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Splenomegaly Should Not Be Considered a Contraindication for Laparoscopic Splenectomy

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Objective
To analyze the impact of spleen size on operative and immediate clinical outcome in a series of 74 laparoscopic splenectomies (LS).

Summary Background Data
LS is gaining acceptance as an alternative to open splenectomy. However, splenomegaly hinders LS, and massive splenomegaly has been considered a contraindication.

Methods
Between February 1993 and September 1997, 74 patients with a wide range of splenic disorders were treated by laparoscopy and prospectively recorded. They were classified into three groups according to spleen weight: group I, <400 g (n = 52); group II, 400 to 1000 g (n = 9); and group III, >1000 g (n = 13). Age, operative time, number of trocars required, need for perioperative transfusion, spleen weight, conversion rate, mode of spleen retrieval (bag or accessory incision), postoperative analgesia requirements, length of hospital stay, and morbidity rates were recorded.

Results
LS was completed in 69 patients, and the conversion rate was thus 6.7%. Operative time was significantly longer in patients with larger spleens, and an accessory incision was more frequently required. However, there were no significant differences in transfusion rate, length of stay, severe morbidity, or conversion rate.

Conclusions
Preliminary evaluation of LS for patients with large spleens suggests that it requires a longer operative time, but it is feasible and may potentially offer the same advantages (shorter stay and faster recovery) as it does to those with smaller spleens.

Laparoscopic surgery is gaining in interest as an approach to splenectomy. The main indications for laparoscopic splenectomy (LS) are hematologic diseases that are not associated with splenomegaly, such as idiopathic thrombocytopenic purpura.[1] Intraabdominal manipulation of bulky organs during laparoscopic surgery increases the technical difficulty of the procedure and the retrieval of the specimen from the abdomen. Splenomegaly was initially considered a contraindication to LS, but improvement and refinement of the techniques of LS have shown that an enlarged spleen can be managed successfully by laparoscopy.[2–4] Many hematologic diseases associated with an enlarged spleen are malignant conditions, and the open approach has been classically associated with an increased morbidity rate.[5–17] We thus hypothesized that a less traumatic approach, such as laparoscopy, may improve the postoperative outcome in these patients. The aim of this article is to analyze the effect of spleen size on perioperative and immediate outcome in a prospective series of 74 LS.

MATERIALS AND METHODS

Between February 1993 and September 1997, 74 patients with a wide range of splenic disorders (Table 1) requiring splenectomy were treated by laparoscopy, and clinical data were prospectively recorded. All patients scheduled for LS received a preoperative pneumococcal vaccine, and antibiotic prophylaxis was initiated during surgery. LS was performed through an anterior or lateral approach, using techniques previously described in detail elsewhere.[18] In cases of enlarged spleens, additional trocars had to be inserted and the simultaneous use of two endoretractors was required to

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Table 1. CLINICAL DIAGNOSIS OF 74 CASES OF ATTEMPTED LAPAROSCOPIC SPLENECTOMY ACCORDING TO THE SPLEEN WEIGHT

	Group I (n = 52) <400 g.	Group II (n = 9) 400–1000 g.	Group III (n = 13) >1000 g.
Idiophatic thrombocytopenic purpura	37	–	–
HIV related thrombocytopenia	3	2	–
Autoimmune hemolytic anemia	3	1	–
Spherocytosis	4	3	2
Nonhodgkin lymphoma	2	1	6
Chronic lymphatic leukemia	–	2	1
Myelofibrosis	1	–	2
Waldenstrom's macroglobulinemia	–	–	1
Splenomegaly of unknown origin	–	–	1
Kassabach-Merit disease	1	–	–
Splenic hamartoma	1	–	–

raise the dissected spleen. While the spleen was hanging, the splenic hilum was severed by repeated application of an endostapler.

Once the spleen was totally free in the abdominal cavity, a bag (Lapsac, Cook España S.A.; EndoCatch II, AutoSuture, USSC, Norwalk, CT) was introduced into the abdomen, and the spleen was then morcellated and retrieved. Morcellated pieces and aspirated splenic pulp were sent for histologic analysis and weighed. In cases of massively enlarged spleen (>1000 g), or when intact retrieval was required (*i.e.*, splenic tumor), the spleen was extracted through an accessory incision in the subumbilical midline or between two orifices of trocars in the left iliac fossa. After surgery, diclofenac sodium or magnesium metamizol administered intravenously (75 mg or 2 g) or orally (50 mg or 0.5 g) every 8 hours was given for pain relief.

Patients were classified into three groups according to spleen weight: group I, <400 g; group II, 400 to 1000 g; and group III, >1000 g. Age, operative time, number of trocars used, perioperative transfusion rate, spleen weight, conversion rate, mode of retrieval of the spleen (bag or accessory incision), postoperative requirements for analgesia, length of hospital stay, and morbidity rate were recorded. Data were expressed as mean plus or minus standard deviation, and range. Cases converted to open surgery were not included in the final analysis.

Correlation tests were used to compare two variable series. The chi square test was used to compare two proportions and Student's t test to compare differences between two series.

RESULTS

Hematologic diagnoses, demographic features, and immediate outcome are summarized in Tables 1 through 3. LS was performed through an anterior approach in 12 patients and laterally in the remaining 62, and it was completed in 69 cases (conversion rate 6.7%). Conversion was necessary in two patients (idiopathic thrombocytopenic purpura and AIDS-related thrombopenia, in which the spleen weights were 175 g and 240 g, respectively) because of diffuse oozing and difficulty in handling the spleen. In three patients with massive splenomegaly (spherocytosis and two cases of non-Hodgkin's lymphoma) with spleens weighing 2500 to 3500 g, conversion was necessary because of difficulty obtaining enough intraabdominal space to manipulate the spleen.

The spleen was extracted in a bag in 48 cases, and an accessory incision was done in 21 (30%), with a mean length of 9 cm (range 2 to 14 cm). An accessory incision was required significantly more frequently in patients with larger spleens (100% in group III *vs.* 18% and 22% in groups I and II; $p < 0.01$). The mean spleen weight in patients with an accessory incision was 886 g *versus* 244 g in patients without an accessory incision ($p < 0.03$). However, the presence of an accessory incision did not significantly affect operative time (170 ±

Table 2. DEMOGRAPHIC FEATURES ACCORDING TO SPLEEN WEIGHT IN 69 COMPLETED LAPAROSCOPIC SPLENECTOMY

	Group I <400 g	Group II 400–1000 g	Group III >1000 g	Overall
n	50	9	10	69
Age (years)	36 ± 16+ (8–72)	47 ± 19 (16–61)	55 ± 7 (42–68)	40 ± 17 (8–72)
Sex	15 m/35 f	5 m/4f	5 m/5 f	25 m/44 f
Hematocrit	38 ± 8+* (26–46)	31 ± 10 (21–42)	29 ± 7 (25–29)	36 ± 9 (21–46)
Platelets ($mm^3 \times 10^3$)	86 ± 87* (5–330)	130 ± 83 (15–271)	154 ± 137 (20–236)	102 ± 97 (5–330)
Spleen weight (gr)	177 ± 90*+ (60–370)	638 ± 163† (400–800)	1616 ± 651 (1000–2950)	446 ± 569 (60–2950)

Mean ± SD, (Range), + $p < 0.01$ *vs* Gr. III.
*$p < 0.01$ *vs* Gr II.
†$p < 0.01$ *vs* Gr. III).

Table 3. OPERATIVE FEATURES AND MAIN OUTCOME RESULTS ACCORDING TO SPLEEN WEIGHT IN 69 PATIENTS WITH A COMPLETED LAPAROSCOPIC SPLENECTOMY

	Group I <400 g	Group II 400–1000 g	Group III >1000 g	Overall
n	50	9	10	69
N° trocars	4 ± 0	4 ± 1	5 ± 1	4 ± 1
Operative time (min)	146 ± 49 (65–250)	184 ± 103 (120–400)	190 ± 69 (120–300)	157 ± 63 (65–400)
Accessory incision	18%	22%	100%	30%
Spleen weight (g)	177 ± 90* (60–370)	638 ± 163 (400–800)	1616 ± 651 (1000–2950)	446 ± 569 (60–2950)
Transfusion	16%	33%	30%	20%
Morbidity rate	12%	33%	30%	17%
Analgesic requirements (doses)	8 ± 5 (1–31)	10 ± 5 (4–18)	14 ± 7† (6–18)	9 ± 5 (1–31)
Stay (days)	4 ± 3 (2–14)	5 ± 2 (2–7)	6 ± 4 (3–10)	4 ± 3 (2–14)

(Mean ± SD, (Range).
*$p < 0.01$ *vs* Gr. II and III.
†$p < 0.01$ *vs* Gr. I and II).

60 minutes *vs.* 156 ± 65 minutes), length of stay (5 ± 3 days *vs.* 4 ± 2.5 days), analgesia requirements (11 ± 6 doses *vs.* 8 ± 5 doses), morbidity rate (24% *vs.* 17%), or transfusion rate (24% *vs.* 26%).

Postoperative complications occurred in 12 patients (17%) (Table 4), although none died. Six complications occurred in patients with spleens weighing <400 g (6/50, 12%) and five in patients with enlarged spleens (5/19, 25%); the difference was not significant.

There was a correlation between the weight of the spleen and operative time when the whole series was considered ($R = 0.32$, $p < 0.01$). Operative time was significantly longer in groups with enlarged spleens (group I, 146 ± 49 minutes; group II, 184 ± 103 minutes; group III, 190 ± 69 minutes; $p < 0.01$). However, there were no significant differences between the groups in the number of trocars required, length of stay, or morbidity rate. Transfusion requirements were higher in the groups with enlarged spleens (group II, 33%; group III, 30%; group I, 16%), although this difference was not significant. The conversion rate was 25% in the group with massive splenomegaly; one patient with a spleen >2500 g was converted, and two with spleens >3500 g were converted.

DISCUSSION

Laparoscopic surgery is increasingly indicated for splenectomy, especially in young, healthy patients with idiopathic thrombocytopenic purpura and a normal-sized spleen (80 to 250 g).[1] As in laparoscopic cholecystec-

Table 4. POSTOPERATIVE MORBIDITY AFTER LAPAROSCOPIC SPLENECTOMY

Complications	Diagnosis	Spleen Weight	
Severe complications			
Subphrenic hematoma	ITP	2 g	
Hemoperitoneum (reoperation)	ITP	200 g	
Diaphragmatic perforation	Spherocytosis	500 g	
Hemoperitoneum (reoperation)	Nonhodgkin lymphoma	1150 g	
			4/69 (6%)
Minor complications			
Atelectasis	ITP	80 g	
Wound hematoma	AHAI	118 g	
Fever	ITP	218 g	
Wound hematoma	ITP	370 g	
Pulmonary TBC	ITP-HIV	630 g	
Atelectasis	Spherocytosis	750 g	
Wound sepsis	Splenomegaly	1000 g	
Ileus	Nonhodgkin lymphoma	115 g	8/69 (11%)
		Total	12/69 (17%)

ITP: Idiophatic thrombocytopenic purpura; AHAI: Autoinmune hemolytic anemia.

tomy, postoperative recovery is smoother, the in-hospital stay is <3 days, and later recovery is faster. However, disorders that require splenectomy include a wide range of diseases with clinical and anatomic characteristics that can influence the performance of LS.[19] A large spleen is difficult to manipulate during surgery and to extract from the abdomen.

Spleens that surpass the costal margin weigh >750 to 1000 g.[20] Splenomegaly can be defined by the dimensions of the main diameters, but we prefer to use the weight, because we do not perform ultrasonographic or computed tomographic measurements routinely. In open surgery, spleens >400 to 500 g[17,20] are considered to indicate splenomegaly, and some authors consider spleens weighing >1000 g[8,9,12] or 1500 g[5–7,10] to indicate massive splenomegaly. These larger spleens are associated with increased morbidity rates and transfusion requirements.[13–15] In laparoscopic surgery, intermediate splenomegaly also increases difficulty. We classified our patients into three groups according to spleen weight to analyze the impact of the weight on LS outcome.

In our series, LS was completed on spleens weighing up to 3000 g. In 22 patients the spleen weighed 400 to 3500 g, and LS was completed in 19 of these. We included 13 patients with a spleen >1000 g (range 1000 to 3500 g); in 10 of these, splenectomy was successfully completed by laparoscopy, and the remaining 3 patients (spleen weights 2500 to 3500 g) were converted because of difficulty manipulating the spleen. The limiting case for the applicability of this technique is the ratio of spleen to be manipulated, or the point at which LS becomes cumbersome and impractical. The technique used in large organs is the same as for small organs, but greater precision is required. Additional ports or endoretractors are also needed to raise the organ, especially when it is almost free and the upper pole must be reached to complete the dissection.

We attempted to ligate the artery in the lesser sac routinely before mobilization of the spleen to diminish the size of the spleen, to facilitate autotransfusion, and to decrease the risk of hemorrhage. The full lateral approach for LS[18,21] facilitates the individualization of the splenic pedicle. We prefer to section the splenic hilum with the help of an endostapler because the sequential ligature of long splenic hilum vessels with clips or ligatures is more prone to accidental dislodgement and intraoperative hemorrhage. In cases of non-Hodgkin's lymphoma, the splenic hilum can be filled with solid adenomegalies, which increases the difficulty of individualizing the vascular elements of the pedicle. In this case, the use of the endostapler near the hilar face of the spleen spares the adenomegalies and avoids unnecessary dissection and bleeding risk.

Massive splenomegaly is associated with an increased morbidity rate (20% to 60%)[13–15] because the underlying hematologic condition usually is more severe and the patients are older. In the overall group of patients with enlarged spleens, the morbidity rate was 26%, with two severe complications (diaphragmatic perforation and hemoperitoneum). The morbidity rate in the group with bigger spleens was 30% (wound sepsis, ileus, and hemoperitoneum). However, in this subgroup of patients, although the mean stay was increased, it was not significantly longer than in patients with smaller spleens (6 *vs.* 4 days).

The best way to assess whether LS has clinical advantages over the classical approach to the treatment of massive splenomegaly is through prospective comparative trials. However, these studies are difficult to perform because splenectomy for massive splenomegaly is not a common procedure in most surgical wards. The conversion rate of 25% and the low incidence of complications or transfusions suggest that an enlarged spleen is not a contraindication for LS, and if performed by skilled teams, it could even be advisable.

Preoperative embolization of the spleen[9,22] has been proposed as a way to reduce operative bleeding and the need for transfusion, but this practice has not gained much interest. Transfusion requirements in the subgroup of patients with enlarged spleens were 31% *versus* 16% in the group with normal-sized spleens (not significant). This can be explained by an increase in operative losses and also by the more liberal use of transfusion in patients with a lower preoperative hematocrit value caused by more severe hematologic disorders.

The retrieval of solid organs during laparoscopic surgery is more difficult when they are enlarged.[23] The introduction of the organ into the bag can be the most difficult part of the procedure, and it may be impossible with massively enlarged organs. Poulin et al.[2] have proposed the intraperitoneal morcellation of the spleen and its retrieval in several pieces, followed by intraperitoneal irrigation to avoid splenic tissue implantation. However, we consider that the risk of implantation of splenic tissue should be avoided,[24] and it is faster, cleaner, and more effective to perform an accessory incision. The use of an accessory incision in laparoscopic surgery has been well accepted and has advantages over the fully open approach, as in colorectal surgery, where an incision is used for specimen retrieval.[25] In this series, the accessory incision did not influence the final outcome of the patients when compared with the group without accessory incisions. We did not find any significant differences in the length of postoperative stay, requirements for analgesia, morbidity rate, or transfusion needs between the patients with and those without accessory incisions. This can be explained because infraumbilical abdominal incisions are usually less painful than supraumbilical ones. During LS using a lateral approach, the trocars are placed close together in a small area of the abdominal wall, and the presence of an accessory incision would not necessarily increase the resulting pain. This finding suggests that laparoscopic mobilization of large spleens in patients

in whom a wide incision is required for extraction offers advantages over fully open splenectomy.

In summary, preliminary evaluation of LS in patients with large spleens suggests that despite the longer operative time required, it is feasible and may potentially offer the same advantages (shorter stay and faster recovery) as it does to healthier patients with smaller spleens.

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