Laparoscopic splenectomy: a personal series of 140 consecutive cases

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ABSTRACT

INTRODUCTION Laparoscopic splenectomy has emerged as a safe and effective treatment for a variety of haematological conditions. The objective was to review the results from a large personal series from the perspective of outcomes according to operative time, conversion to open operation, complications and mortality. The application of laparoscopic splenectomy to cases of splenomegaly without hand assistance is examined.

PATIENTS AND METHODS A retrospective review of 140 patients undergoing laparoscopic splenectomy at a single university hospital by one surgeon during 1994–2006. Case notes were reviewed and data collected on operative time, conversion to open procedure, morbidity and mortality. Particular reference was made towards the results of cases of splenomegaly.

RESULTS In total 140 laparoscopic splenectomies were performed with a complication rate of 15% and no mortality. The median operative time was 100 min and conversion to open procedure was necessary in 2.1%. Conversion for cases of splenomegaly was only 5.7%. The median hospital stay was 3 days.

CONCLUSIONS Laparoscopic splenectomy is a safe procedure with acceptable morbidity. A laparoscopic approach for splenomegaly is feasible.

KEYWORDS

Laparoscopic splenectomy – Splenomegaly – Idiopathic thrombocytopenic purpura – Complications

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Since the first laparoscopic splenectomy in 1991,¹ the procedure has been rapidly established as a safe and effective treatment for a range of benign and malignant haematological conditions. The procedure has tended to take longer than open splenectomy with median operating times in recently reported series of 85–231 min;^{2–6} however, it is associated with low morbidity rates of 18–26%^{2,5,7} and zero mortality in some series^{5,7–10} with others recently reporting mortality of up to 4%.^{2,4,11,12} The hospital stay is also shorter^{7,15} with mean hospital stay reported of 2.4–5 days^{5,6,8,10,12,14,15} and even one small series reported successful day-case laparoscopic splenectomy.¹⁵ There is not an increased risk of missing accessory spleens,¹⁶ and the conversion rate to open operation is reported at 0–15% in recent series.^{2–6,9,10,14,15,18,19}

Little data are present in the literature examining the role of laparoscopic splenectomy in the case of splenomegaly, and there has been concern regarding higher conversion rates and morbidity.²⁰ Several reports suggest advantages of hand-assisted techniques with laparoscopic

splenectomy for massive spleens.^{4,15,21} However, recently, a small series did not require hand assistance or conversion to open operation in the latter part of their experience.¹² Other centres have advocated open splenectomy for spleens larger than 1 kg.²²

The aim of this study was to evaluate the results of a large, single-centre experience of laparoscopic splenectomy, focusing on morbidity, hospital stay, and conversion to open operation. In particular, the role of laparoscopic splenectomy in cases of splenomegaly over 1 kg was examined.

Patients and Methods

Study design

This was a retrospective review of the case notes of all patients undergoing laparoscopic splenectomy between January 1994 and December 2006 at the Leicester Royal Infirmary by a single surgeon. The data extracted included patient age, haematological diagnosis, duration of operation, operative blood loss, size of spleen, conversion to open

procedure, postoperative complications, length of hospital stay, mortality, and the duration of follow-up.

Exclusion criteria

Splenectomy for traumatic or spontaneous rupture was always performed at laparotomy. Hemisplenectomy was also performed at open operation. Splenectomy when combined with distal pancreatectomy was excluded from the current study. A contra-indication to laparoscopic splenectomy in this series was a spleen palpable inferior and to the right of the umbilicus.

Vaccinations and antibiotic prophylaxis

In accordance with the guidelines of the British Committee for Standards in Haematology,²³ all patients were immunised against pneumococcus, haemophilus and meningococcus. In addition, they received influenza vaccine annually. The timing of the vaccinations was at least 2 weeks pre-operatively wherever possible; however, when a splenectomy was required more urgently (for example, when the platelet count was dangerously low and did not respond significantly to transfusion), the vaccinations were given post-operatively. Penicillin V 500 mg twice daily was instituted for life, with erythromycin used for patients with penicillin allergy.

Peri-operative platelet cover

Early in this series, any patient with a pre-operative platelet count below $50 \times 10^9/l$ was routinely transfused with an adult dose of platelets immediately prior to induction and a second dose upon dividing the splenic vessels. Latterly, it has become protocol to transfuse platelets only in the event of a pre-operative platelet count of below $20 \times 10^9/l$.

Operative technique

Patients were subjected to general anaesthesia, paralysed and ventilated. They were positioned in a right, lateral, semisupine position, previously described as the 'leaning' position.²⁴ A 10-mm umbilical port was inserted with an open technique and a blunt trocar. The remaining ports were inserted under direct vision. These consisted of three further ports, two in the left flank (10 mm and 5 mm ports) and one 5-mm port in the epigastrium, just inferior to the xiphoid process (Fig. 1).

In obese patients, it was occasionally necessary to move the camera from the umbilical port to an additional 10-mm port in the left upper quadrant for a better view. A 30° scope was used in all cases.

Patients were placed in the right lateral position at an angle of about 60°. The spleens were mobilised with a combination of diathermy and PK plasma coagulator (Gyrus group plc, Berkshire, UK). The PK plasma coagulator is a particularly useful instrument in laparoscopic splenectomy

as it is good at achieving haemostasis at the site of small capsular tears in the spleen, which is often particularly friable after chemotherapy or radiotherapy for malignant disease.

In the early part of the series, the hilar vessels and short gastric vessels were individually identified and divided between clips (Allport, Ethicon Ltd, Livingstone, UK). Since 2002, the vessels were divided between linear vascular staplers (Ethicon), and, since 2006, a large endovascular stapler (Echelon; Ethicon) has proven superior. The aim of dissection was to mobilise the spleen sufficiently as to reduce the bulk of tissue at the hilum. This would allow safe and accurate placement of the endovascular stapler. The introduction of the Echelon stapler has reduced operating time because of safe transection and requiring less hilar dissection due to wider jaws. Once the posterior aspect of the spleen has been dissected, the lienorenal ligament and lienophrenic ligament are divided either with diathermy scissors or the PK coagulator.

The spleens were placed in Endocatch bags (Autosuture, London, UK) and extracted with finger fracture and suction through the umbilical port. Occasionally, the umbilical port was extended to 4 cm particularly for the enlarged firmer spleens. Specimens were sent for histological analysis. Depending upon subjective assessment of the haemostasis, Occasionally, 19-Fr Blakes drains (Ethicon) were placed in the splenic beds. For massive spleens in which splenectomy was performed for malignant disease, the spleen was occasionally delivered through a lower midline mini-laparotomy or Pfannensteil incision. The Pfannensteil incision was used for cosmetic reasons.

Postoperative care

The patients were transferred to a general surgical ward postoperatively for 4-hourly observations of pulse, blood pressure and temperature. The following morning, the haemoglobin and platelet count were checked. The drains, if present, were removed provided the drainage was less than 50 ml over 24 h. Patients were discharged with oral analgesia once they were sufficiently comfortable, and their observations were satisfactory.

Follow-up

The patients were seen once in general surgical outpatients to ensure good healing of wounds. The haematological follow-up depended upon the underlying diagnosis.

Statistical analysis

Statistical analysis was performed using SPSS v14.0 (SPSS, Chicago, IL, USA). Data were expressed as median and range. Continuous variables were compared using the Mann-Whitney test and categorical data using the Fisher's exact test. $P < 0.05$ was considered significant.

Results

Summary data

During the study period, there were 140 consecutive laparoscopic splenectomies performed. The median age at surgery was 39 years (range, 4–86 years). In the cohort, 81 were female, 59 male. The indications for surgery are given in Table 1.

Outcome

The 30-day mortality rate was zero. The median operating time was 100 min (range, 30–255 min). The mean operative blood loss was 88 ml (from negligible to 1600 ml). The median hospital stay was 3 days (range, 1–17 days). All patients remaining as in-patients for greater than 7 days were kept for further treatment of their underlying haematological condition, rather than secondary to surgery. There were 21 patients (15%) with complications recorded. Eight complications were due to haemorrhage. One patient was taken back to theatre due to haemodynamic instability and had laparoscopic application of a clip to an actively bleeding short gastric artery. This patient required 4 units blood transfusion. Two patients required laparoscopic wash-out of intraperitoneal haematoma, one apparently coming from the splenic bed and the other from a bleeding peritoneal vessel at the umbilical port site. Both of these patients had 2 units blood transfusion. Two patients developed infected haematomas of the splenic bed requiring percutaneous

radiological drainage and antibiotics. Two patients developed port-site haematomas treated conservatively. One patient developed a haematoma of their Pfannenstiel wound requiring surgical evacuation.

Six patients developed pneumonia, none of which required ventilatory support. All resolved with antibiotics and physiotherapy. One patient developed a pancreatic fistula. In his case, a drain had been placed to the splenic bed and the fistula was treated conservatively with octreotide. This was sufficient for the fistula to settle. There were four cases of urinary retention, all of which settled spontaneously, and two port-site infections in the absence of haematomas requiring antibiotic treatment.

Conversion

There were three laparoscopic splenectomies converted to open procedures in this series (2.1%). Two were converted for bleeding and failure to progress as the spleens both these patients had received previous chemoradiotherapy and had dense pericapsular adhesions around the spleen and very friable spleens. The risks of significant haemorrhage were deemed unacceptable and the decision to convert was made on this basis. The third patient was converted as the spleen was too large to mobilise safely, particularly in view of the underlying malignancy and, therefore, the importance of excising the spleen intact.

Splenunculi

Splenunculi were noted and excised from 12 patients in this series (8.6%).

Table 1 Indications for laparoscopic splenectomy

Indication	n
Benign disease	104
Idiopathic thrombocytopenia purpura	68
Hereditary spherocytosis	19
Autoimmune haemolytic anaemia	5
β -Thalassaemia	5
Sickle cell disease	2
Congenital sideroblastic anaemia	1
Post-viral spherocytosis	1
Splenic cyst	1
Autoimmune thrombocytopenic purpura	1
Hypersplenism and splenic pain	1
Malignant disease	36
Non-Hodgkin's lymphoma	19
Chronic lymphocytic leukaemia	10
Other leukaemias	3
Other haematological malignancies	2
Metastatic carcinoma	2

Portal of retrieval

Seven spleens were removed through Pfannensteil incisions, six through left hypochondrial incisions, two through lower left quadrant incisions and one through a lower mid-line minilaparotomy. The remainder were retrieved through the umbilical port site.

Learning curve

A learning curve was apparent when analysing the results in splenectomies performed in the first half of the study (prior to January 2000) compared to those performed after this date. Operative duration in the first half of the study was a median of 120 min (range, 40–255 min) compared to 90 min (range, 30–180 min) in the second half of the study. This was statistically significant ($P = 0.016$ Mann-Whitney). Postoperative complications were 13.1% in the second half of the study compared to 17.9% in the first half; however, this failed to reach significance ($P = 0.06$ Fisher's exact). There was no difference in blood loss between the two groups.

As mentioned above, the Echelon stapler was introduced at the beginning of 2006. It was used in 12 patients in this series. The 60-mm jaws resulted in a reduction of operating time to a median of 60 min (range, 30–85 min) as the wider jaws required less hilar dissection; however, this failed to reach statistical significance.

Long-term data

One patient developed recurrent ITP at 2-year post-splenectomy and was found to have a missed splenunculi in the gastrosplenic ligament, which was excised laparoscopically. There were no other long-term complications in this series.

Splenomegaly

There were 18 spleens weighing over 1 kg. Seventeen of these underwent successful laparoscopic splenectomy. One required conversion to open operation as described above. It was felt that a hand port would only hinder access further, as the operative problem was that there was not enough room to mobilise the spleen. The spleen in this case weighed 3400 g. This experience led to the policy of excluding spleens below and to the right of the umbilicus from consideration for laparoscopic splenectomy.

Discussion

This series of 140 laparoscopic splenectomies by a single surgeon confirms the data in the literature that this is a safe procedure. The low morbidity rate (15%) and zero mortality are comparable to other studies in the literature, the majority of which are smaller series.^{2,5,7–10} In addition, the median operating time of 100 min compares favourably,^{2–6} and the median hospital stay of only 3 days is lower than the

majority of other series.^{5,6,8,10,12,14,15} The conversion rate to open splenectomy was only 2.1% for this series, again comparing favourably to results in the literature, many of which were smaller series.^{2–6,9,10,14,15,18,19} Hand assistance was not employed for any procedure in this series.

Several small recent series have reported results following laparoscopic splenectomy. Canda *et al.*¹⁰ reported a series of 14 laparoscopic splenectomies for benign haematological disease using LigaSure. Our results compare favourably with their average operating time of 85 min, 13% morbidity and 3.1 day median hospital stay. Although they did not require any conversions to open operation, it should be noted that the mean spleen weight was only 247 g, with a maximum spleen weight of 620 g, compared to the 18 spleens over 1 kg in our series.

Laparoscopic splenectomy for splenomegaly remains controversial, and has traditionally been contra-indicated. Data in the literature have demonstrated an increased risk of haemorrhage, morbidity and conversion to open procedure.^{22,26,27} The current study demonstrates that splenomegaly over 1 kg should not be an absolute contra-indication to the laparoscopic approach.

Throughout the learning curve to this operation, the authors have found two pieces of equipment particularly useful in this operation. First, the Gyrus PK coagulator forceps were useful for dividing splenic adhesions, dividing smaller vessels and achieving haemostasis in small splenic capsular tears. The forceps can be used to dissect, coagulate, transect and retract tissues, reducing the number of instrument exchanges. The pulsed bipolar energy minimises lateral thermal spread and can, therefore, be used safely to divide tissues directly adjacent to the spleen and stomach. Second, endoscopic linear vascular staplers have proven useful in dividing the short gastric and splenic hilar vessels. In particular, the Ethicon Echelon stapler with its wider 60-mm jaws mean that less hilar dissection is necessary in order to pass the stapler and transect the hilum. The Echelon was only introduced at the end of this study; therefore, the reduction in operating time was not found to be statistically significant due to the small numbers. However, it has now become standard practice for the authors to use this stapling device.

Conclusions

This is a large series of laparoscopic splenectomies from a single UK surgeon, which demonstrates that it is a safe procedure with good short- and long-term results. In addition, it demonstrates that laparoscopic splenectomy for splenomegaly is feasible with good results obtainable, and that splenomegaly over 1 kg should not be an absolute contra-indication to laparoscopic surgery.

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