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Original Article

Laparoscopic Repair of Perforated Peptic Ulcer: A Report of 58 Cases

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Abstract

Objective: The most common cause of gastroduodenal perforation is a perforated peptic ulcer (PPU). Laparoscopic repair has proved to be beneficial over open repair in terms of less post-op pain and a shorter length of stay. However, complications from site leak and intra-abdominal abscess are more common. The author reported the outcomes of three laparoscopic repair procedures: simple closure alone (SC), simple closure with omental patch (SCO), and simple closure alone with leak test (SCL) in 58 patients who presented with perforated gastroduodenal lesions.

Methods: Between July 2011 and October 2020, retrospective data of 58 patients with gastroduodenal perforation and underwent SC, SCO, and SCL were analyzed.

Results: There were 57 benign peptic ulcers and 1 gastric cancer perforation. Laparoscopic surgery was accomplished in 52 cases (89.7%) and was converted to open surgery in 6 cases (10.3%). SCO was performed in 13 cases (22.4%), SC in 15 cases (25.9%) and SCL in 24 cases (41.4%). In the SCL group, wound leakage was detected in 2 cases (8.3%) and both were corrected intra-operatively. There was no site leak or intra-abdominal abscess in this study, and no re-operation was required. Two deaths (3.4%) were found in this study.

Conclusion: SCO for large ulcers was a safe procedure but took longer operative time. SC for small ulcer was secure with shorter operative time. SCL for high-risk ulcers could detect site leak intra-operatively and could prevent post-operative complications.

Keywords: Perforated peptic ulcer, Laparoscopic repair, Simple closure, Site leak

Introduction

Perforated peptic ulcer (PPU) is a life-threatening complication of peptic ulcer disease with the prevalence range from 2-14%.[1] Mortality remains relatively high and can reach 25% of patients, even in Western countries.[2] Management of this situation was primarily surgery, either by open surgery or a laparoscopic approach. A meta-analysis of eight randomized controlled trials comparing the outcomes of laparoscopic and open repair has shown slightly lower mortality in the laparoscopy group, but re-operation rates to repair site leak and drainage of intra-abdominal abscess rates were higher.[3]

Reinforced the suture line with omentum was expected to prevent complications, however, many reports showed no different rate of site leak when compared with simple closure alone. On the contrary, omentum reinforcement significantly took more operative time than simple closure alone.[4] The leak test is an adjunct

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procedure that is used to confirm the strength of the suture line after closure. If leakage is detected, it could be corrected promptly to prevent post-operative complications. If the wound is secure, omentum reinforcement is unnecessary, which could shorten the operative time.

The objective of the present study was to report the outcomes of three laparoscopic repair procedures: simple closure alone (SC), simple closure with omental patch (SCO), and simple closure alone with leak test (SCL) in 58 patients who presented with perforated gastroduodenal lesions.

Patients and Methods

Retrospective data of emergency laparoscopic surgery of 58 patients with perforated gastroduodenal ulcers admitted at Sawanpracharak Hospital during July 2011-October 2020 were reviewed. Patients' demographic data, pre-operative data, operative data, and post-operative data were analyzed. In the initial phase of the study (the first 24 cases), the procedures performed were simple closure alone (SC) and simple closure with omental patch (SCO). In the latter phase (the last 34 cases), the author developed the "Leak test," which was an adjunct procedure used for checking the integrity of suture lines. This procedure, simple closure alone with leak test (SCL), has been applied in some selected patients who had high-risk ulcers in order to replace the omental patch procedure.

After the perforated site in the stomach or duodenum is identified, the suction is used to remove exudate and friable tissue around the ulcer (Figure 1) until healthy tissue is visualized (Figure 2). If the ulcer is located at the body of the stomach, lesser curvature or greater curvature, a tissue biopsy is performed. If the lesion is located near the pylorus (prepylorus), only some ulcers are biopsied. The ulcer is closed with interrupted stitches (Figure 3) and a leak test is started with normal saline solution loading via a nasogastric tube (Figure 4). The volume is gradually increased every 50 ml until the stomach is fully distended

Figure 1 Ulcer at 1st part of duodenum

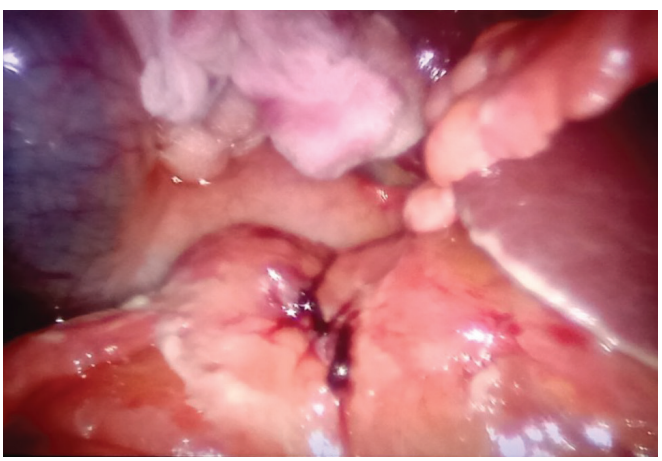

Figure 3 Interrupted closure of ulcer

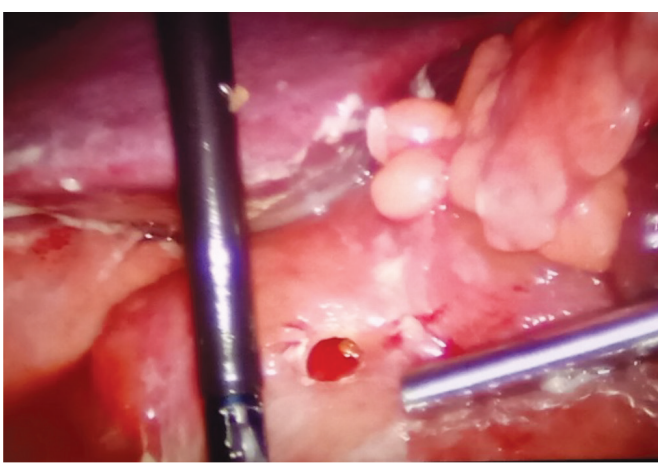

Figure 2 Removal of exudate and friable tissue

Figure 4 Leak test with NSS

(Figure 5). A grasper is pressed on the stomach to create tension at the suture line. If fluid can pass through the wound into the duodenum without leakage seen, the test is finished and residual fluid is sucked out. If a fluid leak is noticed, the wound may be reinforced with additional stitches or revised and the test repeated until it proves safe. In the event that leakage can't be controlled, conversion to open surgery is considered. The peritoneal cavity is irrigated with several liters of normal saline, starting at subhepatic, subphrenic, right paracolic gutter, splenic fossa, left paracolic gutter, and pelvic cavity. If there are gross food particles or sticky fibrin, a 4 × 4 gauze is used to remove them. If a drain is used, it is placed at subhepatic area and exits at the port site (Figure 6).

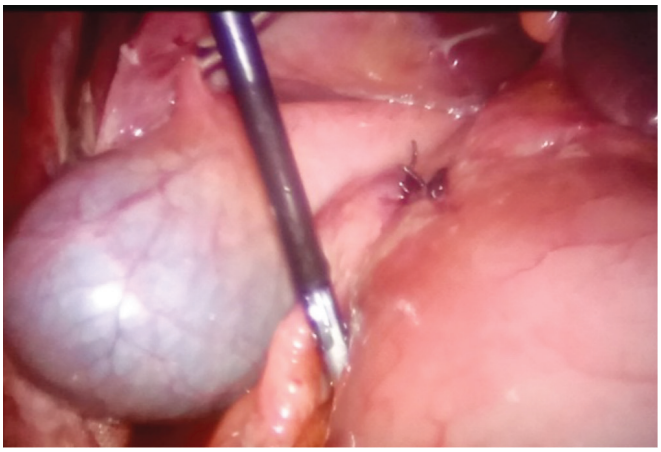

Figure 5 Fully distended stomach

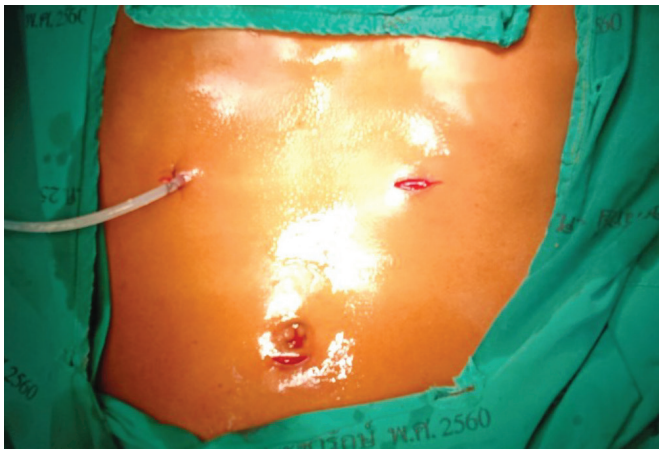

Figure 6 Drain placement

Results

Of a total number of 58 cases, there were 48 males (82.8%) and 10 females (17.2%). The mean age was 57.3 years (30-87). Diagnosis was made from chest film (pneumoperitoneum) 47 cases (81.0%), from CT scan 1 case (1.7%) and from diagnostic laparoscopy 10 cases (17.2%). The average time from onset to operation room was 23 hours (7–80). The average ASA score was 2E (1E–4E). About one-third of patients were operated on after midnight. Perforated sites were from duodenal ulcers in 31 cases (53.5%). Pre-pyloric ulcers were found in 18 cases (31.0%), with 11 cases of biopsy-proven benign lesions. Nine gastric ulcers (15.5%) had lesions at lesser curvature (5), body of stomach (3), and greater curvature (1). Eight were benign conditions, and one lesion at body was adenocarcinoma. The average size of the ulcer was 11.7 mm (5–40 mm) and the number of stitches used to close the ulcer was 2.6 stitches (1–5). Laparoscopic surgery was accomplished in 52 cases (89.7%) with simple closure and omental patch (SCO) in 13 cases (22.4%), simple closure alone (SC) in 15 cases (25.9%) and simple closure with leak test (SCL) in 24 cases (41.4%). In the SCL group, leak proof was confirmed in 22 cases (91.7%) and leakage was detected in 2 cases (8.3%). The mean overall operative time was 103 min (45-200), SCO was 113 min (60-250), SC was 97 min (65-200), and SCL was 93 min (46-160). The mean water volume used for the leak test was 738 ml (300-1,000 ml). The degree of contamination was minimal in 23 cases (39.7%), moderate in 16 cases (27.6%), and severe in 19 cases (32.8%). Drainage has been placed in 43 cases (74.1%).

Table 1 Patient characteristics (N=58)

Characteristics	Summary
Sex: number (%)	
Men	48 (83)
Women	10 (17)
Age (years): mean (range)	57.3 (30 to 87)
Time operation (hour): mean (range)	22.9 (7 to 80)
Diagnostic radiology: number (%)	
CXR (pneumoperitoneum)	47 (81)
CT scan	1 (2)
Diagnostic laparoscopy	10 (17)
ASA score: mean (range)	2 (1 to 4)
Time of day: number (%)	
Before midnight	38 (66)
After midnight	20 (34)

Table 2 Operative findings and management (N = 58)

Operative findings and management	Summary
Number of trocar used: number (%)	
Three ports	50 (80)
Four ports	8 (20)
Perforation site: number (%)	
Benign	57 (98)
Duodenum	31 (54)
Pre-pylorus	18 (31)
Gastric	8 (4)
Malignant (gastric adenocarcinoma)	1 (2)
Ulcer size, overall (mm): mean (range)	11.7 (5 to 40)
Ulcer size in non-conversion group	10.3 (5 to 20)
Simple closure with omental patch	10.8 (5 to 20)
Simple closure alone	9.3 (5 to 15)
Simple closure with leak test	10.7 (5 to 20)
Ulcer size in conversion group	20.0 (10 to 40)
Number of stitches used: mean (range)	2.6 (1 to 5)
Type of operation: number (%)	
Non-conversion group	52 (90)
Simple closure with omental patch	13 (25)
Simple closure alone	15 (30)
Simple closure with leak test	24 (46)
Intact of suture line	22 (92)
Leakage of suture line	2 (8)
Conversion group	6 (10)
Truncal vagotomy with pyloroplasty	4 (67)
Simple closure with omental patch	2 (33)
Operative time, overall (min): mean (range)	99 (45 to 250)
Simple closure with omental patch	113 (60 to 250)
Simple closure alone	97 (65 to 200)
Simple closure with leak test	93 (45 to 160)
NSS volume used (mL): mean (range)	738 (300 to 1,000)
Degree of contamination: number (%)	
Minimal	23 (40)
Moderate	16 (28)
Severe	19 (32)
Drain used: number (%)	43 (74)
Time to start oral feeding (hour): mean (range)	21 (1 to 67)
Length of stay (day): mean (range)	3.4 (2 to 9)

Of the fifty-two cases, there were no post-operative complications, such as a site leak or an intraabdominal abscess, and no additional surgery was required. One operation was switched to hand-assisted surgery with an incision of 6 cm at mid-abdomen to clean the contamination after the ulcer was closed. The average time to start oral feeding was 21 hours (1–67). The mean length of hospital stay (LOS) was 3.4 days (2–9).

There were 6 patients (10.3%) converted to open surgery. Four truncal vagotomy and pyloroplasty procedures were performed, as well as two simple closures with an omental patch. There were two deaths (3.4%) found in this study (Table 1-2).

Discussion

The incidence of PPU in Thailand was about 10% of peptic ulcer disease,[5] which accounts for 5% of all abdominal emergencies.[6,7,8] Diagnostic indicators for peptic ulcer perforation were from clinical and imaging, including intense abdominal pain, tenderness, and guarding and X-ray with free air.[9] CXR could detect free air about 85%[10] and contrast enhanced CT scan has diagnostic accuracy of 98%.[11] Diagnostic laparoscopy is an alternative method which could make a definite diagnosis of 93-98% and 86-100% could be treated laparoscopically during the same session.[12,13] In this report, diagnostic laparoscopy was applied in 10 patients (17.2%) whose clinical suspicion of PPU but their chest film didn't demonstrate free air.

Since the introduction of laparoscopic repair in 1989, laparoscopic simple closure either with or without omental graft is comparable to open surgery, but site leak complications and intra-abdominal abscess are higher. One limitation of laparoscopic hand-sewing is the loss of touch sensation to evaluate suture line integrity. Reinforcement of suture line with omentum showed no different outcomes when compare with simple closure alone but significantly takes more operative time. Checking the integrity of the suture line intra-operatively might be an answer to this problem.

In the early period of this study, before the leak test was introduced, there were 24 PPU patients treated with laparoscopic surgery. SC was performed in 11 patients with small ulcers and SCO was operated in 13 patients with high-risk ulcers (large ulcers, ulcers with fragile edges, or ulcers with extensive scar). The average ulcer size of the SC group was 9.3 mm and the SCO group was 10.8 mm. Although there were no site leak or intra-abdominal abscess complication in both groups but the meticulous steps and time consuming of omental patch procedure had led to leak test trial. For the next 34 cases, 24 high-risk ulcers were closed and checked with a leak test. Twenty-two cases were confirmed secure and two cases showed leakage. Both leakages had 30 mm ulcers and were corrected with additional stitches, which could prevent site leak complications.

There were six patients subjected to open surgery. Ulcer was failed to identify in 2 patients (40 mm ulcer at posterior wall of stomach and duodenal ulcer with severe adhesive to omentum). Two patients had large (20 mm) ulcers with friable edges that couldn't hold tension. Two patients had severe contaminated abdomens which were evaluated as impossible to clean via trans-laparoscopy (ulcers were not attempted to close). However, the last problem could be managed by switching to hand-assisted surgery to clean the abdomen after the ulcer was closed. There was 1 patient diagnosed with gastric adenocarcinoma. He had underlying liver cirrhosis and had a 20 mm ulcer at body of stomach. The lesion was biopsied, closed with silk 2/0 and buttressed with an omental patch. He had an uneventful recovery with a length of stay (LOS) of 4 days. He later had subsequent definite surgery.

There were 2 deaths found in this study. The first patient was a 76-year-old male with an onset time of 30 hours before surgery. He had hypotension on arrival and his ASA score was 4E. He had a 30 mm chronic ulcer at the first part of duodenum with severe contamination. The ulcer failed to close and was converted to a simple closure with an omental patch. He developed pneumonia and respiratory failure and died of septic shock 9 days after surgery. The second patient was an 80-year-old male with an onset time to OR of 30 hours. He had a 4E ASA score and had a 10 mm ulcer at lesser curvature. He developed an acute myocardial infarction after just finishing a simple closure and leak test. His operative time was 95 minutes. He died 3 days after the surgery.

The watertight seal of the suture line could allow the patient to start early oral feeding. Patients would have their NG tubes removed as soon as they gained consciousness and had no GI symptoms (nausea, vomiting). They were allowed to sip water and take liquid and soft diets on the same day if they could tolerate it.[14] On the next day, if the patients had an uneventful recovery, the drain would be removed and they would be discharged.

The average time to start oral feeding was 21 hours, and the average length of stay was 3.4 days.

Leak test has also been applied to another condition other than PPU. The test has been used in one cholecystoduodenal fistula[15] and two iatrogenic duodenal injuries during laparoscopic cholecystectomy.

The limitations of this study was the lack of long-term follow-up. Most of the patients were scheduled two weeks after surgery to look for complications and be informed of the pathology report.

Conclusion

Laparoscopic simple closure alone (SC) for small ulcers is a secure operation with a short operative time. Laparoscopic simple closure with an omental patch (SCO) for large ulcers is a safe procedure but takes longer operative time. Laparoscopic simple closure alone with leak test (SCL) for high-risk ulcers could confirm the integrity of suture line and could prevent site leak complications.

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บทคัดย่อ **รายงานการรักษาผู้ป่วยกระเพาะอาหารและลำไส้เล็กส่วนต้นทะลุด้วยวิธีการผ่าตัดผ่านกล้องจำนวน 58 ราย**

วันชัย มานะกิจศิริสุทธิ, พ.บ.

กลุ่มงานศัลยกรรม โรงพยาบาลสวรรค์ประชารักษ์ จังหวัดนครสวรรค์

โรคแผลในกระเพาะอาหารและลำไส้เล็กส่วนต้นทะลุเป็นภาวะแทรกซ้อนที่พบได้บ่อย การรักษาด้วยวิธีการผ่าตัดผ่านกล้องได้ผลดีกว่าการผ่าตัดแบบแผลเปิดในแง่ อาการปวดแผลน้อยกว่า มีระยะเวลานอนรพ.สั้นกว่า แต่พบปัญหารูรั่วจากแผลเย็บและการเกิดโพรงหนองในช่องท้องได้มากกว่า การทดสอบรูรั่วจากแผลเย็บในขณะทำการผ่าตัดช่วยให้สามารถตรวจพบรูรั่วและทำการแก้ไขได้ก่อนที่จะเกิดภาวะแทรกซ้อนขึ้น ผู้นิพนธ์ได้รายงานผู้ป่วยกระเพาะอาหารและลำไส้เล็กส่วนต้นทะลุจำนวน 58 รายเป็นผู้ป่วยโรคแผลในกระเพาะอาหาร 57 ราย เป็นมะเร็งกระเพาะอาหาร 1 ราย ทุกรายได้รับการรักษาด้วยวิธีการผ่าตัดผ่านกล้อง การผ่าตัดสำเร็จจำนวน 52 ราย (89.7%) เปลี่ยนการผ่าตัดเป็นแบบแผลเปิดจำนวน 6 ราย (10.3%) มีผู้เสียชีวิตจำนวน 2 ราย (3.4%) กลุ่มที่ผ่าตัดสำเร็จได้รับการผ่าตัด 3 แบบ คือ การเย็บปิดแผลทะลุร่วมกับการใช้เยื่อแขวนกระเพาะเสริม (omental patch) จำนวน 13 ราย (22.4%) การเย็บปิดแผลทะลุเพียงอย่างเดียวจำนวน 15 ราย (25.9%) และการเย็บปิดแผลทะลุร่วมกับการทดสอบรูรั่วจำนวน 24 ราย (41.4%) ในกลุ่มที่ทดสอบรูรั่ว ไม่พบรูรั่วจำนวน 22 ราย พบรูรั่วจำนวน 2 ราย (8.3%) และสามารถทำการแก้ไขได้ในขณะผ่าตัด ผลการศึกษาไม่พบภาวะแทรกซ้อนจากการเกิดรูรั่วที่แผลเย็บและไม่พบการเกิดโพรงหนองในช่องท้อง การเย็บปิดแผลทะลุร่วมกับการใช้เยื่อแขวนกระเพาะเสริม (omental patch) สำหรับแผลทะลุที่มีขนาดใหญ่มีความปลอดภัยแต่ใช้เวลาผ่าตัดนาน การเย็บปิดแผลทะลุเพียงอย่างเดียวในแผลขนาดเล็กมีความปลอดภัยและช่วยลดระยะเวลาการผ่าตัดได้ การเย็บปิดแผลทะลุร่วมกับการทดสอบรูรั่วในแผลขนาดใหญ่ช่วยให้สามารถวินิจฉัยและป้องกันการเกิดรูรั่วที่แผลเย็บได้