OUTCOMES OF LAPAROSCOPIC PERFORATED PEPTIC ULCER REPAIR AT DR GEORGE MUKHARI ACADEMIC HOSPITAL (GAUTENG, SOUTH AFRICA) EXPERIENCE

By

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23 May 2019
Declaration

I, Shumani Makhadi, declare that this thesis has been composed solely by myself and that it has not been submitted, in whole or in part, in any previous applications for a Master’s degree. Except where stated otherwise by reference or acknowledgement, the work presented is entirely my own.

Part of this work has been presented at the European Association of Endoscopic Surgery and at the Surgical Research Society of South Africa meetings.

Signature:_______________________________ Date: ______________
Acknowledgement

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Zwo vha zwi nga si ngonadzae arali hu songo vha nga Murena Yehova na vhabebi vhanga.
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Abstract

Background: Laparoscopic management of perforated peptic ulcer has become an acceptable treatment strategy in selected patients. The traditional indication for this procedure is a patient who presents early with a Boey score of 0 or 1. Most investigators would recommend laparotomy for patients with a Boey score of 2 or 3. There is a lack of data on outcomes of these patients who are done laparoscopically with a high Boey score.

Aim: The aim of our study was to evaluate the outcome of patients with perforated peptic ulcers repair.

Methods: This was a retrospective study of all patients with perforated peptic ulcer seen between November 2011 and May 2018. The study examined the data of all patients with perforated peptic ulcer that were offered laparoscopic perforated peptic ulcer repair at our institution. The study considered age, gender, systolic blood pressure, American Society of Anaesthesiologist grade, Boey score, operating time, hospital stay, wound infection, chest infection, leaks, relook and mortality rate.

Results: A total of 140 patients with perforated peptic ulcer were offered laparoscopic Graham patch. Of these, 10 (7,1%) patients had a Boey score of zero; 64 (45,7%) had a Boey score of one; 61 (43,6%) had a Boey score of two, while 5 (3,5%) patients had a Boey score of three. The average operating time was 100 minutes. The overall conversion rate was 6,4%. Reasons for conversion included poor visibility, dense adhesions and haemodynamic instability. Eight (8) patients required relook surgery. The mortality rate was 2,1%. The average hospital stay was 4 days.
Conclusion: Laparoscopy is a safe and feasible procedure to repair a perforated ulcer. Irrespective of the Boey score provided, there is no contraindication to laparoscopy. The operating time is longer in these patients. Further studies are needed to evaluate the role of laparoscopy in this cohort of patients.
Chapter 1: Introduction and Background

1.1. Introduction

The discovery of Helicobacter pylori (H.pylori) has led to a decrease in the incidence of peptic ulcer disease. However, associated complications such as perforation remain a significant health problem [1,2]. Even though peptic ulcers occur less frequently due to proton pump inhibitor medications, ulcer perforation occurs in up to 10% of patients with peptic ulcer [3]. Surgical treatment with Graham’s omental patch and peritoneal lavage is the gold standard of treatment [4–6]. Surgery was traditionally performed by open approach, but the use of laparoscopic for peptic ulcer repair is increasingly being used. The first laparoscopic peptic ulcer repair was published by Mouret et al. [7] and Nathanson et al. [8]. Laparoscopic perforated ulcer repair has become an acceptable way of management as the approach was shown to reduce wound pain, wound sepsis and intra-abdominal septic complications [9-12]. However, open repair remains the gold standard of management in perforated peptic ulcer patients.

Patients who are offered laparoscopic repair are usually those that present early (less than 24 hours) and have low Boey scores (≤1) [4,13]. Patients with higher Boey scores (≥ 2) are usually offered open surgery due to the high mortality associated with a high Boey score [4,13]. The laparoscopic approach involves pneumoperitoneum and longer operating time, which may further compromise the unstable patient further. In developing countries, most patients present with high a Boey score due to delay at the time of presentation [4,13]. Many investigators would offer these patients open perforated ulcer repair.
The study aimed to determine the outcomes of laparoscopic perforated ulcer repair and safety of laparoscopic perforated ulcer repair in patients with high Boey scores. We conducted a retrospective study looking at all patients who presented to our Emergency Department at Dr George Mukhari with perforated peptic ulcers and were repaired laparoscopically. Records of patients who were offered laparoscopic repair were analysed.

1.2. The purpose of the study

Aim

To describe the outcomes of laparoscopic perforated peptic ulcer repair in Dr George Mukhari Academic Hospital.

Objectives

- To determine the post-operative complications, mortality and reoperation rates of patients undergoing laparoscopic perforated peptic ulcer repair;
- To compare hospital stay, wound sepsis and other post-operative complications in laparoscopic repair with open surgery;
- To compare mortality rate, Intensive Care Unit admission days and post-operative complications in patients with high Boey scores in laparoscopic repair to open surgeries.

1.3. Research question

What are the outcomes of patients offered laparoscopic perforated peptic ulcer repair at Dr George Mukhari Academic Hospital?
Chapter 2: Literature Review

Perforated peptic ulcer is the second most common abdominal organ perforation requiring surgery after appendicitis [14]. The most common causes of peptic ulcer disease are Helicobacter pylori infection and nonsteroidal anti-inflammatory drugs usage or abuse. Although the prevalence of uncomplicated ulcer disease has in the last two decades declined across the world, perforated peptic ulcers are still the main reason for emergency operation [15]. Patients with peptic ulcer disease are also at risk of perforation and it is associated with high mortality that can reach 99%, according to Boey et al. [16].

Many studies have investigated risk factors for morbidity and mortality in perforated peptic ulcer patients [16–20]. The Boey score was published by Boey et al. It looked at the predictive mortality and morbidity in patients undergoing open perforated peptic ulcer repair [16]. Duration of symptoms longer than 24 hours, systolic blood pressure of less than 90 mmHg and co-morbid conditions were predictors of outcome identified by Boey et al. [16,21]. Presence of all three factors resulted in increased mortality [16].

Surgical treatment is the mainstay of treatment of perforated peptic ulcers. While the gold standard treatment was previously repair of the perforation and a simultaneous radical anti-ulcer procedure (vagotomy or distal gastric resection), less extensive procedures are chosen more frequently nowadays due to effective supplementary post-operative pharmacotherapy [14,15,22]. Laparoscopy is an attractive option because it allows not only the identification of the perforation but also the closure of
the perforated peptic ulcer and peritoneal lavage, avoiding a large upper laparotomy [14].

Laparoscopic or open omental patch repair for the perforated peptic ulcer followed by eradication of Helicobacter pylori has become the standard of care in most centres [1–4,23], including ours. The question pertains to how the omental patch is done – open or laparoscopic surgery. Open surgery was the standard treatment before 1990. Open surgery for perforated peptic ulcers has several shortcomings, such as a long incision, post-operative pain, slow recovery and higher mortality rates [23]. Compared to the open procedure, laparoscopic surgery is associated with better magnified visualisation during the operation, minimal incisions, less post-operative pain and faster resumption of activity [23, 24].

Many surgeons have opted to use the laparoscopic procedure, and many studies have evaluated the effectiveness of this approach for perforated peptic ulcer repair [23]. There has been much debate about whether laparoscopic repair is better than open surgery [25]. Several authors have suggested that laparoscopic surgery is not superior to laparotomy due to a lack of direct tactile sense, longer operative times and difficulty in peritoneal cavity flushing [23].

Laparoscopic cholecystectomy is the standard of care for elective cholecystectomy despite lack of randomised controlled trials [26]. The same cannot be said for perforated ulcers. Laparoscopy is still not regarded as the standard of care, despite its advantages [23,24]. The main obstacles are multifactorial: the decline in the incidence of perforated peptic ulcer has rendered a reduced exposure to the number of cases
required to attain surgical competency. There is a lack of surgeons capable of performing minimally invasive technique permanently on duty in hospitals treating patients with perforated peptic ulcer. The lack of laparoscopic expertise of the performing surgeon may result in a high conversion rate and deters other surgeons from pursuing the same approach [23,24,25].

To resolve these disputes, several meta-analyses on the advantages of laparoscopic verses open surgery have been published [1–4,23,24]. The metanalysis by Lau et al. [9] showed that laparoscopic repair for perforated peptic ulcer conferred superior short-term benefits only in terms of post-operative pain and wound morbidity [1–3]. Other advantages include a shorter hospital stay and a lower mortality rate but a longer operating time and a greater occurrence of suture-site leakage [1-3,23,24]. Some data suggested that the two approaches had similar morbidity, mortality and reoperation rates [23, 24].

Meta-analyses showed that laparoscopic perforated peptic ulcer repair is a feasible and safe procedure [1–3,23].
Chapter 3: Methods

3.1. Study design

This was a single-centre retrospective study from November 2011 to May 2018 in patients who presented to Dr George Mukhari Academic Hospital with perforated peptic ulcer.

3.2. Inclusion criteria

All patients were presented with a clinical diagnosis of perforated peptic ulcer who were offered laparoscopic repair were enrolled.

3.3. Exclusion criteria

Patients who refused operation, were haemodynamically unstable or were offered laparotomy were excluded from the study.

The preoperative data collected were age, gender, American Society of Anesthesiology (ASA) score and Boey score. Boey score was used for stratification of high-risk patients. Delayed presentation (>24 hours), presence of shock and co-morbid conditions were each scored and recorded. Location of the ulcer, estimated size, operating time and conversion rates were collected intraoperatively. Post-operative data collected were length of stay, post-operative complications (wound sepsis, visual analogue scale and intra-abdominal abscess) and mortalities.
3.4. Surgical technique

All patients were optimised for surgery by putting up two large bore IV lines for intravenous fluids, a nasogastric tube to decompress the stomach, a urinary catheter, analgesia and antibiotics. In theatre, the patient was placed supine. The surgeon and assistant stood on the left-hand side of the patient, with the camera stack placed at the right shoulder of the patient. Access to the abdomen was obtained infraumbilically using either open Hassan or veress needle technique at the discretion of the surgeon. Pneumoperitoneum was achieved by insufflating 15 mmHg through a 10–12 mm umbilical port. Two more ports were inserted: a 5 mm port and 10 mm port in the right upper and left upper quadrants respectively. Additional ports were inserted based on the surgeon’s need. Adequate positioning was achieved by tilting the table to the left and so that the head is up (Anti-Trendelenburg position). Upon entry, the whole abdomen was inspected and the ulcer would be identified. If fibrin obscured vision, it was whipped off or suctioned, depending on the preference of the surgeon. The size of the perforation would be estimated using a laparoscopic grasping forceps. The perforation was repaired with sutures using an omental patch (Cellan-Jones technique). The abdomen was irrigated using 2–4 ℓ of warm saline. A closed suction drain was left around the perforation site. It was the surgeon’s decision which suture to use: whether to tie intra- or extracorporeally. All procedures were done by senior registrars or junior registrars under supervision.
3.5. Post-operatively

Patients were monitored according to their clinical progress data (vital signs, visual analogue scale, volume and fluid drained, urine output). The patients were prescribed antithrombotic, antibiotics, proton pump inhibitors and an antifungal when needed. The nasogastric tube was removed when bowel activity returned and drained less than 200 ml. Diet was progressed according to the patient’s tolerance. Patients were discharged when they were mobile, their pain was manageable on oral analgesics and they were tolerating ward diet. They were prescribed proton pump inhibitor (PPI) for six weeks. Follow-up oesophagastroduodenoscopy was done in 6–8 weeks for those with gastric ulcers.

3.6. End points

The primary end point was in hospital mortality. Secondary outcomes were: post-operative hospital stays, conversion rates and post-operative complications (wound sepsis, pneumonia, reoperation rates).

3.7. Data collection

Standardised data collection using a data collection sheet was done by the registrar in charge of the patient. Post-operative mortality was defined as death that occurred during the hospital stay or within 30 days of primary surgery. Operative time was defined as the time from the first incision to the placement of the last suture. All operative and post-operative complications were noted. Conversation to laparotomy was not regarded as a complication. Wound infection was defined as the presence of
pus or sanguinopurulent discharge from the wound. Chest infections were diagnosed by chest X-ray changes with or without a fever (>38.5) or positive culture from sputum. The length of hospital stay was defined as the number of days in the hospital after surgery, including the day of surgery. Systolic blood pressure of less than 90 mmHg on admission was defined as shock. Patients with severe acute abdominal pain for more than 24 hours before admission were characterised as having delayed presentation.

3.8. Statistics

Means (±SD) were presented for continuous variables and percentages were presented for categorical variables. All statistical procedures were performed on SAS version 9.3 (SAS Institute Inc, Carey, NC, USA) and averages were done for the hospital stay and age. Percentages were used for the age and Boey score distribution. All statistical tests were two-sided and p value ≤ 0.05 (5%) was considered significant.

3.9. Reliability and validity

The study was reliable and valid because all the information needed was acquired as patients were admitted to the hospital and during the hospital stay. Patient information was also collected from files. Patients enrolled were also confirmed through casualty and theatre books. Their files were collected for collection of data. All data of the patients who were admitted with a perforated peptic ulcer were entered into the hospital patient database and admissions register. The Sefako Makgatho Health Sciences University (SMU) general surgery electronic database was searched for
perforated ulcer patients, with individual chart reviews performed on all patients identified who had had laparoscopic perforated ulcer repair.

3.10. Bias

To minimise selection bias, all patients admitted for a perforated peptic ulcer who were assigned to the unit of call on the day of presentation were included. The responsible unit doctors managed the patient from admission to discharge without any interference from the researcher in terms of decision-making regarding the patient. Furthermore, the supervisor and/or co-supervisor verified all the data. The researcher made sure that all patients who qualified to be included were indeed involved without any collection bias. The majority of our patients were repaired laparoscopically, provided that there was no contraindication. Not much was to be done about this bias because our institute use the laparoscopy first approach for perforated ulcers.

3.11. Ethical considerations

Permission from the hospital to access the data was obtained through application to the Executive Management of the hospital. Ethical clearance was obtained from Sefako Makgatho Health Sciences University Research Ethics Committee (SMUREC) in accordance with the Declaration of Helsinki. A SMUREC ethical application was approved: approval number SMREC/M/04/2018/PG. Patients’ information was kept confidential at all times.
Chapter 4: Results

4.1. Introduction

Between November 2011 and May 2018, a total of 199 patients with a preoperative diagnosis of perforated ulcer were identified. Of these, 59 patients were excluded; 57 of those were offered open repair and 2 patients refused operations. The 140 patients in the laparoscopic group were included for the analysis. Table 1 offers a summary of the preoperative data.

4.2. Demographics

The mean (SD) age was 44,5 (17,1) years (range 15–91 years) and 117 (83,6%) of the patients were males. Of the patients, 109 (77,8%) had late presentation to hospital. At presentation, 11 (7,9%) of the patients reported taking anti-ulcer therapy in the 6 months prior to presentation. A total of 16 patients (11,4%) admitted to using NSAIDS. The erect chest radiograph depicted pneumoperitoneum in 98,6% of the patients. This sign was the most important indicator to proceed to surgery.
### Table 1: Demographics

<table>
<thead>
<tr>
<th></th>
<th>Laparoscopy n=140 (%)</th>
<th>Pvalue</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Mean (SD) Age year</strong></td>
<td>44.5 (17.1)</td>
<td>0.008</td>
</tr>
<tr>
<td><strong>Sex</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>117 (83.6)</td>
<td>0.0123</td>
</tr>
<tr>
<td>Female</td>
<td>23 (16.4)</td>
<td>0.0123</td>
</tr>
<tr>
<td><strong>Pain &gt; 24 hours</strong></td>
<td>109 (77.8)</td>
<td></td>
</tr>
<tr>
<td><strong>Admission blood pressure &lt; 90 mmHg</strong></td>
<td>5 (3.5)</td>
<td></td>
</tr>
<tr>
<td><strong>ASA</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I E</td>
<td>58 (41.4)</td>
<td></td>
</tr>
<tr>
<td>II E</td>
<td>61 (43.6)</td>
<td></td>
</tr>
<tr>
<td>III E</td>
<td>21 (15.0)</td>
<td></td>
</tr>
<tr>
<td>IV E</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td><strong>Boey score</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0</td>
<td>10 (7.1)</td>
<td>0.1182</td>
</tr>
<tr>
<td>1</td>
<td>64 (45.7)</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>2</td>
<td>61 (43.6)</td>
<td>0.7085</td>
</tr>
<tr>
<td>3</td>
<td>5 (3.5)</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td><strong>Ulcer medication history</strong></td>
<td>11 (7.9)</td>
<td></td>
</tr>
<tr>
<td><strong>Smoking</strong></td>
<td>26 (18.6)</td>
<td></td>
</tr>
<tr>
<td><strong>Alcohol</strong></td>
<td>22 (15.7)</td>
<td></td>
</tr>
<tr>
<td><strong>Nonsteroidal anti-inflammatory use</strong></td>
<td>16 (11.4)</td>
<td></td>
</tr>
</tbody>
</table>

#### 4.3. Risk analysis

Five (3.5%) patients presented to the Accident and Emergency Department with hypotension. Of the 140 patients, 82 (58.6%) had ASA grade 2 and more. Boey score was calculated retrospectively for assessing post-operative risks: 10 (7.1%) patients had a Boey score of zero; 64 (45.7%) had a Boey score of one; 61 (43.6%) had a Boey score of two and 5 (3.5%) patients had a Boey score of three. This distribution is depicted in Graph 1.
4.4. Outcomes

4.4.1. Mortality

The 30-day mortality was 2.1% (three patients died), p value <0.001 (Table 2). The mortalities occurred in the high-risk group. An 81-year-old female, ASA III, Boey 3, died due to severe pneumonia that required ventilation in the Intensive Care Unit. A 57-year-old male, ASA II, Boey 2, developed renal failure that required dialysis. The third patient was a 61-year-old female, ASA III, Boey 3, who had a myocardial infarction on day 4 post operation.
### Table 2: Post-operative complications

<table>
<thead>
<tr>
<th></th>
<th>Laparoscopy</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wound infection</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Chest infection</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Intrabdominal collections</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Leaks</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Prolonged ileus</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>Conversion</td>
<td>9</td>
<td></td>
</tr>
<tr>
<td>Relook</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Open Laparoscopy</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>Laparoscopy</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Death</td>
<td>3</td>
<td>&lt; 0.001</td>
</tr>
</tbody>
</table>

#### 4.4.2. Conversions

A total of 131 (93.6%) patients had their ulcer perforations repaired laparoscopically. Nine (9) (6.4%) patients were converted to an upper midline laparotomy (Table 2). The reasons for conversion included: three patients had extensive adhesions from previous operations, for three patients the surgeons complained of poor visibility laparoscopically and three patients became haemodynamically unstable intraoperatively.
4.4.3. Operating times

The mean operating time was 100 minutes (range 35–310) (Table 3). The Cellan-Jones technique was used for closure of the perforation. Drains were inserted at the discretion of the surgeon.

| Table 3: Results |
|------------------|-----------------|--------|
|                  | Laparoscopy     | P value |
| Operating time(minutes) | 100             | 0.0024 |
| Site of perforation     |                 |        |
| Gastric               | 86              | 0.0010 |
| Duodenal              | 54              | 0.0010 |
| Size of ulcer (mm)     | 15              | 0.1675 |
| Pain scores           |                 |        |
| Day 1                 | 4               |        |
| Day 3                 | 2               |        |
| Number of intravenous or intramuscular analgesic | 6 |
| Resume of diet (days)  | 3               |        |
| Post-operative hospital stay(SD) | 4 (3,65)       | 0.0166 |

4.4.4. Ulcer locations

Most ulcers were located in the gastric region (61%). Of these, 54.2% were in the prepyloric region (Graph 2). The median size of ulcers was 15 mm (range 5–25) (p=0.1675) (Table 3).
4.4.5. Reoperations

The most common morbidity was due to reoperations (Table 2). Eight (5.7%) patients needed relooks. Six (4.3%) patients were done via laparotomy and the other 2 (1.4%) patients were relooked laparoscopically. Two (1.4%) patients were relooked due intra-abdominal collections that were not amenable to percutaneous drainage. Two patients were found to have leaks from the patch. Two patients were relooked as they were not settling post-operatively and no leaks or collections were found. At relook, the rate of conversion to a laparotomy was 6 patients.

4.4.6. Post-operative complications

Four (2.9%) patients had paralytic ileus which responded to nasogastric tube decompression. One patient developed wound sepsis. Two patients developed pneumonia, of which 1 required admission to the Intensive Care Unit (ICU) (Table 2).
4.4.7. Post-operative hospital stay

The average hospital stay was 4 days, ranging from 3–31 days (p=0.0166).

Graph 3: Post-operative hospital stay

The pain scores were decreased by half on Day 3 (Table 3). Patients received on average 6 intramuscular injections for analgesia. The average day of resumption of diet was on post-operative Day 3. Nasogastric tubes were removed on average on Day 2.

All patients were followed up at Surgical Outpatients Department at 7 days and again after 6 weeks. Patients with gastric ulcers had repeat endoscopy in 6–8 weeks.
4.5. Complications rates analysis

Perforation size: The perforation size had no considerable influence (p=0.1675) on complications rates.

Boey score: A higher Boey score was associated with an increased rate of complications (p<0.001).
Chapter 5: Discussion & Conclusion

The study looked at patients who had been offered laparoscopic perforated ulcer repair over a period of 78 months. Literature mentions that the age of patients presenting with perforated peptic ulcer is increasing, due to better medical anti-ulcer treatment and because of more non-steroidal anti-inflammatory drugs (NSAID) and aspirin usage in the elderly population [1,14,16]. The results in Table 1 show that the average age of patients was 44,5 years, which is younger than that in a study by Teoh [30]. *Helicobacter pylori* is known to be present in about 80% of patients with perforated peptic ulcer. In the study, 11,4% of patients had used NSAIDs and 7,9% of patients had a history of peptic ulcer. This is in keeping with the observation in literature [14,16].

The majority (77,8%) of our patients presented longer than 24 hours prior to arrival in our hospital. Our patients take time to seek medical assistance, which increases the time of presentation. Siow et al. also reported similar reasons for delay in presentation. Most ulcers were in the prepyloric region (54,2%). This differs from some literature where most ulcers are duodenal [32,33]. In 98,6% of patients, free air was visible on the X-ray, which supported the diagnosis of perforated ulcer. However, free air could also be caused by other perforations and, although the diagnosis of perforated peptic ulcer is not difficult to make, there is often a good indication for diagnostic laparoscopic to exclude other pathology. We had two patients who had the diagnosis made at laparoscopy.
According to metanalysis reports by Antoniou et al., laparoscopic repair of perforated ulcers takes 135 minutes [29,31]. Our operative time was 100 minutes; this was mostly because we use the Cellan-Jones technique and we used 2–4 ℓ of irrigation [32,33]. The surgeons were also experienced in doing complicated appendicectomies laparoscopically.

This study found that it is feasible to repair patients with perforated peptic ulcers laparoscopically with a conversion rate of about 6.4%. Reasons for conversion were poor vision, haemodynamic instability and extensive adhesions as determined by the operating surgeon. This conversion is acceptable when compared to the metanalysis by Lau et al. [1–5]. Overall conversion rate ranges from 0–28.5% in literature [1–5,30–32]. The most common reason for conversion was the size of perforation at >5 mm, which was not the case in our study [31,32]. Our average ulcer size was 15 mm, which is thrice the size of those mentioned in literature [1–4,31,32]. The literature lists failure to locate the perforation and shock at admission as other known common reasons for conversion [32]. We were able to locate all our ulcers without difficulty. One patient required insufflation of air in the nasogastric tube to locate the ulcer. Furthermore, time lapse between perforation and presentation negatively influenced conversion rates in a study by Siow et al. [32]. Our conversion rate is comparable even thou the majority of our patients were delayed presenters. The reasons for this could be the experience of the available surgeons.

Other prognostic parameters used for perforated ulcers are ulcers sized >12 mm in a study by Chuan et al. [29,30]. They were associated with a high leak rate [29]. This study showed an ulcer leak rate of 1.4 % despite the average size of 15 mm. In case
of larger perforations, we put sutures far from the edges and a Cellan-Jones technique was used. We had two cases where omentum was not found and we used the falciform ligament. One of these patients had a leak.

The relook rate was 5.7% in the laparoscopy patients. Two patients were relooked laparoscopically and 6 had laparotomies. This was comparable to a study by Teoh et al. [30]. Two patients had collections that were drained percutaneously. Laparoscopic perforated ulcer repair was safe, as evidenced by the comparable relook rate in that in the literature [30]. Two patients were found to have leaks from the patch; one had the falciform ligament used. In the literature, the overall leak rate is 6.3%. In our series it was 1.4% [25,26,30]. At relook, the rate of conversion to a laparotomy was 75% (6 patients).

One patient developed wound sepsis. Two patients developed pneumonia, of which one required ICU admission. This is presumably due to a smaller incision, less tissue manipulation and less tissue injury, resulting in reduced inflammatory and immune responses [1–5,31,32]. The study showed similar outcomes with the one patient in the laparoscopic repair group who had wound sepsis. Lau in his meta-analysis showed that laparoscopic repair is associated with a lower incidence of pulmonary complications when compared to the open repair [1,9]. Our study also had fewer pulmonary complications in our patients (1.4%).

Four (2.9%) patients developed intra-abdominal collections. This is low despite the majority of our patients presenting late. The reason for these low collection rates could
be lavage and closed suction drains. Siow et al. reported no collections in the laparoscopic group when using copious amounts of lavage fluid [33].

The benefits associated with minimally invasive surgery, such as lesser post-operative analgesic usage and lower pain score, were demonstrated in this study by the mean values of pain score in the initial four days after surgery [1,30].

In comparison to the open group study by Teoh et al., the high-risk patients who had been offered laparoscopic repair had shorter hospital stay and the probable reason for this may be due to the minimal trauma [30]. Our average hospital stay was 4 days, which was comparable to other studies [25,26,30]. We found that patients who start mobilising early, and they are also young patients who resume diet earlier when offered laparoscopic repair. During ward rounds, some patients would even ask the doctors how soon they could be discharged. The low morbidity rates also influenced the shorter hospital stay.

The mortality rate was 2.1%. Two patients had a Boey score of 3 and died in ICU from complicated pneumonia and myocardial infarction respectively. One patient died from renal failure complications. These findings are comparable to studies by Bujun et al. and Teoh et al. [25,26,30,31]. The reason for such an impressive mortality rate despite the majority of patients experiencing elevated risk could be that our patients are of a young age.

This study is unique as it looks at laparoscopic perforated ulcer repair even in the high-risk group. The study by Teoh is the latest and the only one that looks at laparoscopy
in high-risk patients suffering from perforated peptic ulcers [30]. In Teoh’s study, only 29 patients were high-risk while our study had 66 patients in the high-risk group. Their morbidity and mortality in the high-risk group of patients were 14% and 2% respectively. In this study, the morbidity rate was 13,6% and the mortality rate was 2,1%. These results are comparable. The advantage of our study is that it has more patients.

This study is limited by the fact that it is a prospective review which has inherent limitations. The cohort is certainly subject to selection bias as laparoscopy is our first option, unless there is a contraindication such as haemodynamic instability. Further randomised controlled trials are needed for comparing laparoscopy to open surgery in the stable perforated peptic ulcer patient to fully elucidate the benefits of laparoscopy. More trials are also needed to evaluate the role of laparoscopy in patients with a higher Boey score.

Conclusion

Laparoscopy is a safe and feasible procedure to repair a perforated ulcer. Irrespective of the Boey score provided, there is no contraindication to laparoscopy.
References


Appendices A: Data Collection Sheet

Participant Number:

GENDER:

AGE:

DATE OF ADMISSION:

<table>
<thead>
<tr>
<th>DURATION OF SYMPTOMS</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>SYSTOLIC BLOOD PRESSURE</td>
<td></td>
</tr>
<tr>
<td>CO-MORBID CONDITIONS</td>
<td></td>
</tr>
<tr>
<td>ARTERIAL BLOOD GAS</td>
<td></td>
</tr>
<tr>
<td>URINE OUTPUT</td>
<td></td>
</tr>
<tr>
<td>ASA CLASSIFICATION</td>
<td></td>
</tr>
<tr>
<td>BOEY SCORE</td>
<td></td>
</tr>
<tr>
<td>NSAID USE?</td>
<td></td>
</tr>
<tr>
<td>ULCER HISTORY/SMOKING/ALCOHOL USE (INDICATE RELEVANT ONE)</td>
<td></td>
</tr>
</tbody>
</table>

DATE OF OPERATION: _______________________________

OPEN/ LAPAROSCOPIC: ______________________________

STARTING TIME: ______________________________

TYPE OF OPERATION: ______________________________

ULCER LOCATION AND SIZE: ______________________________

FINISHING TIME: ______________________________

28
ICU ADMISSION: ______________________

WARD Admitted IN and date: ______________________

POST-OPERATIVE COURSE

COMPLICATIONS (CIRCLE RELEVANT ONES): ______________________

WOUND SEPSIS/CHEST INFECTION/COLLECTIONS/LEAK

INTERVENTION FOR COMPLICATIONS: ______________________

DATE OF DISCHARGE: ______________________

FOLLOW-UP DATE: ______________________

COMPILER: ______________________

SIGNATURE: ______________________

CELL NUMBER: ______________________
Appendices B: Ethics Approval Certificate

01 February 2018

Dr S Makhdadi
Department of General Surgery
P.O Box 231
Medunsa, 0204

MEETING: 01/2018

SMUREC Ethics Reference Number: SMUREC/M/04/2018: PG

The New Application received on 18 January 2018, was reviewed by members of Sefako Makgatho University Research Ethics Committee on 01 February 2018 and was provisionally approved on 01 February 2018.

Title: Outcomes of laparoscopic perforated peptic ulcer repair at Dr George Mukhari Academic Hospital (Gauteng, South Africa) experience

Researcher: Dr S Makhdadi
Supervisor: Prof MZ Koto
Hospital Superintendent: Dr S Mogotsi (DGMAH – Clinical)
Department: General Surgery
School: Medicine
Degree: MMed General Surgery

Please note the following information about your approved research protocol:

Approval Period: 01 February 2018 – 01 February 2019

After Ethical Review: Kindly remember to use your protocol number (SMUREC/M/04/2018: UG) on any documents or correspondence concerning your research protocol with the REC. The REC has the prerogative and authority to ask further questions, seek additional information, require further modification, or monitor the conduct of your research and the consent process. A template of the progress report is obtainable from the Research Office and is due on an annual basis for your study irrespective of the approval period. Please note that a number of projects may be selected randomly for an external audit every year. Translation of the consent document in the language applicable to the study participants should be submitted if required.

International Organisation (IORG0006891), Institutional Review Board (IRB000010396) Expiry date: 09 December 2018, Federal Wide Assurance (FWA000023943) Expiry date: 03 March 2021 and NHREC No: REC 210408-003

Sincerely,

PROF C BAKER
DEPUTY CHAIRPERSON SMUREC

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