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การเปรียบเทียบระหว่างการผ่าตัดม้ามโดยการส่องกล้องโดยใช้ LigaSure และการผ่าตัดม้ามแบบเปิดหน้าท้องในโรคที่ไม่ได้เกิดจากอุบัติเหตุ

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Comparison between Laparoscopic Splenectomy Using LigaSure and Open Splenectomy for Non-traumatic Diseases

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หลักการและวัตถุประสงค์: การผ่าตัดม้ามโดยการส่องกล้องได้กลายเป็นแนวทางมาตรฐานสำหรับความผิดปกติของม้ามที่ไม่ได้เกิดจากอุบัติเหตุ การศึกษาในอดีตพบว่าการผ่าตัดม้ามโดยการส่องกล้องด้วยเครื่องมือ LigaSure ในการห้ามเลือดบริเวณขั้วม้ามมีประสิทธิภาพและความปลอดภัย การศึกษานี้เปรียบเทียบประสิทธิภาพและความปลอดภัยของการผ่าตัดม้ามโดยการส่องกล้องโดยใช้เครื่องมือ LigaSure กับการผ่าตัดม้ามแบบเปิดหน้าท้องผู้ป่วยที่เป็นโรคที่ไม่ได้เกิดจากอุบัติเหตุ

วิธีการศึกษา: เราทำการศึกษาย้อนหลังเปรียบเทียบข้อมูลการผ่าตัด ภาวะแทรกระหว่างการผ่าตัด และ ผลลัพธ์การรักษาต่างๆระหว่างการผ่าตัดม้ามโดยการส่องกล้องกับการผ่าตัดม้ามแบบเปิดหน้าท้อง

ผลการศึกษา: ผู้ป่วยเข้ารับการผ่าตัดม้ามทั้งหมด 25 ราย ผ่าตัดม้ามแบบเปิดหน้าท้อง 6 ราย ผ่าตัดม้ามโดยการส่องกล้อง 19 ราย โดยผู้ป่วยเข้ารับการผ่าตัดม้ามแบบเปิดหน้าท้องใช้เวลาในการผ่าตัดสั้นกว่าผู้ป่วยเข้ารับการผ่าตัดม้ามโดยการส่องกล้อง (45 นาทีเทียบกับ 100 นาที p= 0.030) ผู้ป่วยเข้ารับการผ่าตัดม้ามโดยการส่องกล้องมีคะแนนความเจ็บปวดหลังการผ่าตัดน้อยกว่า (7 คะแนนเทียบกับ 3 คะแนน p< 0.001) และสามารถเริ่มรับประทานอาหารได้เร็วกว่า (18 ชั่วโมงเทียบกับ 6 ชั่วโมง p= 0.003) ทั้งนี้ไม่พบผู้เสียชีวิตทั้งสองกลุ่มและไม่พบความแตกต่างอย่างมีนัยสำคัญทางสถิติแง่ภาวะแทรกระหว่างการผ่าตัดระหว่างผู้ป่วยทั้งสองกลุ่ม (ร้อยละ 16.7 เทียบกับร้อยละ 26.3% p= 0.629)

สรุป: การผ่าตัดม้ามด้วยการส่องกล้องโดยใช้ LigaSure นั้นปลอดภัยและมีประสิทธิภาพสำหรับผู้ป่วยที่เป็นโรคที่ไม่ได้เกิดจากอุบัติเหตุ ทั้งนี้การผ่าตัดม้ามด้วยการส่องกล้องมีความสัมพันธ์กับระยะเวลาการผ่าตัดที่ยาวนานขึ้น ความเจ็บปวดหลัง

Background and Objective: Laparoscopic splenectomy (LS) has become the standard approach for non-traumatic splenic disorders. Previous studies demonstrated the effectiveness and safety of LigaSure for the dissection and sealing of splenic pedicels in LS. This study compared the efficacy and safety of LS using LigaSure and open splenectomy (OS) in patients with non-traumatic disease.

Materials and Methods: We retrospectively reviewed patients who underwent LS and OS. Operative data, perioperative course, and clinical outcome were assessed.

Results: In all, 25 patients were included in the analysis; 6 in the OS group, and 19 in the LS group. The OS group had a significantly shorter duration of surgery (median [interquartile range; IQR] = 45 [30-95] vs. 100 [60-120] minutes, p=0.030). The LS group had significantly lower post-operative pain scores (median [IQR] = 7 [6-9] vs. 3 [1-5], p<0.001) and shorter time to step diet (median [IQR] = 18 [18 to 24] vs. 6 [6 to 18] h, p=0.003). No mortality occurred in either group. There was no significant difference in perioperative complications between the two groups (16.7% vs. 26.3%, p=0.629).

Conclusion: Laparoscopic splenectomy using LigaSure appeared safe, feasible, and efficacious for non-traumatic splenic disorders. LS using LigaSure was associated with a significantly longer duration of

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การผ่าตัดน้อยลง และเริ่มรับประทานอาหารทางปากได้เร็วขึ้น เมื่อเทียบกับการผ่าตัดม้ามแบบเปิดหน้าท้อง โดยไม่มีความเสี่ยงที่เพิ่มขึ้นของการตกเลือดระหว่างการผ่าตัดและภาวะแทรกซ้อนระหว่างการผ่าตัด

คำสำคัญ: การผ่าตัดตัดม้ามผ่านกล้อง; การตัดม้ามแบบเปิด; ตัดม้าม

surgery, lesser postoperative pain, and faster resumption of oral diet compared to OS, without increased risks of intraoperative bleeding and perioperative complications.

Keywords: Laparoscopic splenectomy; open splenectomy; splenectomy; LigaSure

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Introduction

Since its introduction in the early 1990s, laparoscopic splenectomy (LS) has become the standard approach for surgical resection for non-traumatic splenic disorders[1, 2]. LS has many advantages compared with open splenectomy (OS), which are ascribed to a minimally invasive procedure, including lesser decrease postoperative pain, faster recovery, a lower rate of procedure-related complications, and cosmetic results[3-5], however, the primary concern of long duration of surgery and intraoperative bleeding remains[6]. Uncontrolled bleeding, mainly when securing vascular control of the splenic pedicels, is a significant risk requiring conversion to OS[7].

Several techniques have been developed to decrease the duration of surgery and control splenic vasculature, including clips, ligature, ultrasonic shears, endovascular staplers and LigaSure devices[8-11]. Previous studies demonstrated the effectiveness and safety of LigaSure in the sealing and dissection of splenic pedicles during LS[8]. En bloc ligation to secure the main vasculature of the splenic pedicle is associated with an increased risk of splenic arteriovenous fistula[12, 13]. Bleeding from the secondary splenic pedicles can be successfully controlled during without additional morbidities by using the LigaSure vessel sealing system[14]. The aim of this study was to compare the perioperative clinical outcomes of LS using LigaSure and OS in patients who underwent splenectomy for non-traumatic conditions.

Materials and Methods

This retrospective study included patients who underwent splenectomy for non-traumatic conditions at Hatyai hospital (the regional referral center in southern Thailand) between January 2013 and December 2017. The techniques used for splenectomy was selected by consensus between the surgeons and patients based on their condition. Patient characteristics and perioperative details were obtained from the patient charts. The measured outcomes were the operative time, intraoperative blood loss, need for intraoperative red cell transfusion, conversion rate, splenic weight, postoperative pain (at 24 hours after the procedure), perioperative complications, time of oral diet resumption, and length of hospitalization (LOH). Operative time was measured from the skin incision to closure. Massive splenomegaly was defined as a spleen weighing > 1,000 g. The study was conducted according to the STROBE guidelines and was reviewed and approved by the Ethics Committee on Human Subjects in Hatyai Hospital (protocol number 63/2563), it was performed in accordance with the Helsinki Declaration.

Surgical procedure

All patients, undergoing LS were subjected to general anesthesia, immobilized, and ventilated. A nasogastric tube and urethral catheter were inserted routinely. Vaccination was administered to all patients according to the guidelines of the British Committee for Standards in Hematology[15] (including Pneumococcus, Hemophilus, and Meningococcus) at least 2 weeks preoperatively. A single dose of antibiotic prophylaxis with third generation cephalosporin was routinely administered, except to patients who were given antibiotics for other indications.

In our center, the method of choice is laparoscopic 2-port splenectomy. In this procedure, the patient is placed in the semi-right lateral decubitus (30-45^{O}) position with the left arm hanging using a head screen (to expose the area between the left costal margin and the iliac crest). Usually, 2 incisions are made for insertion of ports, using a single-incision laparoscopic surgery (SILS) port (Covidien, Mansfield, MA, USA) and a 5 mm port; a 30-degree optic is necessary. After insertion of the ports, dissection of the spleen and sealing of the hilar and short gastric vessels were performed using

LigaSure 5 mm. blunt tip vessel-sealing system (Valleylab, Boulder, CO, USA). Sealing of the secondary splenic pedicles was performed close to the spleen without identifying the splenic arteries and veins from the lower pole to the upper pole, using the conventional technique (using one time application of LigaSure) following transection[14]. No laparoscopic staplers, sutures, clips or monopolar/ bipolar cauterization were used. After being completely freed from its attachments, the spleen was placed in a plastic bag (with or without crushing using a sponge holder depending on the splenic size) and extracted through the SILS port wound trocar after extending the incision to 15 mm. The surgical specimen was sent for pathologic examination to document the hematological disease. Case in which the spleen was larger, a Pfannenstiel incision was made to enhance splenic retrieval. Subsequently, the peritoneal cavity was irrigated and examined for any active hemorrhage.

Statistical analysis

Categorical variables were summarized using frequency statistics (e.g., frequencies, percentage) and compared using the Pearson chi-Square or Fisher's exact test. For continuous variables, descriptive statistics (e.g., mean, standard deviation [SD], median with interquartile range [IQR]) were performed and compared with Student's t-test and Wilcoxon rank-sum test as appropriate. All data analyses were conducted using the statistical program Stata (Version 15.1, College Station, TX, StataCrop LLC). P-values less than 0.05 were considered statistically significant.

Results

Out of 25 patients enrolled in this study, nine were in the OS group, while the LS group included 16 patients. The demographic characteristics of patients in both groups are shown in Table 1. Parameters between the two groups were significantly different. The preoperative platelet count of patients in the LS group was significantly lower than that in the OS group (OS, median [IQR] = 207 [187 to 322] × 103/μL; LS median [IQR] = 120 [187 to 322] × 103/μL; p=0.026). Patients in the OS group had lower body mass index (BMI) (OS, mean ± SD = 18.3 ± 1.9; LS mean ± SD = 21.6 ± 4.2; p=0.078), higher number of patients with palpable spleen on physical examination (83.3% of OS vs. 31.6% of LS; p = 0.056) and higher incidence of patients underwent splenectomy due to symptomatic hypersplenism (66.7% of OS vs. 26.3% of LS, p=0.073) compared to patients who underwent LS. There was no significant difference in term of sex, age, comorbidities, and preoperative hemoglobin level.

The perioperative outcomes of patients who underwent OS and LS are shown in Table 2. The duration of surgery was significantly lower in the OS group (median [IQR] = 45 [30-95] minutes; LS median [IQR] = 100 [60-120] minutes; p=0.030). The OS group had significantly higher splenic weight (median [IQR] = 1550 [280 to 2150] g; LS median [IQR] = 150 [58 to 300) g; p=0.011) and a higher incidence of massive splenomegaly (66.7% in the OS group vs. 5.3% in LS, p=0.001).

There were two cases of open conversion in the LS group. One patient required conversion because of excessive bleeding from the splenic vessels, and the other patient had huge splenomegaly (2190 g splenic weight) and the surgery that could not be performed laparoscopically.

Although there was no significant difference in intraoperative blood loss between the two groups (OS, median [IQR] = 150 [50 to 200] mL; LS median [IQR] = 100 [50 to 250] mL; p=0.626), more patients in the OS group require red blood cells during the procedure (50.0% of OS vs. 15.8% of LS, p=0.073).

Compared to patients in the OS group, patients in the LS group had significantly lower postoperative pain (median [IQR] = 7 [6-9]; LS median [IQR] = 3 [1 to 5], p<0.001) and took lesser time to resume oral intake (OS, median [IQR] = 18 [18-24] h; LS median [IQR] = 6 [6-18] h, p=0.003).

In the LS group, complications occurred in 5 patients (26.3%) of which superficial surgical site infection occurred in 3 patients, portal vein thrombosis in 1 patient, and stress- related mucosal disease presenting with melena in 1 patient. Only 1 patient (16.7%) in the OS group developed perioperative complications as portal vein thrombosis. There was no significant difference in perioperative complications between the two groups (16.7% VS. 26.3%, p=0.629). There was no mortality occurred in both groups. LOH of the LS group was trended to shorter (OS, median (IQR) = 8 (6 to 9) days; LS median (IQR) = 6 (5 to 7) days, p=0.082) than those of the OS group.

Table 1 Baseline demographic data and clinical characteristics of open splenectomy and laparoscopic splenectomy.

Factor	Open splenectomy (N = 6)	Laparoscopic splenectomy (N = 19)	p-value
Female sex	5 (83.3)	12 (63.2)	0.356
Age (years): mean ± SD	26.5 ± 8.7	26.2 ± 15.3	0.156
BMI (kg/m2): mean ± SD	18.3 ± 1.9	21.6 ± 4.2	0.078
Indication			
ITP/AIHA	1 (16.7)	10 (76.0)	0.122
Symptomatic splenomegaly	4 (66.7)	5 (26.3)	0.073
Splenic lesion	1 (16.7)	4 (21.1)	0.815
Co-morbidity			
None	6 (100)	17 (89.5)	0.407
Hypertension	0 (0)	1 (5.3)	0.566
Dyslipidemia	0 (0)	1 (5.3)	0.566
Diabetic mellitus	0 (0)	0 (0)	N/A
Palatable spleen	5 (83.3)	6 (31.6)	0.056
Laboratory			
Baseline hemoglobin (g/dL): mean ± SD	9.5 ± 1.6	10.2 ±3.1	0.618
Baseline Platelet (x103/μL): median (IQR)	207 (187 to 322)	120 (46 to 181)	0.026

Data were expressed as number (%) unless specified

SD, standard deviation; IQR, interquartile range; BMI, body mass index

Table 2 Perioperative courses and clinical outcomes between the open splenectomy and laparoscopic splenectomy.

Outcomes	Open splenectomy (N = 6)	Laparoscopic splenectomy (N = 19)	p-value
Operative time (min): median (IQR)	45 (30 to 95)	100 (60 to 120)	0.030
Convert to open splenectomy	N/A	2 (10.5%)	N/A
Estimate blood loss (mL): median (IQR)	150 (50 to 200)	100 (50 to 250)	0.626
Intra-operative RBC requirement	3 (50%)	3 (15.8%)	0.087
Weigh of spleen (gm): median (IQR)	1550 (280 to 2150)	150 (58 to 300)	0.011
Massive splenomegaly	4 (66.7%)	1 (5.3%)	0.001
Pain score at 24 hours: median (IQR)	7 (6 to 9)	3 (1 to 5)	<0.001
Time of oral diet resumption (hours): median (IQR)	18 (18 to 24)	6 (6 to 18)	0.003
Complications	1 (16.7%)	5 (26.3%)	0.629
Portal vein thrombosis	1 (16.7%)	1 (5.3%)	0.369
Superficial surgical site infection	0 (0%)	3 (15.8%)	0.299
Stress related mucosal disease	0 (0%)	1 (5.3%)	0.566
Length of hospitalization (days): median (IQR)	8 (6 to 9)	6 (5 to 7)	0.082

Data were expressed as number (%) unless specified

IQR, interquartile range

Discussion

LS has been considered the gold standard approach for splenectomy, particularly for non-massive splenomegaly[2, 8]. Previous studies demonstrated the beneficial effect of LS in the term of lower postoperative morbidities, faster recovery, and cosmesis over OS[16, 17]. The main results of this study were as follows: First, LS using LigaSure as the dissecting and sealing tool is equally safe and effective for splenectomy compared to OS. Second, the duration of surgery in LS was significantly longer than that in OS. Third, LS was associated with lower postoperative pain, faster resumption of oral diet, and a shorter hospital stay.

The major challenge in laparoscopic procedures is vascular control, particularly in organs with a high blood supply such as the spleen[18]. Compared to other modalities, LigaSure leaves nothing behind after splenectomy (e.g., a clip of staplers) and decrease duration of surgery with a more secured vascular control[14]. Our data supports the data in previous studies, which demonstrated that LigaSure is a safe and effective tool in LS[14, 19, 20].

The median duration of surgery in our study was significantly higher for LS than for OS. This is consistent with previous studies, which demonstrated that LS is associated with a longer operative time than OS[21, 22]. This might be due to the lesser experience of surgeons. Based on a meta-analysis conducted by Winslow and Brunt[23], the duration of surgery for LS will continue to decrease as experience (of minimally invasive approaches) increases over time. This might explain the finding that patients who underwent OS had significantly lower platelet counts, lower BMI, and larger splenic size (according to examination, an indication of symptomatic splenomegaly and splenic weight). There seemed to be selection bias due to the lack of experience; an open procedure was performed in patients who risk for intraoperative complications or had a low probability of success with the laparoscopic approach.

Excessive hemorrhage required conversion to laparotomy with a reported rate ranging from 2% to 15% in a large series[8, 9]. In our study, although only LigaSure was used for sealing the secondary splenic pedicles, intraoperative uncontrolled bleeding during LS that led to conversion to OS occurred in 1 case (5.3%). Although previous studies revealed that LS is associated with lesser blood loss than OS[21, 22], our study failed to demonstrate a significant difference in this aspect. However, more patients in the OS group required red blood cells during surgery than those in the LS group. This difference might be due to the small sample size of the study; hence, a future study with a larger group and/or multiple different settings is necessary to confirm these finding.

The incidence of portal thrombosis after splenectomy has been reported to range from 0% to 52%, depending on whether the reported cases were asymptomatic or symptomatic[24]. In our series, this was seen in 1 case each in the LS group (5.3%) and OS group (16.7%). The risk factors were a preexistent coagulation disorder or elevated platelet count during the postoperative course. Portal thrombosis could be attributed to the long duration of surgery manipulation of vessels during the surgery[25].

The results of this study show that LS offers numerous advantages over OS because of its minimally invasive approach. Postoperative pain score (at 24 h after the procedure) and the period before the resumption of the oral diet resumption were significantly lower in the LS group. Furthermore, the LOH of patients in the LS group was shorter than that of patients in the OS group. Similar to other laparoscopic procedures, the minimally invasive approach causes less tissue injury. It is well established that LS is universally accepted due to lower postoperative pain, faster recovery, and shorter hospital stay[26].

Some limitations of this study should be noted. First, this study was conducted in a single tertiary care center and included only Thai patients; hence, the results might not be universally applicable. Second, the populations involved in each group are a relatively small size which may limit interpretation of the outcome. Third, since this was a retrospective study, some selective bias occurred inevitably, resulting in limitations in comparison between these two surgical approaches. Moreover, all data collection was based on existing records, which might be incomplete.

Conclusion

LS using LigaSure appeared safe, feasible, and efficacious for non-traumatic conditions. Compared to OS, LS was significantly associated with a longer duration of surgery, lower postoperative pain, and faster resumption of oral diet. LS did not increase the risk of intraoperative bleeding and perioperative complications.

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Compliance with ethical standards: The study protocol was reviewed and approved by the Institutional Review Board of Hatyai Hospital (protocol number 63/2563) comply with the Declaration of Helsinki.

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