International Journal of Surgery 15 (2015) 40–44

Contents lists available at ScienceDirect

International Journal of Surgery

journal homepage: www.journal-surgery.net

Original research

Risk factors associated with conversion of laparoscopic simple closure in perforated duodenal ulcer

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HIGHLIGHTS

- We analyzed risk factors for the failure of laparoscopic simple closure for PPU.
- The size of perforation was the only risk factor for conversion.
- The size and the duration of perforation are available for predicting suture leakage.

ARTICLE INFO

Article history:
Received 1 January 2015
Received in revised form
23 January 2015
Accepted 26 January 2015
Available online 31 January 2015

Keywords:
Perforated duodenal ulcer
Laparoscopic simple closure
Totally laparoscopic
Conversion

ABSTRACT

Background: Precise patient selection criteria are necessary to guide the surgeon in selecting laparoscopic repair for patients with perforated peptic ulcers. The aims of this study are to report surgical outcomes after surgery for perforated duodenal ulcers and identify risk factors for predicting failure of laparoscopic simple closure for perforated duodenal ulcer.

Methods: In total, 77 patients who underwent laparoscopic simple closure for perforated duodenal ulcers from January 2007 to September 2013 were retrospectively analyzed. Patients were divided into totally laparoscopic and conversion groups. The characteristics of patients, intraoperative findings, postoperative complications, conversion rates and suture leakage rates of each group were investigated.

Results: Laparoscopic repair was completed in 69 (89.6%) of 77 patients, while 8 (10.4%) underwent conversion to open repair. Patients in the conversion group had longer perforation time, larger perforation size, more suture leakage, longer hospital stay, and higher 30-day mortality rate than those in the totally laparoscopic group. The size of perforation was the only risk factor for conversion in multivariable analysis. Patients with an ulcer perforation size of ≥9 mm or with perforation duration of ≥12.5 h had a significantly increased risk for conversion and suture leakage.

Conclusions: Ulcer size of ≥9 mm is a significant risk factor for predicting conversion in laparoscopic simple closure. Suture leakage is associated with ulcer size (9 mm) and duration of perforation (12.5 h).

1. Introduction

The prevalence of peptic ulcer disease has decreased in recent decades because of the introduction of medical treatments, including H2 receptor antagonists, proton pump inhibitors (PPIs), and *Helicobacter pylori* eradication [1,2]. However, this decrease in peptic ulcer disease has not been followed by a similar reduction in complications from peptic ulcers [1,3]. The perforated peptic ulcer (PPU) is a highly morbid condition, and its incidence has remained stable over the past several decades [4].

Since the first description of laparoscopic management of PPU in 1990 [5], many studies have sought to determine the feasibility and safety of this approach [6–8]. Laparoscopic repair of PPU is superior to conventional open repair with respect to reduced pain, shorter hospital days, and minimal invasion. These advantages of laparoscopic repair have led to a trend that laparoscopic simple closure (LSC) has gradually replaced open repair for patients with PPU with an improvement in medical treatment and universalization of laparoscopic surgery. However, not all patients are suitable for laparoscopic repair. Some studies have reported a significantly higher reoperation rate after laparoscopic repair than after open

Abbreviations: PPU, perforated peptic ulcer; LSC, laparoscopic simple closure; ICU, intensive care unit; PPI, proton pump inhibitor.

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http://dx.doi.org/10.1016/j.ijsu.2015.01.028
1743-9191/

repair [9]. Despite the fact that many studies have reported the efficacy of laparoscopic and open repair in PPU, the treatment frequently remains a challenge to surgeons, and optimal treatment strategies are needed [10].

The aims of this study were to examine the clinicopathological features influencing surgical outcomes after surgery for PPU and define the risk factors for the conversion and for the suture leakage.

2. Patients and methods

2.1. Patients and data collection

From January 2007 to September 2013, 115 patients who underwent surgical treatment for PPU in the Department of Surgery, St. Vincent's Hospital, The Catholic University of Korea were enrolled in this study. Of these 115 patients, 77 underwent laparoscopic repair and 38 underwent open surgery. Open surgery was performed to the patients who had shock at admission (systolic pressure < 90 mmHg with evidence of peripheral organ hypoperfusion), the patients who had severe cardiorespiratory comorbidities with anesthetic contraindications for pneumoperitoneum, and the patients who had undergone previous open upper abdominal surgery. Patients who had gastric ulcer or underwent open repair were excluded in this study. The operations were performed by eight surgeons with more than 5 years of experience in laparoscopic appendectomy and cholecystectomy. They were all junior staffs with wide experiences and enough skills in the laparoscopic suture. Decisions regarding the method of surgery (i.e., either laparoscopic or conversion, either simple closure or gastrectomy) were dependent on the individual surgeon's preference and expertise.

All information of each patient was collected through retrospective medical record review. The Institutional Review Board of St. Vincent's Hospital, The Catholic University of Korea approved this study (No.VC14RISI0017). The study variables were age, sex, comorbid diseases, medication history, previous ulcer history, duration of perforation, ulcer size, ulcer location, conversion, reasons for conversion, postoperative complications, surgical outcomes, and duration of hospital stay.

2.2. Laparoscopic simple closure (LSC)

The patient was placed in the supine position, and carbon dioxide pneumoperitoneum (up to a pressure of 12 mmHg) was established with a Veress needle through an infraumbilical incision. After establishing pneumoperitoneum, the laparoscope was introduced through a 11-mm-diameter trocar and the whole abdominal cavity was investigated thoroughly. The surgeon and the camera operator stood on the patient's left side, and adequate positioning was obtained by tilting the operating table to the left side with elevation of the patient's head (reverse Trendelenburg position). After the perforation site had been identified, if the preliminary diagnosis was not rejected, two additional 5-mm trocars were inserted into the right and left upper quadrants of the abdomen. The perforation site was repaired with two or three vicryl stitches tied over an omental patch. The peritoneal cavity around the perforation site was irrigated with several liters of normal saline in variable positions, while special attention was paid to the right subphrenic, subhepatic, and pelvic regions. A closed suction drain was always left around the perforation site. All surgeons performed the operations using the same technique.

2.3. Postoperative management

Each patient was observed with electronic monitoring in the intensive care unit (ICU) until his or her vital signs were stable. The same preoperative antibiotics and intravenous PPI medications were continued immediately after the operation. The nasogastric tube was removed once the bowel activity had returned and the daily aspirate volume was less than 200 ml. The patient was allowed to have sips of water initially and then graduate to a regular diet. If the patient was able to tolerate the diet, he or she was discharged after removal of the drain. Oral PPI medication was prescribed for 8 weeks. The first follow-up was performed 1 week after discharge to remove the stitches or staplers. Gastrointestinal endoscopy was performed to assess healing of the ulcer and to evaluate the state of *H. pylori* infection. The *H. pylori*-positive patients were given a 1-week course of triple therapy that included omeprazole, amoxicillin, and clarithromycin.

2.4. Statistical analysis

Discrete or categorical variables are expressed as counts and percentages, and continuous variables are expressed as means with standard deviations (range). Fisher's exact test was used to compare differences in discrete or categorical variables, and the Mann–Whitney test was used for continuous variables. Receiver operating characteristics (ROC) curve analysis was applied to determine the best cutoff value for predicting conversion. Differences were considered statistically significant at a p value of <0.05.

Multivariable analysis for discrete variables was performed using a stepwise logistic regression test with all pair-wise interactions. Statistical analysis was conducted using SPSS version 20 (SPSS, Chicago, IL, USA).

3. Results

3.1. Demographics of patients

Patients' mean age was 45.9 ± 16.4 years (range, 17–89 years). The distribution of the patients showed 73 men (94.8%) and 4 women (5.2%). Asymptomatic ulcers were found in 65 patients (84.4%). Twenty-two patients (22.1%) had comorbidity and 5 patients (6.5%) had history of previous operation. The mean duration of perforation was 11.3 ± 7.7 h and the mean ulcer size was 4.8 ± 5.1 mm.

Laparoscopic repair was completed in 69 patients (89.6%) and 8 patients (10.4%) underwent conversion to open repair. Six patients out of 77 (7.8%) had complications. Suture leakage occurred in 3 patients (3.9%) and all three patients required reoperation. One patient (1.3%) out of 3 patients with suture leakage died within 30 day. Outside of the suture leakage cases, ileus was reported in only one patient (1.3%) and two patients (2.6%) had pulmonary complications. The mean hospital stay was 9.9 ± 4.8 days.

3.2. Comparison between totally laparoscopic repair and conversion groups

Patients were divided into totally laparoscopic repair (69 patients) and conversion (8 patients) groups (Table 1). There was no significant difference between the two groups in sex, age, comorbidities, histories of medication or previous ulcer and history of operation. The duration of perforation was significantly longer in the conversion group than in the totally laparoscopic repair group (21.0 ± 14.0 *vs.*10.2 ± 5.8 h, respectively; $p = 0.002$). The mean size of the perforation was greater in the conversion group than in the totally laparoscopic repair group (14.0 ± 11.8 *vs.* 3.8 ± 1.9 mm, respectively; $p = 0.001$). There was no statistical difference between the two groups in the complication rate, but a higher trend of complication rate was found in the conversion group. The hospital stay was longer in the conversion group than in the totally