Surg Endosc (1999) 13: 865–868

Surgical Endoscopy
Ultrasound and
Interventional Techniques

Laparoscopic splenectomy for hematologic malignancies

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Received: 19 March 1998/Accepted: 20 November 1998

Abstract
Background: Patients with hematologic malignancy (HM) tend to have large spleens. The purpose of this study was to compare the outcomes of laparoscopic splenectomy for patients with HM to those with benign disease (BD).
Methods: A review was conducted of a prospectively accumulated database of 64 consecutive, unselected laparoscopic splenectomies performed by two surgeons between March 1992 and August 1997.
Results: Of 14 patients with HM (7 lymphoma, 6 leukemia, 1 myeloid metaplasia), three required conversion to open splenectomy (21%). In the remaining 11 patients, two had postoperation complications (18%), including one death from sepsis (9%). Of 50 patients with BD (36 idiopathic thrombocytopenic purpura [ITP], 5 spherocytosis, 4 hemolytic anemia, and 5 others), three were converted to open surgery (6%). Complications developed in 5 (11%) of the remaining 47 patients. No deaths occurred. All patients who had spleens larger than 27 cm in diameter required conversion. Patients undergoing laparoscopic splenectomy for HM were older (54 ± 16 years vs. 36 ± 18 years; $p = 0.002$), had larger spleens (median 17.0 cm vs. 11.0 cm; $p < 0.001$), and had lower preoperation hemoglobin levels (113 ± 30 g/L vs. 132 ± 23 g/L; $p = 0.03$) than patients with BD. The HM group required longer operation time (239 ± 73 min vs. 180 ± 61 min; $p < 0.01$), but showed no differences with respect to operation blood loss (median, 100 vs. 165 mL), requirement for transfusion (median, 0.0 vs. 0.0 units), and length of hospital stay (median 3.0 vs. 3.0 days).
Conclusions: Although patients with HM had larger spleens and required longer operation time for laparoscopic splenectomy, surgical outcomes were equivalent. The laparoscopic approach should be preferred, even for patients with HM. The only limitation appears to be splenic size greater than 27 cm.

Key words: Hematologic malignancy — Hematologic neoplasms — Laparoscopic splenectomy — Laparoscopic surgery — Laparoscopy — Splenectomy

When the first splenectomies were performed laparoscopically, it was hoped that patients ultimately would realize the same benefits of shortened postoperation recovery and improved cosmesis first demonstrated with laparoscopic cholecystectomy [1, 8]. Although no randomized trials are available currently, several retrospective and case-control studies have provided mounting evidence that laparoscopic splenectomy (LS) results in fewer postoperation complications and a shorter hospital stay than open surgery [2–4, 6, 14, 18]. As a result, LS now is the procedure of choice for the removal of small to moderately enlarged spleens.

At this writing, most LS series consist predominantly of patients with immune thrombocytopenic purpura and other benign hematologic disorders. This reflects the relative prevalence of these diseases and the fact that these spleens tend to be smaller, thus lending themselves well to the laparoscopic approach. Patients undergoing splenectomy for hematologic malignancies (HM) seem to represent a different group. They tend to have larger spleens, which technically are more demanding to remove, and according to several reviews, these patients have suffered high morbidity and mortality rates after open surgery [7, 9].

This review was conducted to determine whether patients with HM undergoing LS also represent a unique subgroup, and whether they derive the same benefits from the laparoscopic approach as patients with benign disease (BD).

Methods

From March 1992 to December 1997, 64 laparoscopic splenectomies in 32 men and 32 women were performed by two surgeons (E. C. P., J. M.). For each patient, clinical information was accumulated in a prospective computer database that included age, diagnosis, and indication for surgery, medications, comorbid conditions, perioperative hematologic monitoring, estimated blood loss at surgery, requirement for transfusions, use of pre-

Presented at the Annual Scientific Session of the Society of American Gastrointestinal Endoscopic Surgeons (SAGES), Seattle, Washington, USA, April 1998

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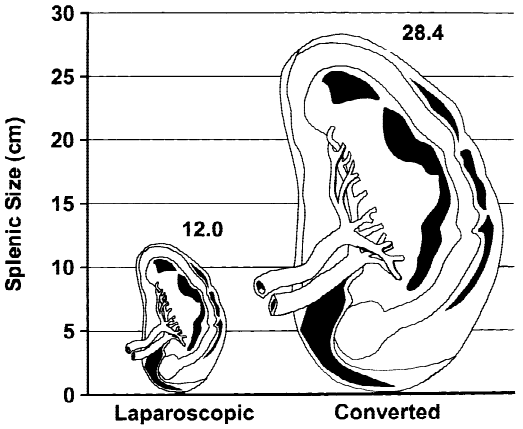

Fig. 1. Relative sizes of spleens removed laparoscopically and by conversion to open surgery. Median splenic size in cases converted to open surgery was significantly larger than in those completed laparoscopically (28.4 cm vs. 12.0 cm; $p = 0.01$).

operation splenic artery embolization, surgical approach, perioperative complications, and length of postoperation hospital stay. Splenic size was determined by preoperation ultrasound or computed tomography (CT) and measured as the maximum pole length [5]. Operation time was measured from the first skin incision to the application of dressings.

All patients received pneumococcal vaccine perioperatively. The first 20 cases of LS were performed using an anterior approach as described previously [16]. All except the first two patients underwent preoperation splenic artery embolization [13]. Subsequently, except for spleens measuring greater than 20 cm in diameter, LS was performed without embolization and with the patient in the lateral position [12]. The indications for splenic artery embolization have been reviewed previously [13].

Fifty patients underwent LS for BD including immune thrombocytopenic purpura (36 patients), spherocytosis (5 patients), autoimmune hemolytic anemia (4 patients), and 1 case each of Wegener's granulomatosis, thrombotic thrombocytopenic purpura, splenic cyst, splenic infarct, and stable splenic trauma. The remaining 14 patients had LS for HM including non-Hodgkin's lymphoma (7 patients), chronic myelogenous leukemia (5 patients), chronic lymphocytic leukemia (1 patient), and myeloid metaplasia (1 patient).

Data averages are reported as mean ± standard deviation (SD) except where indicated otherwise. Groups were compared using the Student's *t* test or Mann-Whitney *U* test for nonparametric data. Proportions were compared using χ^2 analysis or the Fisher's exact test. A *p* value less than 0.05 was considered statistically significant.

Results

Conversion to open surgery was required in three patients with BD (6%), including the first attempted LS in this series, which was converted for intraoperation hemorrhage; a patient with dense intra-abdominal adhesions secondary to a prior episode of severe pancreatitis; and a patient with a 34-cm spleen. Three patients with HM also were converted (21%). Of these, two had very large spleens: 31 and 34 cm. The third had a 26-cm spleen and severe intra-abdominal adhesions. These conversion rates were not significantly different. Two patients with HM and spleens measuring 23 and 24 cm and one patient with BD and a 27-cm spleen required small Pfannenstiel incisions for extraction. Spleens were significantly larger in the cases converted to open surgery than in those cases completed laparoscopically (Fig. 1).

Comparison of the patient groups revealed that patients with HM undergoing LS were older than patients with BD and had lower preoperation hemoglobin levels and larger spleens (Table 1). Although operation time was significantly longer for patients with HM than for those who had BD, no differences were observed for estimated blood loss, requirement for blood transfusion, or length of postoperation hospital stay (Table 2). For LS, a positive correlation was found between splenic size and operation time (Fig. 2).

Table 1. Laparoscopic splenectomy: group profiles

	Hematologic malignancy	Benign disease	*p* value
Number of cases	11	47	
Age	54 ± 16 years	36 ± 18 years	0.002
Preoperation Hb	113 ± 30 g/l	132 ± 23 g/l	0.03
Preoperation WBC (median)	7,750	9,900	NS
Preoperation platelets (median)	81,000	107,000	NS
Splenic size (median)	17.0 cm	11.0 cm	<0.001

Hb, hemoglobin; WBC, white blood count; NS, nonsignificant

Postoperation complications developed after LS in two patients with HM (18%). One was a 75-year-old man with chronic lymphocytic leukemia who developed a pleural effusion. He was discharged on the third postoperation day. The other, a 59-year-old man with chronic myelogenous leukemia and a 23-cm spleen who developed severe pancreatitis and died of sepsis, was the only death in this group (9%). Five patients who underwent LS for BD developed postoperation complications (11%). Four of these were pulmonary complications including pleural effusion (2 cases), atelectasis (1 case), and pneumonia (1 case). One patient developed a postoperation ileus. No deaths occurred in this group. Overall, the groups did not differ with respect to postoperation morbidity or mortality (Table 3).

Of the patients whose procedure was converted to open surgery, three had BD and three had HM. One postoperation complication developed in each group. The first patient in this series was a frail 63-year-old woman with extensive cardiac disease and autoimmune hemolytic anemia. Her operation was converted because of bleeding, and she also hemorrhaged postoperatively. She died in the hospital 33 days after surgery. The second, a 39-year-old acquired immunodeficiency syndrome (AIDS) patient with non-Hodgkin's lymphoma and a 31-cm spleen, developed severe sepsis, to which he was permitted to succumb at his family's request.

Discussion

The optimal management of patients with HM is a complex process that requires multimodal therapy. Occasionally, the general surgeon is consulted to perform a splenectomy for diagnosis, symptomatic splenomegaly, or hypersplenism. This decision is never taken lightly because of the poor outcomes generally associated with splenectomy for HM. Open splenectomy for HM has been associated with higher complication rates than BD. One recent review demonstrated postoperation complications in 52% of patients who had open splenectomy for HM. The mortality rate was 9% [7].

Furthermore, worse postoperation morbidity and mortality have been observed with open splenectomy for myeloproliferative (e.g., chronic myelogenous leukemia, my-

Table 2. Laparoscopic splenectomy: outcomes

	Hematologic malignancy	Benign disease	*p* value
Number of cases	11	47	
Operation time	239 ± 73 min	180 ± 61 min	<0.01
EBL (median)	100 ml	165 ml	NS
Transfusions (median)	0.0 U	0.0 U	NS
Length of stay (median)	3.0 days	3.0 days	NS

EBL, estimated blood loss; NS, nonsignificant

eloid metaplasia), lymphoproliferative (e.g., chronic lymphocytic leukemia) disorders, and non-Hodgkin's lymphoma than for Hodgkin's disease [7, 9, 10]. This series of 64 LS cases included 14 patients with HM, none of whom had Hodgkin's disease. Therefore, the HM group in this study included patients who had the worst conditions in terms of risk for postoperation complications.

Whereas no statistically significant difference in conversion rate was found between patients with HM and those with BD, it seems apparent that this finding may be related to insufficient numbers. Of only six cases converted to open surgery in this series, one was the first case, and three others involved spleens with diameters greater than 30 cm. Laparoscopic splenectomy for massive splenomegaly has been reported only anecdotally [11, 15, 17]. Very large spleens can be removed laparoscopically, but the procedure is technically demanding. The largest spleen successfully removed laparoscopically in our series was 27 cm in size. The median size of all spleens converted to open surgery was significantly greater than the size of spleens removed laparoscopically, and the median splenic size for HM patients was greater than for BD patients. This is a strong indicator that the difference in conversion rates in this series may become significant as the number of cases grows, provided there is no selection of laparoscopic cases on the basis of splenic size.

Splenic size was an important indicator of both conversion rate and operation time in the current series. Others have found that splenic size correlates with operation outcomes after open splenectomy [7, 10]. In the era of open surgery, spleens could be weighed after removal, providing a precise means of comparing relative splenic size. Spleens removed laparoscopically almost always come out in a piecemeal fashion, however, with a considerable amount of blood lost to suction during the extraction process. Weighing the pooled remnants after laparoscopic splenectomy probably gives a variable underestimation of the true splenic size. In this study, splenic size was measured from the preoperation ultrasound or CT scan and expressed as maximum pole length. In view of the fact that spleens can have quite different shapes, this is a better representation of splenic size because it is reproducible and can be obtained preoperatively to assist in planning the approach to LS.

In the current series, it is clear that when patients with HM undergoing LS were compared with patients who have BD, the groups were not equivalent. Patients with HM were significantly older than those with BD, but an average age of 54 years is consistent with other series that have reviewed this condition. A significant difference in age might predispose patients to greater postoperation complications and

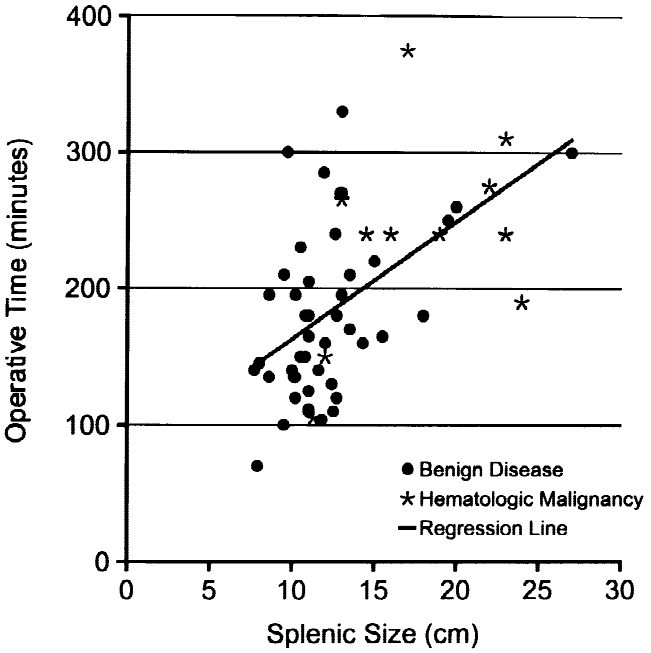

Fig. 2. Scatter plot of operation time as a function of splenic size for all cases of successfully completed laparoscopic splenectomy. There is a positive correlation between splenic size and operation time ($r = 0.551$; $p < 0.001$).

longer hospital stay simply as a result of more comorbid conditions or a diminished ability to comply with chest physiotherapy and postoperation ambulation. This is particularly relevant given that, excluding wound complications, the most frequent postoperation complications after open splenectomy for HM are pulmonary.

Surprisingly, no differences were observed in postoperation complication rates after LS between patients with HM and those with BD. In fact, of the five patients with pulmonary complications, four were in the BD group. The overall complication rate (12%) and rate of pulmonary complications (9%) are well below those reported for open procedures and consistent with other large LS series [3, 4, 19]. Notably, not a single incidence of subphrenic abcess after LS was observed in either group in this study. No difference in median hospital stay after LS was observed between patients with HM and those with BD.

Inherent with any laparoscopic procedure is the need to maintain excellent hemostasis. As a result, estimated blood loss at LS was very low for both groups, and no differences were observed between this parameter and the median requirement for perioperative transfusions, even though the patients with HM had lower preoperation hemoglobin levels.

In this series, splenic size may represent the single most important difference between patients with HM and those with BD. A positive correlation was found between splenic size and time of surgery for all patients undergoing LS. Patients with HM had significantly larger spleens and likely required longer operation times as a result.

One death occurred after LS for HM. In Horowitz's review of open splenectomy for HM, mortality from sepsis alone was 5% and accounted for 70% of the total deaths [7], possibly because these patients often are immune compro-

Table 3. Complications after splenectomy

	Hematologic malignancy	Benign disease	*p* value
Number of cases	14	50	
Completed laparoscopically	11	47	
Deaths (rate)	1 (9%)	0 (0%)	NS
Complications (rate)	2 (18%)	5 (11%)	NS
	Pleural effusion, pancreatitis[a]	Pleural effusion (2), ileus, pneumonia, atelectasis	
Converted to open surgery	3	3	NS
Conversion rate	21%	6%	
Deaths	1	1	
Complications	1	1	
	Sepsis[a]	Hemorrhage[a]	

[a] Postoperative death
NS, nonsignificant

mised and generally have a poorer overall medical condition. As more experience with LS is gained, it will become more apparent whether overall mortality can be improved for patients with HM.

It is logical to expect that morbidity and mortality for patients with HM converted to open surgery may be higher than cases completed laparoscopically or cases in historical reports of open splenectomy. As stated earlier, the average size of spleens converted to open surgery in this study was significantly larger than spleens removed laparoscopically, and splenic size has been shown to correlate with postoperation complications after open splenectomy [7, 10]. Six patients in this series required conversion to open surgery, three each with BD and HM. Of these, one death occurred in each group. These numbers currently are too small for meaningful comparison. As experience with LS for HM grows, it may become apparent that the poorest outcomes occur in the converted group. If so, this should not be considered a drawback of the laparoscopic approach, but merely that this is a highly selected group of patients with very poor prognosis. Therein will lie the frontier for improvement.

Conclusions

Patients with HM undergoing LS had larger spleens and required longer operation times than patients with BD. Nevertheless, no statistically significant differences were observed in operation blood loss, requirement for transfusions, postoperation complications, or length of postoperation hospital stay. Although no differences in rates of conversion to open surgery and postoperation mortality were appreciated, the number of patients may have been insufficient to demonstrate such a difference. Because of the benefits of shorter hospital stay, improved cosmesis, and presumed decrease in pain and recovery time, clearly the laparoscopic approach should be preferred, even for patients with HM. The only limitation at this time appears to be spleens larger than 27 cm in diameter.

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