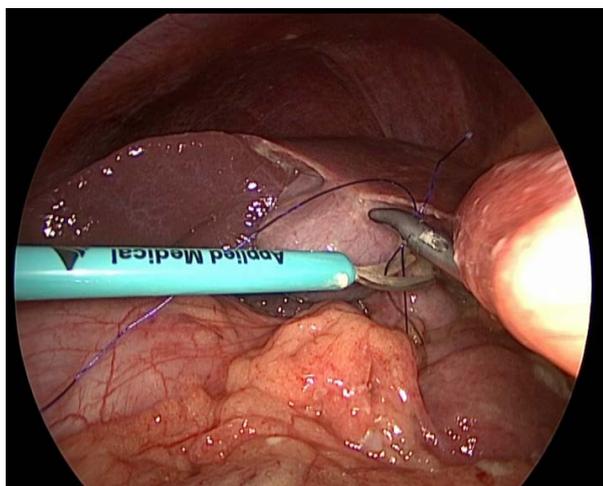
**Figure 1.** Irrigation and suction of the pelvis.



**Figure 2.** Taking the stitch through the edges of the perforated duodenal ulcer.



**Figure 3.** Intra-corporal knotting of the stitch over a pedicled omental flap.



**Figure 4.** The final appearance of the repair.

wound infection, chest infection, intra-abdominal collections and leakage from the site of repair. The patient was discharged once he or she tolerated oral diet, afebrile and ambulated. Duration of hospital stay was calculated. The patients were reviewed in the out-patient clinic at 2 weeks, 3 and 6 months post-operatively. All the patients were advised to use triple therapy for one month, proton pump inhibitors for 3 months with proper diet control and avoidance of smoking, NSAIDs, and alcohol.

## 4. Results

Between July 2009 and August 2014, 50 patients with perforated peptic ulcer in Hamad Medical Corporation (HMC), Doha, Qatar were treated by laparoscopic repair of the perforation.

### 4.1. Demographic Data

The age of the patients ranged between 19 and 56 years with a (mean  $\pm$  SD of  $38.6 \pm 4.3$ ) years. There were 31 males (62%) and 19 females (38%). patients. In all our patients the duration of symptoms ranged between 4 and 24 hours with a mean duration of 18 hours (**Table 1**).

### 4.2. Associated Co-Morbidity

Associated co morbidities presented in 16 of our patients, three of them are presented with multiple co morbidities of which two required post operative transfer to SICU (**Table 2**).

### 4.3. Intra-Operative Findings

In all patients, plain X-ray of the abdomen in erect position was done. It showed free air under diaphragm in 43 patients (86%). In the other 7 patients (14%), no free air under the diaphragm was seen in the plain X-ray. So, CT scan of the abdomen was done and it showed free intra-peritoneal air.

Intra-operatively, there is significant difference were noted regarding the size of perforation with the median size of perforation was 6.2 mm. All the patients showed intra-abdominal free fluid that ranged between localized fluid in hepatorenal and subphrenic spaces (12 patients) to diffuse peritonitis in all abdominal compartments and pelvis (38 patients). Also there is difference regarding the nature of free fluid that ranged between greenish bilious fluid to purulent fluid with pyogenic membranes covering the bowel and the intra-abdominal viscera according to the duration of the perforation. Meticulous irrigation and suction was done for all the intra-abdominal compartments and between the bowel loops. Major part of the operative time was spent for this peritoneal wash. In 2 patients, there was marked technical difficulty to control the intra-abdominal soiling with food particles and bowel adhesions. So, midline laparotomy was done for proper control of the intra-abdominal soiling in these 2 patients with closure of the perforation over an omental patch (**Table 3**).

**Table 1.** Patients demographics.

| Criteria                           | Number of patients (n = 50) |
|------------------------------------|-----------------------------|
| Age (mean $\pm$ SD)                | 38.6 $\pm$ 4.3              |
| Male: female ratio                 | 1.6:1                       |
| Known history of peptic ulcer (n%) | 9 (18%)                     |
| Smoking (n%)                       | 27 (54%)                    |
| NSAID use $\geq$ 2 weeks (n%)      | 13 (26%)                    |

**Table 2.** Associated co-morbidities.

| Comorbidity                   | Patients (n%) |
|-------------------------------|---------------|
| No                            | 34 (68%)      |
| Yes                           | 16 (32%)      |
| • Diabetes Mellitus           | 3             |
| • Hypertension                | 5             |
| • Coronary artery disease     | 2             |
| • COPD                        | 3             |
| • Chronic renal insufficiency | 1             |
| • Liver cirrhosis             | 4             |
| • Previous stroke             | 1             |

**Table 3.** Operative finding.

| Operative findings | Patients (n%) |
|--------------------|---------------|
| Ulcer size         |               |
| Ulcer (<5 mm)      | 12 (24%)      |
| Ulcer (5 - 10 mm)  | 30 (60%)      |
| Ulcer (>10 mm)     | 8 (16%)       |
| Peritonitis        |               |
| Local              | 12 (24%)      |
| Diffuse            | 38 (66%)      |
| No. of stitch      |               |
| One stitches       | 31 (62%)      |
| Two stitches       | 11 (22%)      |
| Three stitches     | 8 (16%)       |
| Conversion to open | 2 (4%)        |

#### 4.4. Post Operative Outcome Results

Post-operatively, VAS pain score ranged between 3 and 6 with a mean of 3.5 in the first post-operative day. Also, it ranged between 2 and 4 in the second post-operative day with a mean of 2.4. The patients needed post-operative parenteral narcotics for a period ranged between 1 and 2 days with a mean of 1.5 days. All the patients

started on clear fluids on the 2<sup>nd</sup> post-operative day, allowed to take soft diet on the 3<sup>rd</sup> post-operative day, and they were allowed to take full diet on the 4<sup>th</sup> post-operative day except the patients who were converted to laparotomy as they were kept fasting for 3 days post-operatively

The operative time ranged between 70 minutes and 100 minutes except in the 2 patients converted to laparotomy, the operative time ranged between 100 minutes and 115 minutes (**Table 4**).

Leakage from the repair site reported from 2 patients, both of them reported at 5<sup>th</sup> day post operative, one of these patients was treated conservatively by ultrasound guided drainage for the abdominal collection, AB, kept NPO and parenteral nutritional for 5 days. The other one failed this conservative measure and reoperated again laparoscopic repair with 3 stitches and omentum patch. Only one patient from those who converted to open suffered from ileus for 5 day and treated by remains NG tube and conservative measure. NO mortality was recorded in the study. No significant long term complications were noticed during follow up (**Table 4**).

## 5. Discussion

Laparoscopic surgery is replacing gradually the open one in the treatment of different gastro-intestinal diseases as it is associated with less pain, shorter hospital stay, less scaring and faster recovery as compared with open surgery [7]. However, the implementation of laparoscopic approach in the management of perforated peptic ulcer is slowly evolving and is still unavailable in many surgical departments. This may be explained by the fact that the decision to do laparoscopy depends on the laparoscopic experience of the surgeon on duty [8]. So, we conducted this study trying to assess the efficacy of laparoscopy in perforated duodenal ulcer repair.

Generally, Peptic ulcer disease is more prevalent in males than females, more in middle age group. Predisposing factors include NSAID use, Helicobacter pylori infection, smoking, high body mass index, and habitual tea and coffee drinking [9]-[11].

This study included 50 patients with a mean age of 38.6 years with male/female ratio 1.3:1. These results are consistent with the results of Bertleff & Lange [12] and Vaidya *et al.* [13] who reported in their studies a mean age of 48 years and 38.5 years respectively with male predominance. However, Bertleff *et al.* [14] reported a mean age of 66 years in their study with a male: female ratio of 1.3:1.

History of peptic ulcer disease was positive in 18% of our patients. These results are in accordance with the results of many other studies like Lee *et al.* [15] and Ates *et al.* [16] who reported a positive ulcer history in 23% and 14.3% of patients respectively. In our study, 54% of the patients were smokers and 26% of patients were using NSAIDs more than 2 weeks prior to the perforation. These results were matched with Bertleff & Lange [12] and Vaidya *et al.* [13].

The perforation was diagnosed in our study by demonstration of free air under the diaphragm in the plain X-ray of the abdomen in the erect position in 43 patients (86%), while in the other 7 patients (14%) the free air was demonstrated by the CT scan of the abdomen. Bertleff & Lange [12] reported that the free air can be seen on the plain X-ray in 85% of the patients. Ates *et al.* [16] reported a higher incidence (94%) of demonstration of free air in the plain abdominal X-ray. However, even in the absence of the free air in the plain abdominal X-ray, the

**Table 4.** Outcome result.

| Outcome result                 | (Mean ± SD)          |
|--------------------------------|----------------------|
| Operative time min             | 78.3 ± 36.1          |
| Hospital stay day              | 4.5 ± 2.3            |
| <b>Postoperative morbidity</b> | <b>Patients (n%)</b> |
| Suture leakage                 | 2 (4%)               |
| Intraabdominal abscess         | 2 (4%)               |
| Dinamic ileus                  | 1 (2%)               |
| Chest infection                | 3 (6%)               |
| Wound infection                | 3 (6%)               |
| Reoperation                    | 1 (2%)               |

laparoscopy can be very useful in cases of acute abdomen for diagnosis and localization of the site of perforation. Sauerland *et al.* [17] found in their study that in 7% of cases, there was a diagnosis different from perforated peptic ulcer and they concluded the benefit of laparoscopy as a diagnostic procedure indicating either an upper or lower laparotomy incision or continuation of the laparoscopy.

It is important to preselect patients who are good candidates for laparoscopic repair of the perforation [18]. Boey's classification [19] [appears to be useful for patients' selection, this classification depends on 3 risk factors: shock on admission, American Society of Anesthesiologists (ASA) grade III - IV, and more than 24 hours duration of symptoms. The minimum score is 0 the maximum one is 3. Many authors reported that laparoscopic repair is only safe for patients with Boey's score 0 and 1 [20] [21]. Also, Thorsen *et al.* [22] reported in their study that 86% of patients with perforated peptic ulcer treated laparoscopically were Boey's score 0 and 1. In our study, we excluded patients presented by septic shock, hemodynamic instability, and patients with duration of symptoms more than 24 hours so all our patients were in Boey's score 0 and 1.

Only 16 (32%) patients in our study had associated comorbidities. Hypertension represented the most common of it (5 patient), while DM and liver cirrhosis presented also in significant number (3, 4 patients). Also 3 patients presented with multiple co morbidities 2 of them need post operative transfer to SICU. This result was matched with low risk group (35%) in study of Hung-Chieh *et al.* 2011 [23] in whom they compare laparoscopic repair of perforated duodenal ulcer in low risk patients with those of high risk high risk where the co morbidities was (44.7%). However, many series had high co morbidity percentage in compare to our study [6] [7] [18] [20].

During surgery, we put the patient in Liyod-Davis' position with the surgeon standing between patient' thighs. Many surgeons prefer to do laparoscopy in this position [13] [16]. However, other surgeons prefer to stand on the patient' left hand [19] [24]. The number of ports used for laparoscopic repair of perforated peptic ulcer differs from one study to another. Some surgeons prefer to use 4 ports: 10-mm umbilical port for the camera, two 5-mm working ports in right and left mid-clavicular lines, and a fourth 5-mm port just below xiphoid process for liver retraction [13] [19] [24]. In our study, we succeeded to perform the laparoscopic procedure in all the patients with only 3 ports without the use of the 4<sup>th</sup> port for liver retraction which is similar to the technique used by Lo *et al.* [16]. The ulcer was closed by 1 to 3 stitches over a pedicled omental flap by intra-corporeal knotting as the extra-corporeal suturing is likely to cut through the friable edge of the perforation [25].

In the beginning of the study, the operative time was about 110 minutes and decreased gradually to be around 75 minutes towards the end of the study with a mean of 90 minutes. The operative time is widely variable in the literature. Linevicius & Morkevicius [19] reported an operative time of  $76.2 \pm 35.3$  minutes. Lam *et al.* [26] reported an operative time of 86 minutes. Lo *et al.* [23] reported an operative time of 50 minutes for patients treated by ulcer closure with omental patch and 45 minutes for patients treated with simple ulcer closure only. Lee *et al.* [15] reported a shorter operative time; only  $20.7 \pm 4.9$  minutes.

In our study, the most common cause of increasing the operative time is the meticulous peritoneal irrigation which is a very crucial step to prevent post-operative intra-abdominal collections and sepsis. We did in our cases thorough peritoneal irrigation till we were sure that adequate control of the intra-abdominal soiling had been achieved. Many authors [13] [27] [28] demonstrated the great effect of laparoscopic irrigation in controlling the intra-abdominal contamination and decreasing the septic abdominal complications in cases of prolonged peritonitis. However, some surgeons claimed that there is no evidence that irrigation lowers the risk of sepsis [29].

Also, some studies showed that gas insufflation in the peritoneal cavity with excessive irrigation may be associated with increasing bacterial translocation and septic complications in patients with prolonged peritonitis [30] [31]. They concluded that the use of laparoscopy in patients with prolonged peritonitis might be associated with increasing risk of sepsis [24] [27] [32] [33].

The reasons for use of abdominal drains post-laparotomy are variable. They may obliterate the dead space, evacuate any collected blood and serum, drain residual contamination, detect any early leak, provide a track for late leaking, and reassure the surgeon when he is unhappy about the anastomotic technique [34]. On the contrary, other surgeons believe that the drains actually stimulate serous fluid formation; increase risk of infection; increase rate of leakage by preventing omental mobilization, thereby obstructing its sealing action on the anastomotic suture line; and even create leakage by mechanical erosion of the anastomosis [35]-[37]. The early detection of the anastomotic leak by the drain remains speculative. Urbach *et al.* [38] in a meta-analysis of 4 randomized controlled trials that included 414 adult patients with colonic or rectal anastomosis, reported that of 20 observed leaks that occurred in patients with drains in place, in only 1 case did pus or enteric contents appeared in the effluent of the existing drain.

In our study, we did not insert intra-abdominal drain in any of our patients because we thought that adequate peritoneal wash is enough and the presence of the drain does not prevent the development of intra-abdominal collections. In spite of omitting drain insertion, we had only 2 patients who developed post-operative intra-abdominal collection (4%). These results are consistent with the results of Lo *et al.* [23] that did not use drains in their cases. Also, Lam *et al.* [39] mentioned in their study that the drain use is optional. They used the drain only in cases of severe contamination. They had only one patient with post-operative intra-abdominal collection out of 35 patients with perforated peptic ulcer treated laparoscopically.

Causes of conversion in the literature are many. These causes included big perforation size [12], technical difficulties [13], and failure to locate the perforation [40]. Shock on admission was associated with a higher conversion rate [31]. Furthermore, time lapse between perforation and presentation negatively influenced the conversion rate [31]. The conversion rate in our study was 4% as 2 patients required mid-line laparotomy for proper control of the intra-abdominal sepsis. This rate is in accordance with many other studies. Vaidya *et al.* [13] reported conversion in 2 out of 31 patients (6.5%) although all of their patients presented more than 24 hours after the onset of pain. Siu *et al.* [41] reported a conversion rate of 14.2% among 63 patients. On the other hand, some studies reported 0% conversion rate as Palanivela *et al.* [24] and Lee *et al.* [15] who treated 120 patients and 13 patients consecutively with laparoscopic repair of perforated peptic ulcer. In a review of 29 studies, Bertleff & Lange [12] found that the overall conversion rate is 12.4% in a total of 2788 patients.

Our study showed that the laparoscopic treatment of perforated peptic ulcer gives the patient all the advantages of the minimally invasive surgical technique. The patients had less post-operative pain (a mean VAS score of 3.5 in the 1<sup>st</sup> post-operative day), less narcotics need (a mean of 1.5 days), earlier recovery of the post-operative ileus (all of them tolerated soft diet by the 3<sup>rd</sup> post-operative day) and shorter hospital stay (a mean of 4.5 days) in compared with the open technique. The different studies in the literature confirmed the better post-operative course for the laparoscopic technique if compared to the open one [8] [14] [27] [41] [42].

Post-operatively, 2 patients (4%) developed pelvic intra-abdominal collection, and 3 patient (6%) developed umbilical port site wound infection (2 of them with DM). It was treated by wound drainage under local anesthesia, daily dressing, and oral antibiotics. Chest infection reported in 3 patients (6%) (2 of them with history of COPD) who were treated by strong AB and chest physiotherapy. However, only one patient had dynamic ileus which treated conservatively. These results were matched with many series as Elbroend & Andersen 2010 [8] reported in their study that, 10% had intra-abdominal abscess, 11.7% had wound infection, 5.8% had pneumonia, Lunevicius and Matas 2005 [24] reported in this series of 62 patients 1 had intra-abdominal collection and 2 developed ileus and 3 with chest infection. However, Bertleff *et al.* [14] reported ileus and wound infection rate of 0%.

Leakage from the repair site reported from 2 patients (4%), both of them reported at 5<sup>th</sup> day post operative, one of these patients was treated conservatively by ultrasound guided drainage for the abdominal collection, AB, kept NPO and parenteral nutritional for 5 days. The other one failed this conservative measures and re operated again laparoscopic repair with 3 stitches and omentum patch. This result was highly accepted among different series as Lunevicius and Matas 2005 [24] reported 4 cases with leakage and also in other series of the same authors in comparison between open and laparoscopic repair of perforated DU [20] reported 4 (7%) cases in laparoscopic group. Also Le Hu in 2007 [23] reported 2 cases of 47 cases in high risk group also, Bertleff *et al.* [14] reported a leakage rate of 3.8%. However small number of series reported no leakage at all as low risk group in Le Hu in 2007 [23] and J. Arnaud 2002 [27]. Our leakage rate was only 4% (2/50). One of the explanations may be that most of our patients were younger and had lower preoperative risk according to ASA and Boey scores (0 - 1) compared to data published by other authors.

In conclusion, laparoscopic repair of perforated peptic ulcer is safe and reliable technique. It gives the patient all the advantages of laparoscopic surgery with accepted post-operative morbidity and mortality rates. However, laparoscopic closure of the perforation is technically demanding. It should be considered as a good choice in the presence of reasonable laparoscopic skills and experience.

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## List of Abbreviations

CT: Computer tomography  
HMC: Hamad Medical Corporation  
VAS: Visual Analogue Scale  
NSAIDs: Non steroidal anti inflammatory drugs  
NPO: Nil per os  
NG tube: Naso gastric tube  
ABs: Antibiotics  
ASA: American Society of Anesthesiologists  
SICU: Surgical Intensive Care Unit  
COPD: Chronic Obstructive Pulmonary Disease  
DM: Diabetes mellitus

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