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Laparoscopic splenectomy is emerging 'gold standard' treatment even for massive spleens

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ABSTRACT

INTRODUCTION Since its first description by Delaitre and Maignien in 1991, laparoscopic splenectomy (LS) has evolved as treatment of choice for mild-to-moderately-enlarged spleens and for benign haematological disorders. LS is a challenge if massive spleens or malignant conditions necessitate treatment, but we report our method and its feasibility in this study.

METHODS We undertook a retrospective study of prospectively collected data of all elective splenectomies carried out in our firm of upper gastrointestinal surgeons from June 2003 to June 2012. Only patients opting for elective LS were included in this study.

RESULTS From June 2003 to June 2012, elective splenectomy was carried out in 80 patients. Sixty-seven patients underwent LS and 13 underwent open splenectomy (OS). In the LS group, there were 38 males and 29 females. Age ranged from 6 years to 82 years. Spleen size in the LS group ranged from ≤11cm to 27.6cm. Twelve patients had a spleen size of >20cm. Weight ranged from 35g to 2,400g. Eighteen patients had a spleen weight of 600–1,600g and eight had a spleen weight >1,600g. Operating times were available for 56 patients. Mean operating time for massive spleens was 129.73 min. There was no conversion to OS. There were no major complications.

CONCLUSIONS With improved laparoscopic expertise and advancing technology, LS is safe and feasible even for massive spleens and splenic malignancies. It is the emerging 'gold standard' for all elective splenectomies and has very few contraindications.

KEYWORDS

Spleen – Laparoscopic – Complications – Splenectomy

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Laparoscopic splenectomy (LS) has evolved as a standard and safe minimally invasive procedure for elective splenectomies since its first description by Delaitre and Maignien in 1991.[1] Several studies have shown that it has distinct clinical advantages and economic benefits compared with open splenectomy (OS) because LS reduces the duration of hospital stay, operative blood loss and the prevalence of complications while promoting faster recovery, improved cosmetic effect and better quality of life.[2–6]

In a healthy adult, the spleen measures 11cm in the long axis and weighs 150–200g.[7] Guidelines set by the European Association of Endoscopic Surgeons (EAES) denes 'splenomegaly' as a spleen with a long axis >15cm and 'massive splenomegaly' as a long axis >20 cm.[8] Classification of spleen size based on weight varies. However, spleen weight 600g is usually defined as 'massive' and 1,600g as 'supramassive splenomegaly'.[9–10] Spleen size is not an important parameter in determination of the success of LS.

LS has become the procedure of choice for mild-to-moderately enlarged spleens and for benign haematological disorders.[11,6,12] LS with massive spleens has always been a challenge due to: limited working space; increased risk of bleeding due to well-developed collaterals; inadvertent injury to enlarged veins and the splenic capsule; difficulty in retraction and retrieval; increased operating times. With improved expertise and skill in laparoscopic procedures combined with the availability of advanced laparoscopic instruments, the procedure is finding favour even for massive spleens and malignant conditions necessitating splenectomy.[10,13,7] However, the EAES considers portal hypertension secondary to liver cirrhosis and major comorbidities as contraindications for LS. It also recommends hand-assisted laparoscopic splenectomy (HALS) for massive splenomegaly to avoid conversion to OS and complications.[8]

Here, we detail our experience of LS over a ten-year period with an emphasis upon our surgical procedure for massive spleens.

Methods

We undertook a retrospective study of all splenectomies done in our firm of upper gastrointestinal surgeons (DM

and JR) from June 2003 to June 2012. Planned OS and splenectomies undertaken for trauma were excluded from the study. Data regarding patient demographics, indications for splenectomy, preoperative spleen size, operative details, duration of surgery, and postoperative weight as well as the final histology of the spleen were collected from patient notes and electronic databases.

Spleen size was assessed to decide whether to proceed to OS or LS. Preoperative imaging was not always undertaken in non-palpable spleens. Palpably enlarged spleens were assessed by ultrasound or CT.

Vaccinations against *Streptococcus pneumoniae*, *Haemophilus influenzae* type B, and meningococcal C were given 2 weeks before surgery. Patients were informed about immediate, short- and long-term complications while consenting for surgery.

LS method

The patient was positioned supine with a slight reverse Trendelenburg position. The left flank was bolstered using a saline bag. Position and size of trocars varied according to spleen size. The usual arrangement was a 10mm umbilical port and two or three left, subcostal, 5mm ports with the medial port almost adjacent to the xiphisternum. A 5mm, 30° endoscope was used.

Initially, the endoscope was passed through the umbilical port. However, as soon as appropriate, it was passed through the central left subcostal 5mm port for an unparalleled view of the short gastric vessels, splenic artery and splenic hilum. The endoscope may need to be repositioned into the umbilical port for division of the lienorenal ligament.

A diagnostic laparoscopy was undertaken to look for other disease and to detect an obvious accessory spleen. The gastrosplenic ligament was opened to identify the splenic artery running along the superior border of the pancreas. The splenic artery was isolated along the superior border of the pancreas after opening the lesser sac by division of the short gastric vessels and reflecting the greater curve of the stomach medially. It was tied or clipped in continuity using a locking, plastic laparoscopic clip (Laparo-Clip™; Covidien, Dublin, Ireland) to reduce the volume of the spleen. The gastrosplenic ligament was divided completely using Harmonic Ace (Harmonic Scalpel; Ethicon EndoSurgery, Cincinnati, OH, USA) and the dissection continued to divide the short gastric vessels. The splenic hilum was divided using a vascular stapler (EndoGIA; AutoSuture, Norwalk, CT, USA; or Endolinear Cutter; Ethicon EndoSurgery). Care was taken to ensure that the entire circumference of the pedicle was secured to prevent bleeding. The fully mobilised spleen was retrieved using a Huge Bag for Endoscopic Retrieval of Tissues ('HUBERT'). In cases of benign disease, the spleen was crushed within the bag using sponge-holding forceps and retrieved through the 12mm port by enlarging it slightly. Care was taken to avoid puncturing the bag to prevent spillage (and, therefore, subsequent implantation and recurrence). In suspected malignant conditions, the spleen was delivered intact through a left subcostal incision for diagnostic purposes. Pneumoperitoneum was recreated and the splenic bed examined for bleeding. Adequate haemostasis was achieved and a 20-F Robinson drain secured in the splenic bed.

Patients were started on prophylactic antibiotics (penicillin V) for life to prevent bacterial infections. The drain was removed on the first or second postoperative day if the output was <30ml/day.

Results

From June 2003 to June 2012, 114 patients underwent splenectomy. Details and notes were not available for eight of these patients. Splenectomy for trauma was undertaken in 26 patients. Elective splenectomy was carried out in 80 patients. Based on the surgeon's discretion and clinical/radiological assessment of spleen size, 67 patients underwent LS and 13 underwent OS. Only patients scheduled to undergo elective LS were included in this study.

The LS group comprised 38 males and 29 females. Age at the time of surgery ranged from 6 years to 82 years. Five patients were in the paediatric age group.

Preoperative imaging was not necessarily carried out. The spleen was assumed to be of normal size (≤11cm) if it was not palpable during clinical examination. Imaging data were available for 27 patients. Spleen size in the LS group ranged from ≤11cm to 27.6 cm. Twelve patients had a spleen size of >20cm (massive splenomegaly).

Splenectomy specimens were weighed routinely for histopathology. The weight ranged from 35g to 2,400g. Based on weight, patients were categorised into three groups (Table 1).

Duration of surgery was recorded from electronic databases from 'Theatre web' and from anaesthetic records in patient notes. Details were available for 56 (group 1 = 35; group 2 = 15: group 3 = 6) LS patients. Timings ranged from 37 minutes to 4.5 hours.

There was no conversion to OS in the LS group. However, in six patients, the intact spleen was retrieved by a slightly larger incision after laparoscopic mobilisation. The final histology of resected spleens is shown in Table 2. Postoperative complications are shown in Table 3. Duration of hospital stay ranged from 1 day to 9 days.

Discussion

In our series of 67 patients who underwent LS, there was a slight preponderance of male patients. LS was carried out in the subject aged 6 years as well as in the patient aged 82 years. We were selective when carrying out preoperative imaging. Patients with non-palpable spleens were not

Table 1 Classification of laparoscopic splenectomy groups based on spleen weight

Weight (g)	Number
0–600 (group 1)	41
600–1,600 (group 2 – massive splenomegaly)	18
>1,600 (group 3 – supra-massive splenomegaly)	08

Table 2 Final histology of resected spleens

Disease observed	Number
Idiopathic thrombocytopaenic purpura	20
Splenic lymphoma	14
Autoimmune haemolytic anaemia	7
Chronic lymphocytic leukaemia	7
Splenic marginal zone lymphoma	7
Hereditary spherocytosis	6
Splenic cyst	1
Littoral haemangioma of spleen	1
Tropical splenomegaly	1
Lymphoid hypoplasia	1
Angiosarcoma	1
Epithelial cyst	1

Table 3 Complications after laparoscopic splenectomy

Complication	Number
Wound infection	3
Port-site dehiscence	2
Thrombosis in splenic vein	1
Pulmonary embolism	1
Infection in the lower respiratory tract	1
Bile leak (after concomitant laparoscopic cholecystectomy)	1

subjected to further imaging because additional useful information would not have been garnered. The necessity for preoperative imaging to detect accessory spleen(s) is not clear, and does not obviate thorough intraoperative searching.[8] Patients with clinically palpable spleens were subjected to ultrasound or CT to identify spleen size and any other obvious disease to help inform the decision to undertake OS or LS.

Extensive experience of laparoscopic surgery is required for carrying out LS on large spleens to prevent complications and conversion to OS. Appropriate positioning of ports, meticulous dissection, early ligation of the splenic artery to reduce splenic volume to aid laparoscopic dissection, and perfect haemostasis are essential for a successful LS.[13] Another important factor to consider is the relationship between spleen size and abdominal volume. We believe early ligation of the splenic artery permits completion of these cases via a laparoscopic approach. Our subjective view is that spleen size seems to be reduced by about one-third, and becomes softer and easier to mobilise.

Conversion is defined as making an incision in the midline or left subcostal region to control bleeding or because of an inability to complete the procedure by laparoscopic means.[10] Since 2003, we have undertaken more elective LS than OP (67 vs 13). Twelve (18%) have been for massive spleens without conversion from LS to OS due to bleeding or difficulty in mobilisation. This scenario is due to the experience and discretion of the surgeon in deciding the most appropriate procedure without compromising patient safety. The prevalence of conversion varies from 3% to 18% for normal-sized spleens and ≤30% for massive spleens.[13,10] Patients undergoing LS for malignancy had a slightly larger incision for retrieval of the intact specimen, but this was inevitable. This phenomenon did not increase morbidity or duration of hospital stay and shortened the operative time because less time was spent on specimen retrieval.

The EAES recommends HALS for massive spleens to avoid conversion. However, we did not feel the need to use this method because it takes up the already limited working space and interferes with vision. It also requires an upper-midline incision or left subcostal incision, which results in increased postoperative pain.[10] However, we acknowledge that this method may aid lateral dissection, provide tamponade of any intraoperative bleeding, and also help manipulate the specimen into the retrieval bag, which can be challenging with a large spleen.[15]

LS specimens were weighed postoperatively. We carried out LS on 18 massive spleens and 8 supra-massive spleens. It is well known that morcellated weight often underestimates the actual weight of an intact spleen.[16] However, this fact is not helpful in the laparoscopic era because preoperative size must be known to plan the procedure. Hence, the craniocaudal length or the maximum diameter of the spleen on preoperative imaging has been recommended to assess spleen size.[10]

Mean operative time for all three groups of patients compared favourably with other studies within the last five years,[10,7,13] and was significantly less than that note in previous studies.[8] LS for patients with malignancies facilitates earlier adjuvant treatment because recovery is faster. Mean duration of hospital stay was 3.5 days. No major complications were noted. One patient stayed for 9 days in hospital because he developed a pulmonary embolism postoperatively.

The present study had limitations. First, it was a retrospective study. Second, the study cohort was small. Third, the study was non-randomised. Finally, a selection bias may have been incurred because the decision to subject the patient to OS or LS was left to the surgeon. However, our study was comparable with other studies on LS, and is of major clinical interest because it showed that LS can be done in massive and supra-massive spleens without HALS and with a shorter operative time and minimal morbidity.

Conclusion

We demonstrated that LS is a feasible and safe procedure with very few absolute contraindications. It is considered to be an emerging 'gold standard' procedure for all elective splenectomies. However, portal hypertension with liver

cirrhosis, severe uncorrected coagulopathy and splenomegaly of >27cm should remain relative contraindications.[17,8,4]

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