Laparoscopic splenectomy: Assiut University early experience

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Purpose
Laparoscopic splenectomy (LS) as a treatment for hematological diseases has proven its safety and efficacy with experienced surgeons. The authors present a series of LSs performed in the institution and review the experience with this approach.

Patients and methods
Medical records of 25 consecutive patients who underwent LS from October 2011 to March 2019 were retrospectively reviewed. Data on patient demographics, operative time, operative blood loss, hospital stay, and complications were evaluated. A comparison between the former period (group A, 2011–2015) and the latter period (2015–2019) was performed.

Results
The patients comprised 23 women and two men with a mean age of 35 years. The mean operative time, operative blood loss, and hospital stay were 150 min, 145 ml, and 3 days, respectively. Open conversion was performed in three (12%) patients due to intraoperative bleeding (all open conversions were in group A). Total complications occurred in three (12%) patients. A comparison between groups A and B revealed a significant shorter operative time in group B than in group A ($P<0.05$) with no significant difference in operative blood loss, open conversion, complications, and hospital stay.

Conclusion
LS is feasible and provides good results and safe outcomes. Further prospective studies on a larger number of patients are needed.

Keywords:
laparoscopic, minimally invasive surgery, spleen, splenectomy

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Introduction

Laparoscopic splenectomy (LS) is widely accepted as a gold standard alternative to open splenectomy for the treatment of hematological diseases of the spleen [1,2]. After the first case of LS reported by Delaitre and Maignien [3], many authors have suggested that LS for hematological diseases is as safe and effective as open splenectomy and offers the advantages of better cosmetic results, more rapid return to work, shorter hospital stay, and decreased complications [1,2–5].

However, due to technical difficulties, risk of hemorrhage, and costs of LS, the open approach remains the standard option for splenectomy in our institution. The aim of this study was to describe the technical procedures and outcomes of LS in a consecutive series of patients in our institution and review our early experience with this approach.

Patients and methods

The ethics committee of Assiut University Hospital approved this study. Owing to the retrospective design of the study, written informed consent was not obtained.

Patients

The medical records of 25 consecutive patients who underwent LS from October 2011 to March 2019 at Assiut University Hospital were retrospectively reviewed. Data were collected on the patients' age, sex, BMI, diagnosis, longitudinal diameter of the spleen (cm), operative time (min), operative blood loss (ml), presence of overall complications, and postoperative hospital stay (day). Concomitant cholecystectomy was performed in seven patients due to associated gall bladder stones, and associated repair of small epigastric hernia was performed in one patient. All patients underwent abdominal ultrasound as a primary preoperative imaging and multidisciplinary approach was performed for proper preoperative patient preparation. Vaccination against *Pneumococci* spp., *Meningococci* spp., and *Hemophilus influenza* was taken at least 2 weeks before surgery. Overall postoperative complications were determined based on the Clavien–Dindo classification [6], and

significant complications of grades II–V were noted. Oral fluid was started upon the return of bowel activity, usually 1 day after the operation. The intraperitoneal drain was removed within 2–3 days after surgery.

Surgical technique

Upon induction of general anesthesia via endotracheal intubation, the patient was placed in the supine position with the head up and the trunk tilted 45° toward the right side. A 10 mm incision was performed 3 cm above and to the left of the umbilicus, and the first trocar was inserted under camera visualization. Insufflation with carbon dioxide at 14 mmHg was then attained. Three additional trocars were inserted at the left hypochondrium, two for the surgeon and one for the assistant, as illustrated in Fig. 1. Additional two 5 mm trocars were inserted in the right hypochondrium in seven patients in which concomitant cholecystectomy was performed. Formal laparoscopic exploration was performed at the start of the procedure and the presence of any accessory spleen was noted and carefully removed. The procedure started by mobilization of the lower pole of the spleen with division of the splenocolic ligament and lower segmental splenic vessels using ultrasonic coagulating shears (Harmonic scalpel; Ethicon Endo-surgery, Inc., Cincinnati, Ohio, USA) or a vessel-sealing system (LigaSure; Valleylab, Boulder, Colorado, USA). The short gastric vessels were sealed and divided. Dissection was continued on the splenic hilum until the splenic vessels were encountered, which were ligated and transected using a linear stapler, Hem-o-lok clips, or nonabsorbable sutures (Figs. 2 and 3). The spleen was put on a retrieval bag and extracted after morcellation using ring forceps and widening of the 12 mm trocar incision or through a small Pfannenstiel incision. A drainage tube was placed on the splenic bed.

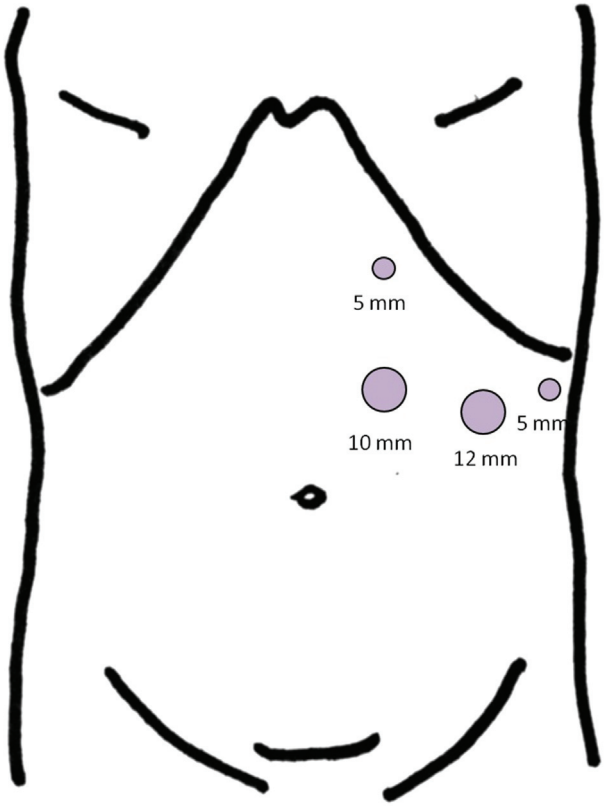
Statistical analysis

Comparison between groups A (2011–2015) and group B (2015–2019) was performed. Statistical analysis was performed using the SPSS software program, version 16.0 (SPSS Inc., Chicago, Illinois, USA). Data are expressed as mean±SD. The Mann–Whitney *U*-test for continuous data and Fisher's exact test or the χ^2-test for categorical data were used to evaluate differences between the two groups. A probability value of less than 0.05 was considered to indicate statistical significance.

Results

The characteristics of the study population are shown in Table 1. The patients comprised 23 women and two men with a mean age of 35 years (range: 15–50 years). The mean BMI was 28 kg/m^2 (range: 22–40 kg/m^2) and the mean longitudinal diameter of the spleen was 18 cm (range: 14–20 cm). Idiopathic thrombocytopenic purpura was the diagnosis in most of our patients (21 out of 25). The operative data and perioperative outcomes are shown in Table 2. The mean operative time was 150 min (range: 90–240 min), the mean operative blood loss was 145 ml (range: 0–850 ml), and the mean hospital stay was 3 days (range: 2–4 days). Open conversion

Figure 1



Trocar sites in laparoscopic splenectomy.

Figure 2

Ligation of the splenic vein by Hem-o-lok clips.

Figure 3

Complete hilar dissection with ligation of the splenic artery and vein by Hem-o-lok-clips.

Table 1 Characteristics of the study population

	N=25
Age (year)	35±9.7
Sex (female/male)	23/2
BMI (kg/m^2)	28±4.6
Longitudinal diameter of the spleen (cm)	18±1.6
Indication for splenectomy	
ITP	21
Hereditary spherocytosis	1
Splenic focal lesion	2
Hypersplenism	1

ITP, idiopathic thrombocytopenic purpura.

Table 2 Operative data and perioperative outcomes

	N=25 [*n* (%)]
Associated procedures	
Cholecystectomy	7 (28)
Small epigastric hernia	1 (4)
Splenic pedicle transection	
Clips	15 (60)
Stapler	7 (28)
Ligation	4 (16)
Operation time (min)	150±46.2
Blood loss (ml)	145±172
Open conversion	3 (12)
Complications	
Subphrenic abscess	1 (4)
Hematoma	1 (4)
Trocar site hernia	1 (4)
Mortality	–
Hospital stay (days)	3 (2–4)

was performed in three patients due to intraoperative bleeding. All the patients of open conversion were in group A.

Total complications occurred in three (12%) patients as illustrated in Table 2. They include a subphrenic abscess that developed 1 week postoperatively (managed by laparoscopic drainage), small splenic bed hematoma (managed conservatively), and trocar site hernia that developed 6 months postoperatively (managed by hernioplasty). There was no reported mortality in our series.

Table 3 Comparison between groups A and B

	Group A (*N*=13)	Group B (*N*=12)	*P* value
Period	2011–2015	2015–2019	
Age	34±9	36±11	0.72
Sex (female/male)	12/1	11/1	0.97
BMI	27±4	28±5	0.81
Spleen diameter (cm)	17±2	18±2	0.4
Operative time (min)	174±48	125±28	0.008
Blood loss (ml)	190±228	99±60	0.47
Associated procedures			0.67
Cholecystectomy [*n* (%)]	4 (31)	3 (25)	0.08
Epigastric hernia [*n* (%)]	1 (8)	0	
Open conversion [*n* (%)]	3 (23)	0	
Hospital stay (days)	3 (2–4)	3 (2–4)	0.37
Complications [*n* (%)]	2 (16)	1 (8)	0.59

Comparison between the former (group A) and the latter (group B) revealed significant shorter operative time in group B than group A ($P<0.05$). No significant difference was found in operative blood loss, open conversion, complications, and hospital stay. Details of comparison are shown in Table 3.

Discussion

Splenectomy represents a standard and effective management of hematological diseases for patients with refractory, recurrent, or chronic diseases after failure of the medical treatment [7]. With the advancement of minimally invasive surgery and patient awareness of new techniques, LS has gained popularity as the standard procedure for a number of benign and malignant hematological disorders which are associated with a small-sized spleen [1,2,8]. In cases of concurrent gallbladder stones with hematological disorders, laparoscopic cholecystectomy can be performed simultaneously with splenectomy with good results and safe outcomes [9].

Hemostasis is a fundamental component of LS procedure, and intraoperative bleeding is the major concern due to the rich splenic blood supply and the fragile parenchyma. The reported open conversion rates in the literature are between 2 and 13% [5,10–13], and most conversions are related to uncontrollable bleeding from hilar vessels or capsular

injury [14–16]. Dissection without splenic traction is recommended to avoid incidental hemorrhage from tearing of the capsule and fragile parenchyma [10]. Several hemostatic devices can help in dissection during LS such as ultrasonic devices, vessel sealing system, monopolar and bipolar diathermy besides the clips and sutures. For the patients of massive splenomegaly, hand assistance or preoperative splenic artery embolization are reported to facilitate hemostatic dissection and minimize intraoperative bleeding [17–19].

Different methods can be used for splenic pedicle transection. In our series, we used Hem-o-lok clips in 15 patients and linear stapler in seven patients. Direct ligation of the splenic artery and vein with nonabsorbable sutures was performed in one patient in addition to three other patients who were converted to open surgery and were managed by suture ligation. The use of stapling devices is reported to be a safe and effective method for transection of the splenic pedicle during LS and shows a low rate of complications in experienced hands [20–22]. Several papers have reported the use of the LigaSure Vessel Sealing System (Valleylab) for complete separation of the splenic pedicle with good and safe outcomes [10,13,23].

Similar to other advanced laparoscopic procedures, LS has its own learning curve which can be defined as the plateau of the operative times and would be associated with improvement of the perioperative outcomes including estimated blood loss and rate of conversion to open surgery. Bagdasarian *et al.* [11] reported significant reductions in open conversion rate after the first, eight cases. Other studies reported a significant improvement in operative time after the first 20 cases [24,25]. In our series of LS, 3 out of 25 patients (12%) were converted to open surgery due to intraoperative bleeding from the splenic hilum and/or splenic parenchyma. The three patients were in the beginning of our learning curve (group A) and all were associated with obesity (BMI $>30\,kg/m^2$) which added to the technical difficulty during dissection. Regarding the impact of obesity on LS, some studies have reported that the rate of complications and conversion to open surgery were similar in obese and nonobese groups, while the operative time was significantly longer in the obese group [26,27]. The mean operative time in our series was 150 min. We reported a significant reduction in operative time in group B (125 min) than group A (174 min) denoting improvement of our procedure and skills after the learning curve.

The reported postoperative complications rate after LS varied from 0 to 35% [1]. They include bleeding, portal vein thrombosis, subphrenic abscess, pancreatic leakage, wound infections, and respiratory complications [28,29]. Our complications rate is comparable to other studies (12%). One of our patients was complicated by subphrenic abscess 1 week postoperatively and was successfully managed by laparoscopic drainage. The amylase level was tested within the abscess fluid and was high denoting a possible associated minor pancreatic tail injury. Linear stapler was used in this patient to secure the vascular pedicle. The use of linear stapler for the splenic hilar vascular control requires accurate hilar dissection and positioning of the stapler as close to the spleen as possible away from the pancreatic tail [10,20].

Conclusion

LS is feasible, has good results and safe outcomes. Learning curve and experience of the surgical team play an important role in the perioperative outcomes of LS. Our study included a small number of patients and has the limitation of being retrospective. Further prospective studies involving larger numbers of patients are still needed.

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Nil.

Conflicts of interest

There are no conflicts of interest.

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