

Laparoscopic Simple Closure Alone is Adequate for Low Risk Patients with Perforated Peptic Ulcer

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Abstract

Background *Helicobacter pylori* (H.P.) eradication has led to a significant decline in peptic ulcer prevalence; however, the number of patients requiring surgical intervention remains relatively unchanged. Laparoscopy suture repair is the most commonly used procedure for perforated peptic ulcer (PPU). Whether omental patch adds any benefit than simple closure alone is not answered.

Methods From July 2007 to August 2010, patients received emergency surgeries for PPU in our department were enrolled in this study. The demographic data, disease pattern, surgical outcomes were retrospectively collected. Patients who had previous multiple operations, with profound shock, and complicated ulcers were excluded.

Results Totally 73 patients were enrolled. 26 of them received simple closure and the other 47 received simple closure plus an omental patch. There were no difference in age, gender, ASA, Boey risk score, and incidence of co-morbidities. The Mannheim Peritonitis index, median operation time and length of stay were not different between groups.

Conclusions In terms of leakage rate and surgical outcome, the maneuver to cover an omental patch on the repaired PPU did not show additional advantages compared to simple closure alone. Further prospective randomized study is required to clarify the safety and feasibility of simple closure alone without buttressing an omentum patch.

Introduction

Helicobacter pylori (H.P.) eradication has led to a significant decline in peptic ulcer prevalence [1]. However, the number of patients requiring surgical intervention remains relatively unchanged [2, 3]. We found that there were regional differences in the incidence of perforated peptic ulcer. According to updated epidemiological data on duodenal ulcer perforation in United Kingdom [3], the age-standardized incidence rate was 3.77 per 100,000 population per year which is much lower as compared in Asia. For example, a study in Hong Kong described that the incidence of perforation increased with age, and there was a statistically significant rising annual duodenal ulcer perforation rates over time between 13 and 16 per 100,000 population [2]. Various surgical techniques had been attempted for the treatment of perforated peptic ulcer (PPU). These included stapled omental patch [4], gastroscopy aided insertion of the ligamentum teres [5], or omental plug [6]. However, these techniques were either used only in small case series or tend to have high rates of re-operation. Laparoscopic suture closure, initially reported by Nathanson et al. [7], was considered to be a procedure as safe as open approach. Laparoscopic repair confers benefits including reduced postoperative pain, less pulmonary infection, shorter hospital stay, and earlier return to normal activities [8]. In nowadays, the two most commonly accepted laparoscopic procedures for PPU are simple closure with or without an omental patch to cover the repaired ulcer. The rationale to add an omental patch is based on the assumption that it may decrease the probability of leakage and provide a further sense of security. However, there is a paucity of evidence to justify this procedure. In the current study, we aimed to specify if there is any difference between simple closure with or without an omental patch.

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Materials and methods

From July 2007 to August 2010, patients diagnosed to have PPU and underwent emergency surgeries in China Medical University Hospital were enrolled in this study. The excluding criteria included repeated upper abdominal operations, profound shock, extreme age (>90), bleeding tendency, ulcer complicated with bleeding, outlet obstruction, or the ulcer was suspected to be malignant. The demographic data collected were age, gender, American Society of Anesthesiologists Association Score (ASA), presence of shock, White blood cell (WBC) count, Boey risk factor [9], and co-morbidities of the patients. The Boey risk scoring system, propose by Boey et al. in 1987, is well known for stratification of high risk patients in PPU. Major medical illness, preoperative shock, and longstanding perforation (more than 24 h) each scored if present. Intra-operative findings such as the location and size of perforation, severity of abdominal cavity contamination were reviewed. To compare the disease severity, in addition, Mannheim Peritonitis index (MPI) [10] was calculated. The Mannheim peritonitis index was an easy and reliable means of risk evaluation and classification for patients with peritonitis, MPI took age, gender, presence of organ failure, underlie malignancy, peritonitis over 24 h, presence of colon perforation and severity of contamination in peritonitis into consideration. It was surgeon's discretion to decide whether omental patch be added or not after the perforated ulcer was closed. However, all the surgeons performed the operations with the same procedures.

In brief, patient were placed in a 15–20° reverse Trendelenburg position. The operating surgeon stands to the patient's left side. Carbon dioxide pneumo-peritoneum up to 12 mmHg was established through a peri-umbilical incision. A 10 mm 30° laparoscope (Karl Storz, Tuttlingen Germany) was introduced through the umbilical 11 mm trocar (Versaport, Covidien Surgical Devices, North Haven, CT, USA) followed by insertion of a second 11 mm trocar at left upper abdomen and another 5 mm trocar at right upper abdomen. Closing the perforated ulcer was done by using 3/0 polygalactin (Vicryl Ethicon, Johnson & Johnson, Cincinnati, OH, USA) stitches in interrupted fashion with intra-corporeal tie. The Omental patch was performed by mobilizing the greater omentum over the repaired ulcer and tie over by previous retained suture ends in buttressing manner.

SAS software version 9.1 was used for statistical analyses. Variables of each group were reported as medians and interquartile ranges (IQR) whenever suitable. Discrete variables were expressed as counts and percentages. Serial Chi-square tests or Fisher exact tests were used to compare categorical variables. Wilcoxon Rank Sum Test was used

for serial variables. Statistical significance was defined as the level of significance being ≤ 0.05 .

Results

From July 2007 to August 2010, a total of 117 patients diagnosed to have PPU received emergency operation in our department. Thirty-nine of these patients were contraindicated for laparoscopic surgery and were excluded from this study. Another 5 patients were converted to laparotomy. The reason for these 5 conversions were large perforations in two of them (perforations ≥ 15 mm), fragile ulcer edge which precluded safe suture approximation and intra-corporeal knotting in the third patient, posterior localization of pre-pyloric perforated ulcer which made secure suture closure impossible in the fourth case and obscured surgical field due to bulky fatty liver in the last. The remaining 73 patients were enrolled in this study. The demographic data of these patients were shown in Table 1. There were 26 patients who received simple closure (group 1) and 47 patients who received simple closure plus omental patch (group 2). A majority of patients in both groups were male (65.4% and 72.3%, respectively). Median age is 53.5 years old in group 1 (range 21–85 years old) and 54.0 years old in group 2 (range 19–90 years old). Two patients in group 1 and six patients in group 2 were between 80 and 90 years old. Three patients in group 1 and one patient in group 2 were found to be in shock status before operation but all of them were still responsive to fluid resuscitation. Patients of Group 2 had a slight higher median WBC count (13.5 k/ μ l vs. 10.5 k/ μ l) compared to that of group 1 but did not reach statistical significance ($p = 0.102$). All patients of group 1 and 45 of the 47 patients in group 2 were categorized as ASA 1–3. The other 2 patients of group 2 were ASA 4. However, there was no statistical difference between these 2 groups in terms of ASA classification. 92.3% and 91.5% of the patients in group 1 and 2 respectively were either Boey risk factor score 0 or 1 ($p = 0.239$). Therefore, there was also no statistical difference between these 2 groups considering their Boey risk factor scoring. 38.5% (10/26) of the patients in group 1 and 44.7% (21/47) of the patients in group 2 had certain comorbid medical diseases. Diabetes mellitus and hypertension account for the most. As of surgical perspectives (Table 2), the perforations were all juxta-pyloric with no difference in the distribution of location. The median size of perforation in both groups was 5 mm and no difference were noted between both groups for the percentage of patients having small (<5 mm), medium (5–10 mm), and large perforations (>10 mm). 7 cases (26.9%) in group 1 and 8 cases (17%) in group 2 had a MPI ≥ 26 and there was no statistical difference between the 2

Table 1 Demographic data

	Suture (group 1)		Suture + omental patch (group 2)		<i>p</i> -value
	<i>(N</i> = 26)		<i>(N</i> = 47)		
	<i>n</i>	(%)	<i>n</i>	(%)	
Gender					0.723
Female	9	(34.6)	13	(27.7)	
Male	17	(65.4)	34	(72.3)	
Age (years), median (IQR)	53.5(21–85)	(30)	54.0(19–90)	(26)	0.590
Shock					0.248
No	23	(88.5)	46	(97.9)	
Yes	3	(11.5)	1	(2.1)	
>24 h					0.833
No	22	(84.6)	42	(89.4)	
Yes	4	(15.4)	5	(10.6)	
WBC (k/μl), median (IQR)	10.5	(7.1)	13.5	(7.5)	0.102
ASA					0.797
1	5	(19.2)	10	(21.3)	
2	11	(42.3)	21	(44.7)	
3	10	(38.5)	14	(29.8)	
4	0	(0)	2	(4.3)	
Boey risk factor					0.239
0	11	(42.3)	29	(61.7)	
1	13	(50.0)	14	(29.8)	
2	2	(7.7)	4	(8.5)	
Co-morbidity					0.789
No	16	(61.5)	26	(55.3)	
Yes	10	(38.5)	21	(44.7)	
Diabetes Mellitus	2		6		
Hypertension	5		12		
Coronary artery disease	0		6		
COPD	0		4		
Chronic renal insufficiency	1		4		
Liver cirrhosis	3		4		
Previous stroke	1		2		
Heart failure	0		3		

IQR interquartile range, *ASA* American Society of Anesthesiologists Association Score, *COPD* chronic obstructive pulmonary disease

groups for their MPI ($p = 0.484$). The outcome of operation between these 2 groups were compared and listed in Table 3. The median operation time was 90 min in group 1 and 80 min in group 2 ($p = 0.347$). The median time to resume regular diet was 4 days in both groups ($p = 0.167$). The median length of hospital stay was marginally longer in group 1 (7 days) than in group 2 (6 days, $p = 0.098$). The numbers of patients with complications were 8 (30.8%) in group 1 and 14 (29.8%) in group 2 ($p = 1.000$). The most common complications in both groups were ileus, surgical site (trocar wound) infection and pulmonary problems (atelectasis or pleural effusion). Two patients in group 2 but none in group 1 were complicated with leakage

after operation, furthermore, leakage led to mortality of both patients. Both these patients were very old (87 and 90 years old, respectively) and had multiple systemic diseases with impaired organ functions before operation. Their general condition got worse rapidly and did not have chances to recover from their surgical complication. No patients were reoperated for their complications.

Discussion

H.P. eradication has led to a significant decline in peptic ulcer prevalence and recurrence [1]. Following the

Table 2 Surgical perspectives

	Group 1		Group 2		<i>p</i> -value
	(N = 26)		(N = 47)		
	<i>n</i>	(%)	<i>n</i>	(%)	
Location					0.706
Duodenum	12	(46.1)	17	(36.2)	
Pylorus	6	(23.1)	13	(27.7)	
Pre-pylorus	8	(30.8)	17	(36.2)	
Size (mm), median (IQR)	5	(1)	5	(3)	0.124
					0.378
Ulcer <5 mm	5	(19.2)	16	(34.0)	
Ulcer 5–10 mm	20	(76.9)	29	(61.7)	
Ulcer >10 mm	1	(3.8)	2	(4.3)	
MPI					0.484
<26	19	(73.1)	39	(83.0)	
≥26	7	(26.9)	8	(17.0)	
MPI, median (IQR)	15	(18)	16	(11)	0.635
Previous operation	2		1		

IQR interquartile range, *MPI* Mannheim Peritonitis index

Table 3 Surgical outcome and complications

	Group 1		Group 2		<i>p</i> -value
	(N = 26)		(N = 47)		
	<i>n</i>	(%)	<i>n</i>	(%)	
Op time (mins), median (IQR)	90	(50)	80	(45)	0.347
Time to diet(days),median (IQR)	4	(1)	4	(3)	0.167
LOS (days), median (IQR)	7	(2)	6	(4)	0.098
Morbidity					1.000
Yes	8	(30.8)	14	(29.8)	
No	18	(69.2)	33	(70.2)	
Leakage	0		2		
Intra-abdominal abscess	1		2		
Ileus	3		8		
Surgical site infection	4		4		
Pleural effusion or atelectasis	5		7		
Mortality	0		2		

IQR interquartile range, *LOS* length of stay

introduction of proton pump inhibitors, the role of acid reduction surgery become less important for the management of PPU [11]. However, the number of patients requiring surgical intervention remains relatively unchanged [3, 12]. With or without an omental patch, simple closure has become a popular surgical procedure for PPU [13]. Various laparoscopic sutureless techniques have been attempted to simplify the surgical procedure while still are able to achieve satisfactory results. However, these techniques were either reported only with small case series or

were not well-accepted due to high rates of re-operation. Furthermore, patients admitted today tend to be older and sicker [14, 15], in another word, more risky. Whether the previously well accepted approach is still applicable today worth further discussion. We aimed to evaluate the role of omental patch as an adjuvant procedure. Buttressing an omental patch on the repaired ulcer was based on the assumption that it had the advantage to prevent potential leakage and provided a further sense of security. However, there is still paucity of related studies to justify this procedure. One may argue that the current study is a non-randomized retrospective study and a potential patient selection bias was that surgeons tend to add an omentum patch to “difficult” ulcers based on their personal experience to provide further sense of security. Moreover, such “individualized” surgical practice, non-randomized patient selection were the weakpoints and major flaw of this study. However, while there was no existing generally-accepted indications for adding an omentum patch or not (which was the core idea to initiate this study), we use objective parameters to show that both groups of patients were having similar surgical risks and disease severity even though the patient-selection was non-randomized. To achieve this goal, in addition to age, gender and disease severity, Boey scoring system was used to stratify those patients based on their surgical risks. Furthermore, preoperative physical conditions of these patients were also been compared by their ASA score, presence of shock or not as well as their co-morbidities. Our results showed that there were no statistical differences regarding the above parameters. We also found that intra-operative findings in terms of location and size of the perforated ulcers are similar between groups. To further valid the disease severity in peritonitis between groups, the Mannheim peritonitis index were used. Likewise, the percentage of patients with a MPI of 26 or higher (which was associated with high mortality rates [16]) was not higher in group 2 compared to that of group 1. The only difference was that there was a slightly increased leukocyte count noted in group 2 (10.5 k/μl versus 13.5 k/μl, *p* = 0.097), but still, it did not reach statistical significance. Therefore, their surgical outcomes were comparable.

Compared to the reported high leakage rate of up to 26.8% for patients that received operation in emergency settings [17], our leakage rate was only 2.7% (2/73). One of the explanations may be that most of our patients had a low risk for surgery (Boey risk factor score 0–2). Leakage is known to associated with wound infection, intra-abdominal abscess formation, prolonged ileus and longer hospital stay [18]. In our study, although there were only 2 clinical apparent cases of leakage, it was possible that minor leakage may went undetected and was accounted for the minor complications as mentioned above. Nonetheless, the

incidences of these complications were similar between the two groups. Furthermore, there was no difference regarding operation time, time to diet and length of hospital stay.

It is arguable if there are standard laparoscopic procedures to treat PPU. Sutureless repair was once considered as safe as suture repair [19] but it took extra cost such as the use of fibrin glue. Although the rationale of this sutureless technique was to simplify the procedure and shorten operative time, it did not gained wide acceptance owing to its high leakage rate as compared to suture repair (16–6%) [18]. Siu et al. [20] proposed a technique of closing the ulcer with a single stitch plus omental patch for small perforations (i.e. <10 mm). They obtained satisfactory results with a conversion rate of only 7.4% [21, 22]. Song et al. [23] further simplified the method by suturing the perforation without knotting followed by tying the suture over an omental patch. Although simple and effective by avoiding applying suture on fragile edge, the drawback was that no further rescue maneuver could be made if the single stitch was tied without good security. Ates et al. [24] compared the results of laparoscopic simple closure without omental patch with that of conventional open repair in patients with small perforated duodenal ulcer and prove that is was as safe and as effective. On the other hand, Turner et al. [25] reported that suture without an omental patch would result in a significantly higher mortality rate than with a patch. However, most cases in their series were perforated gastric ulcers instead of juxta-pyloric perforation. Finally, Lunevicius et al. [26] reviewed 13 prospective and 12 retrospective studies and concluded that repair method should best be judged by the properties of the ulcer edge.

In short, although it seems that no single method is considered being standard, Our results showed that there were no differences between these two most common adopted procedures in terms of postoperative recovery and incidence of surgical complications.

In this study, power and sample sizes are important to avoid failure to reject a Null Hypothesis when it is false. Although we assume there's no difference between the two groups but owing to not having enough case volume to discriminate small difference between groups, we may incorrectly accept our hypothesis. We have to admit the existence of such unpreventable imperfect statistical blindness, that is, a type II error.

To summarize, laparoscopic simple closure alone without adding an omental patch is a safe procedure for juxta-pyloric perforation in low risk patients.

Conclusions

In terms of leakage rate and surgical outcome, the maneuver to cover an omental patch on the repaired PPU did not show any additional advantage. Prospective

randomized study is indicated to further clarify the safety and feasibility of simple closure alone without buttressing an omentum patch.

Conflicts of interest All of the authors declare that they have no conflicts of interest or financial ties to disclose.

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