Obesity does not adversely affect outcomes after laparoscopic splenectomy

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KEYWORDS:
Laparoscopic splenectomy; Obesity; Morbidly obese; Morbidity; Surgical outcomes

Abstract

BACKGROUND: Obesity is still considered a relative contraindication to laparoscopic splenectomy (LS).

METHODS: All patients undergoing LS at our institution were classified as obese or nonobese (group A, body mass index [BMI] >30; group B, BMI <30). Primary end points included conversion rate, operative complications, length of stay, operative time, and estimated blood loss (EBL).

RESULTS: Three hundred seventy patients who underwent LS were included. Baseline characteristics were similar in groups A (n = 127; mean BMI, 36.2 ± 6.9 kg/m²) and B (n = 243; mean BMI, 24.6 ± 2.9 kg/m²). Conversion rates and overall morbidity were similar in both groups (9% vs 11% for conversion to open procedures, P = .621; 16% vs 16% for morbidity rates, P = .940). Length of hospital stay and EBL were also comparable (P = .643 and P = .544, respectively). Mean operative time was significantly increased in the obese group on multivariate analysis (170 vs 151 minutes, P = .021).

CONCLUSIONS: Obesity does not adversely affect outcomes after LS. The laparoscopic approach is the optimal technique for splenectomy regardless of the patient’s weight.

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this approach for massive splenomegaly.\textsuperscript{5,13} More recently, even these challenges are being overcome as experience with LS grows and improvements in technology occur.

There remains conflicting data regarding the use of the laparoscopic approach for splenectomy in obese patients specifically. Morbid obesity presents a technical challenge in many abdominal surgical procedures. The excessive abdominal adiposity, and invariably enlarged fatty liver, reduces intra-abdominal working space and impairs visualization. In the embryonic period of laparoscopy, obesity was actually considered a contraindication for many operations, including cholecystectomy.\textsuperscript{14} Despite these early concerns, the laparoscopic approach has since become the gold standard approach for abdominal surgery in patients with increased body mass index (BMI) on the basis that it was shown to significantly reduce postoperative pain, promote a quicker return to activities, and result in a shorter hospital stay; wound complication rates were also dramatically decreased.\textsuperscript{15–20} With regard to the safest operative approach for splenectomy in obese individuals, data show that LS in this population is associated with increased blood loss and longer operative times, particularly in patients with massive splenomegaly.\textsuperscript{21–23} However, other reports have challenged these findings and indicate that the aforementioned benefits of laparoscopic surgery are also observed in obese individuals requiring splenectomy.\textsuperscript{11,12} Even among patients with splenomegaly, evidence has emerged to support LS as the procedure of choice.\textsuperscript{13}

The aim of this study was to review our experience with LS in obese and nonobese patients to determine the feasibility, safety, and outcomes of the laparoscopic approach in this setting. We also sought to determine the effects of spleen size in obese patients undergoing LS.

\section*{Methods}

\subsection*{Study cohort}

After obtaining institutional review board approval, we conducted a retrospective review of a prospectively maintained splenectomy database at a tertiary referral minimally invasive surgical center. All patients who underwent LS between 1996 and 2011 were identified and included in this study.

Patients' medical records were reviewed and data obtained on their baseline demographics (age, sex, BMI), clinical details (comorbidities, American Society of Anesthesiologist [ASA] classification), primary diagnosis and indication for splenectomy, operative details (including weight of spleen), and perioperative outcomes. Patients were classified into groups according to their BMI; group $A = \text{BMI} \geq 30 \text{ kg/m}^2$ or greater (obese) and group $B = \text{BMI} \leq 30 \text{ kg/m}^2$ (nonobese). To evaluate the influence of splenomegaly on the feasibility and safety of LS in obese patients, we further divided the obese patient cohort (group A) into 2 subgroups based on spleen weight: group $A_1 =$ obese patients without splenomegaly and group $A_2 =$ obese patients with splenomegaly. Splenomegaly was defined as a spleen weighing 500 g or more, as in previous studies.\textsuperscript{5,22}

\subsection*{Laparoscopic splenectomy technique}

After thorough preoperative evaluation and having obtained informed written consent from patients, all cases were performed at a single institution by several experienced laparoscopic surgeons. The majority of cases were performed by 3 surgeons. Preoperative antimicrobial prophylaxis was administered, and all patients received appropriate vaccinations against encapsulated organisms 7 to 14 days before surgery. Our approach to perioperative and postoperative anticoagulation was to apply pneumatic compression devices to the lower limbs of all patients on admission and then to commence prophylactic doses of subcutaneous low molecular weight heparin on the first postoperative night. This was continued once daily for the duration of the patient’s hospital stay. This protocol was adhered to only if the patient’s platelet count was normal and it was determined that there was no significantly increased risk of bleeding. If significant thrombocytosis developed postoperatively (platelet count of approximately $1 \times 10^5/\mu\text{L}$ or greater), daily low-dose aspirin was started and continued after discharge.

The LS technique was standardized and performed per the following brief description. With the patient under general anesthesia and in the right lateral decubitus position, the abdomen was entered with an optical trocar and pneumoperitoneum was established. Three additional 5-mm ports were inserted in standard fashion. The ligamentous attachments were transected using either sharp dissection or the harmonic scalpel. One of our ports was upsized to a 12-mm trocar, and the splenic hilum was visualized and divided using an endoscopic linear stapling device. The spleen was collected in an impervious specimen bag and removed after fragmentation or extension of a port site incision at the discretion of the operating surgeon. All specimens were weighed in the operating room before undergoing pathologic assessment. The procedure was converted to a laparotomy if excessive difficulty was encountered intraoperatively (including difficult anatomy, poor exposure or visualization, excessive bleeding, or excessive splenomegaly).

\subsection*{Study end points}

The primary outcomes evaluated in this study included conversion rate, operative time, estimated blood loss (EBL), length of hospital stay, postoperative morbidity, and mortality rates.

\subsection*{Data analysis}

Data were analyzed using the software package PASW Statistics, version 18.0 for Windows (SPSS, Inc, Chicago, IL). Descriptive statistics were computed for all variables,
and baseline patient characteristics are presented in numbers and percentages. Distribution of the data was checked for normality; parametric data are presented as means (± standard deviation) and nonparametric data are presented as median with interquartile range (IQR). Comparisons of dichotomous groups, defined by BMI (<30 kg/m² vs ≥30 kg/m²) and spleen weight (500 g vs ≥500 g), were performed with respect to blood loss, length of stay, and operative time using the Student 2-sample t test or the Mann-Whitney U test for parametric and nonparametric data, respectively. Groupings with more than 2 levels, such as a 3-level categorization of BMI (<30, 30 to 40, and ≥40 kg/m²), or groups formed by combinations of BMI and spleen weight, were compared using analysis of variance, followed by the Tukey honestly significant difference post hoc test or the Kruskal-Wallis test, followed by pairwise group comparisons using the Wilcoxon test. Group comparisons with respect to frequency of conversion or complications were performed with a chi-square test. P values are reported for individual comparisons; a P value of less than .05 was considered statistically significant.

Results

Patient characteristics

Between July 1996 and April 2011, 370 patients (51% women) underwent LS at a single tertiary level minimally invasive surgery center. In this consecutive series there were 127 obese patients (group A), with a mean BMI of 36.2 ± 6.9 kg/m². This subgroup was compared with 243 nonobese patients (group B), with a mean BMI of 24.6 ± 2.9 kg/m², with regard to baseline characteristics and outcomes of LS.

Demographic and preoperative clinical details of the groups are presented in Table 1; both groups were comparable in terms of sex, age, and ASA grade preoperatively. The main indications for splenectomy were idiopathic thrombocytopenic purpura (ITP), lymphoproliferative disease, and autoimmune hemolytic anemia. A smaller proportion of patients in each group had other pathologic conditions of the spleen, including masses, tumors, or splenomegaly of unknown cause. ITP was a more common indication for splenectomy in obese patients than in nonobese patients (56% vs 39%; P = .002), whereas lymphoproliferative disease was more frequent in the nonobese group (30% vs 16%; P = .006). Preoperative platelet counts were, on average, similarly low in both groups (122 × 10³/dL in group A vs 129 × 10³/dL in group B; P = .535).

Operative data for laparoscopic splenectomy

Operative details of the LS procedures, including conversion rates, duration of procedure, EBL, and mean length of hospital stay, are presented in Table 2. The rate of conversion to open splenectomy was 9% (n = 12) in the obese group A and 11% (n = 27) in the nonobese group B (P = .621). EBL was similar in groups A and B (210 mL and 237 mL, respectively; P = .544). However, operating time was significantly longer for patients in group A (170 vs 151 minutes; P = .021). The mean spleen weight, which was recorded immediately after retrieval of the specimen, was higher in group A (536 g) than in group B (500 g), although the difference did not reach statistical significance (P = .580). Length of stay was also similar in both groups (median hospital stay, 2 days for group A vs 3 days for group B; P = .230).

Postoperative outcomes

Morbidity and mortality. Overall postoperative morbidity was similar in both groups (16% vs 16%, respectively; P = .940). Specific details of these morbidities are illustrated in

Table 1 Baseline characteristics of 370 patients who underwent LS

<table>
<thead>
<tr>
<th>Variable</th>
<th>Group A obese</th>
<th>Group B nonobese</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>N</td>
<td>127</td>
<td>243</td>
<td>.013*</td>
</tr>
<tr>
<td>Age, y (mean ± SD)</td>
<td>56 ± 17</td>
<td>51 ± 17</td>
<td></td>
</tr>
<tr>
<td>Male/female (%)</td>
<td>49/51</td>
<td>49/51</td>
<td>.978†</td>
</tr>
<tr>
<td>BMI, kg/m²[mean ± SD]</td>
<td>36.2 ± 6.9</td>
<td>24.6 ± 2.9</td>
<td>&lt;.001*</td>
</tr>
<tr>
<td>ASA grade median (IQR)</td>
<td>3 (3–3)</td>
<td>3 (2–3)</td>
<td>.984§</td>
</tr>
<tr>
<td>Primary diagnosis and indication for LS, n (%)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ITP</td>
<td>71 (56)</td>
<td>95 (39)</td>
<td>.002†</td>
</tr>
<tr>
<td>Lymphoproliferative disease</td>
<td>21 (16)</td>
<td>72 (30)</td>
<td>.006†</td>
</tr>
<tr>
<td>AIHA</td>
<td>11 (9)</td>
<td>27 (11)</td>
<td>.461†</td>
</tr>
<tr>
<td>Other†</td>
<td>24 (19)</td>
<td>49 (20)</td>
<td>.702†</td>
</tr>
<tr>
<td>Preoperative platelet count (10³/dL) [mean ± SD]</td>
<td>129 ± 116</td>
<td>122 ± 107</td>
<td>.535*</td>
</tr>
</tbody>
</table>

AIHA = autoimmune hemolytic anemia; ASA = American Society of Anesthesiologists; BMI = body mass index; IQR = interquartile range; ITP = idiopathic thrombocytopenic purpura; LS = laparoscopic splenectomy; SD = standard deviation.

*Student t test.
†Chi-square test.
‡Includes splenic mass, tumor, or unknown diagnosis.
§Mann-Whitney U test.
preoperative diagnosis and spleen weight, revealed no sig-
trol of sepsis. Multivariate analysis, controlling for
8 of 13 patients. Of 16 patients with infectious complica-
tions (1% vs 11%; P = .087, respectively). After a mean overall follow-up of 76 ± 56 months, which was similar in both groups (P = .375), there was 1 mortality in the obese group A, and there had been 6 deaths in the nonobese group B (P = .260). Three of these 7 mortalities were within 30 days of the LS procedure (all 3 in the nonobese group B). One patient with a preoperative diagnosis of ITP and multiple comorbidities died of over-
whelming sepsis and multiorgan failure on postoperative
day (POD) 8. A second early mortality occurred on POD 26,
in an 80-year-old woman with autoimmune hemolytic
anemia and a lymphoma in whom pneumocystis pneumo-
nia and acute respiratory distress syndrome developed post-
operatively. The third early mortality occurred on POD 10,
in a 78-year-old man with comorbid ITP and a history of
non-Hodgkin lymphoma. He experienced upper gastroin-
testinal bleeding, and subsequently aspiration pneumonia
developed, which precipitated his death. The other 4 deaths
occurred on PODs 36, 42, and 70, and 3 years postopera-
tively, from underlying disease or unrelated comorbidities.

Effect of increased severity of obesity on outcomes. We
performed a further subgroup analysis to determine whether
increased severity of obesity influenced the outcomes of
LS. Comparing patients with BMIs of 40 or more (n = 25)
with those with BMIs less than 30 (n = 243), we observed
no significant increase in the rates of complications,
conversion, or operative duration in the morbidly obese
subgroup compared with the nonobese group (P = .287,
P = .268, and P = .087, respectively).

Effect of splenomegaly on outcomes of obese patients
undergoing laparoscopic splenectomy. To evaluate the
influence of splenomegaly on the feasibility and safety of
LS in obese patients, we performed a subgroup analysis of
the 127 obese patients, based on spleen weight [group A1: 80
obese patients with normal-sized spleens; group A2: 47
obese patients with splenomegaly (>500 g)]. Obese
patients with splenomegaly, whose mean spleen weight was
1052 ± 680 g, were found to have significantly longer
operating times (P < .001), greater EBL (P = .054), and
higher rates of conversion to open splenectomy (17% vs
5%; P = .025), compared with obese patients with
normal-sized spleens (Table 4). Median length of hospital
stay was similar in groups A1 and A2 (2 days vs 3 days,
respectively; P = .059). Overall, the postoperative morbidity
rate was similar in both subgroups (11% vs 23%; P = .069).
However, compared with group A1, patients in group
A2 had a significantly higher incidence of bleeding complica-
tions (1% vs 11%; P = .016).

Comments
Obesity complicates many surgical procedures by
increasing the technical complexity of the operation as
well as increasing the patient’s risk of postoperative

Table 2: Operative details of 370 patients who underwent LS, according to obesity status

<table>
<thead>
<tr>
<th>Operative detail</th>
<th>Group A obese</th>
<th>Group B nonobese</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>N</td>
<td>127</td>
<td>243</td>
<td></td>
</tr>
<tr>
<td>Conversion to open splenectomy, n (%)</td>
<td>12 (9)</td>
<td>27 (11)</td>
<td>.621*</td>
</tr>
<tr>
<td>Operating time, min (mean ± SD)</td>
<td>170 ± 60</td>
<td>151 ± 60</td>
<td>.021†</td>
</tr>
<tr>
<td>EBL, mL (mean ± SD)</td>
<td>210 ± 292</td>
<td>237 ± 345</td>
<td>.544†</td>
</tr>
<tr>
<td>Length of hospital stay (median [IQR])</td>
<td>2 (2–4)</td>
<td>3 (2–5)</td>
<td>.230‡</td>
</tr>
<tr>
<td>Spleen weight, g (mean ± SD)</td>
<td>536 ± 592</td>
<td>500 ± 542</td>
<td>.580†</td>
</tr>
</tbody>
</table>

*Chi-square test.
†Student t test.
‡Mann-Whitney U test.

EBL = estimated blood loss; IQR = interquartile range; LS = laparoscopic splenectomy; SD = standard deviation.

Table 3: Bleeding and infection represented the majority of morbidities encountered in the entire series (29 of 59 complications). Reoperation to control bleeding was required in 7 patients, which is similar to that reported in the literature. Of the 127 obese patients, based on spleen weight [group A1: 80 obese patients with normal-sized spleens; group A2: 47 obese patients with splenomegaly (>500 g)]. Obese patients with splenomegaly, whose mean spleen weight was 1052 ± 680 g, were found to have significantly longer operating times (P < .001), greater EBL (P = .054), and higher rates of conversion to open splenectomy (17% vs 5%; P = .025), compared with obese patients with normal-sized spleens (Table 4). Median length of hospital stay was similar in groups A1 and A2 (2 days vs 3 days, respectively; P = .059). Overall, the postoperative morbidity rate was similar in both subgroups (11% vs 23%; P = .069). However, compared with group A1, patients in group A2 had a significantly higher incidence of bleeding complications (1% vs 11%; P = .016).

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operating times (P < .001), greater EBL (P = .054), and
higher rates of conversion to open splenectomy (17% vs
5%; P = .025), compared with obese patients with
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stay was similar in groups A1 and A2 (2 days vs 3 days,
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rate was similar in both subgroups (11% vs 23%; P = .069).
However, compared with group A1, patients in group
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tions (1% vs 11%; P = .016).

Comments
Obesity complicates many surgical procedures by
increasing the technical complexity of the operation as
well as increasing the patient’s risk of postoperative
massive splenomegaly. These concerns have not been fully refuted, even though many of the studies reporting these results were performed in the period when experience with the technique was at the beginning of the learning curve.

In this study, we reviewed our experience with LS over the past decade, with the specific aim of evaluating the safety and efficacy of LS in obese and nonobese patients. Our data demonstrate that LS in obese individuals is feasible and safe, regardless of the indication for the procedure, and outcomes are comparable to those in nonobese patients. Although the median operative time was significantly longer in obese patients (by 19 minutes), we observed similar blood loss, length of hospital stay, conversion rates, and postoperative morbidity when compared with a comparable group of nonobese patients undergoing LS. Longer operating times are not desirable, but as experience with the LS procedure has increased over time, the reported durations of the operation are decreasing. Early series published by Park et al and Targarona et al reported operative times of longer than 200 minutes. More recent series from Domínguez et al and the present study show that LS times range between 130 and 160 minutes, regardless of the patient’s BMI. A difference of 19 minutes between obese and nonobese patients, although statistically significant in our study, is unlikely to have any major clinical or cost implications. As noted by Domínguez et al, the minor increase in operating room time in obese patients undergoing LS is often related to patient positioning, gaining abdominal access, and retrieving the specimen, all of which are challenging in patients with abdominal obesity in particular. Overall, our data are encouraging and provide further evidence supporting the laparoscopic approach as the preferred technique for performing splenectomy in patients of any body habitus.

Thus far, the major limitation of the literature examining the impact of obesity on perioperative outcomes of LS has been the small numbers of patients included in existing studies. It has been difficult to draw definitive conclusions based on data from case reports or series including as few as 7 obese patients. The largest series to date in this setting, until now, was that by Domínguez et al, who described their experience with LS in 39 obese patients and 73 nonobese patients. Similar to the results of our current study, the authors demonstrated that LS was safe in obese individuals with a BMI of 30 to 40 kg/m². Only when patients had severe and morbid obesity (BMI ≥ 40) did they experience higher rates of complications and conversions and longer operating times. In light of these results, we performed a further subgroup analysis on our own data, comparing outcomes of all patients with BMIs of 40 or greater (n = 25) with those of patients with BMIs less than 30 (n = 243). We found no significant increase in the rates of complications, conversions, or operative duration in the morbidly obese subgroup compared with the nonobese group (P = .287, P = .268, and P = .087, respectively). Considering the larger number of morbidly obese patients in our analysis, these data provide strong evidence that LS is safe even in severely obese individuals.

Table 4: Safety and efficacy outcomes of LS in obese patients, according to spleen size

<table>
<thead>
<tr>
<th>Variable</th>
<th>Group A1 obese, normal size spleen</th>
<th>Group A2 obese, splenomegaly</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>N</td>
<td>80</td>
<td>47</td>
<td>&lt;.001*</td>
</tr>
<tr>
<td>Spleen weight, g (mean ± SD)</td>
<td>240 ± 121</td>
<td>1,052 ± 680</td>
<td>.025†</td>
</tr>
<tr>
<td>Conversion to open procedure, n (%)</td>
<td>4 (5)</td>
<td>8 (17)</td>
<td>.254†</td>
</tr>
<tr>
<td>Overall morbidity, n (%)</td>
<td>9 (11)</td>
<td>11 (23)</td>
<td></td>
</tr>
<tr>
<td>Operating time, min (mean ± SD)</td>
<td>150 ± 49</td>
<td>196 ± 64</td>
<td>&lt;.001*</td>
</tr>
<tr>
<td>EBL, mL (mean ± SD)</td>
<td>150 ± 160</td>
<td>282 ± 388</td>
<td>.054*</td>
</tr>
<tr>
<td>Length of hospital stay, days (median [IQR])</td>
<td>2 (2–3)</td>
<td>3 (2–4)</td>
<td>.059†</td>
</tr>
</tbody>
</table>

EBL = estimated blood loss; IQR = interquartile range; LS = laparoscopic splenectomy; SD = standard deviation.

*Student t test.
†Chi-square test.
‡Mann-Whitney U test.
of normal, based on a review of commonly used definitions at the outset of this study. Despite the heterogeneity in defining splenomegaly, most studies of LS in this setting, including the current study, have consistently demonstrated that it is associated with longer operative times, increased blood loss, higher rates of perioperative complications, longer hospital stays, and higher rates of conversion to open splenectomy when compared with LS for normal-sized spleens. However, there is also strong evidence that the laparoscopic approach is superior to open splenectomy for this group of patients. In cases of massive splenomegaly (diameter >20 cm or weight >1,000 g), a hand-assisted laparoscopic approach has been demonstrated to improve the feasibility of a minimally invasive approach, thereby sparing the patient the morbidity associated with an open procedure.32,33

Much of the experience with laparoscopic procedures in obese patients stems from the field of bariatric surgery. Over the past decade, the safety profile of bariatric procedures has improved substantially, largely resulting from the widespread transition to performing these cases laparoscopically.24,34 The ensuing rapid uptake of laparoscopic bariatric surgery worldwide has led to significant advances in laparoscopic instruments and to greatly improved expertise in the perioperative care of obese patients. This knowledge has translated well to other surgical subspecialties, and the LS procedure can be safely performed by adhering to basic principles and recommendations.29

Despite the accumulating evidence supporting LS as the procedure of choice for splenectomy in obese and nonobese patients, regardless of spleen size, the design of studies from which these data have emerged remains imperfect. There is still no prospective randomized trial comparing laparoscopic and open splenectomy in various scenarios such as obesity and splenomegaly. Proponents of LS may argue that there is no need and that it may not be ethically justifiable, given the obvious benefits of the laparoscopic approach reported in existing literature. At present, it appears that the only absolute contraindications to LS are those that preclude any laparoscopic procedure in a given patient, such as severe cardiopulmonary disease and portal hypertension with cirrhosis.

Conclusions

LS is a feasible and safe procedure in obese patients. Although caution should be exhibited in obese patients with splenomegaly, this technique offers patients many benefits compared with the open surgical approach and should be considered the standard of care irrespective of body size.

References


