International Journal of Surgery 55 (2018) 1–4

Contents lists available at ScienceDirect

International Journal of Surgery

journal homepage: www.elsevier.com/locate/ijsu

Original Research

Robotic vs laparoscopic splenectomy for splenomegaly: A retrospective comparative cohort study

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ARTICLE INFO

Keywords:
Robotic surgery
Splenectomy
Splenomegaly
Laparoscopy
Outcomes

ABSTRACT

Background: The aim of this study was to evaluate the role of robotic total splenectomy for splenomegaly, comparing this approach with the laparoscopic technique.

Methods: We conducted a retrospective review of all patients who underwent minimally invasive splenectomy for splenomegaly (maximum splenic diameter > 15 cm) at our institution between 2000 and 2017.

Results: A total of 39 patients (27 laparoscopic vs 12 robotic splenectomies) were included in the study. Operative time was significantly longer in the robotic group (270 min vs 180 min, p = 0.007). Median intraoperative blood loss was 350 ml for laparoscopic procedures while it was 100 ml for the robotic ones (p = 0.032). Conversion to open surgery was required in 4 cases of laparoscopic splenectomy while no conversion were registered in the robotic group.

No significant differences were seen in postoperative morbidity and mortality between the two groups.

Conclusions: Robotic splenectomy for splenomegaly is associated with less blood loss and longer operative times than the laparoscopic procedure.

1. Background

Laparoscopy is the gold standard for elective total splenectomy for spleens of normal size [1,2]. The literature about the comparison between the laparoscopic and robotic approach is scarce. Two comparative studies reported similar outcomes in terms of safety, but they showed that robotic splenectomy was associated with higher costs and longer operative times [3,4]. For these reason, nowadays, its role seems to be limited only to training purposes.

It has been demonstrated that, in the presence of challenging conditions such as splenomegaly, hematological malignancies, obesity, or previous laparotomies, the laparoscopic approach was associated with higher morbidity and conversion rates [5]. In particular, splenomegaly seems to be the most important variable affecting perioperative outcomes of laparoscopic splenectomy [5,6]. The aim of this study was to evaluate the role of robotic total splenectomy in a technically demanding condition like splenomegaly, comparing this approach with the conventional laparoscopic technique.

2. Materials and methods

We conducted a retrospective review of all patients who underwent robotic or laparoscopic splenectomy for splenomegaly at our institution between January 2000 and October 2017. This retrospective cohort study was designed and reported as per Strengthening the Reporting of Cohort Studies in Surgery (STROCSS) criteria [7].

Electronic medical records were reviewed to collect relevant information for each patient. Recorded variables included: age, sex, body mass index (BMI), American Society of Anesthesiologists physical (ASA) score, type of disease, spleen cranio-caudal diameter, type of surgery, operative time, conversion to open surgery, intraoperative blood loss, timing of naso-gastric tube and drain removal and oral intake, time to first flatus, hospital stay and postoperative morbidity and mortality.

2.1. Definitions

Primary outcome measure was conversion to open surgery. Secondary outcome measures were: postoperative morbidity and mortality, intraoperative blood loss, operative time, length of hospital stay

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https://doi.org/10.1016/j.ijsu.2018.05.012
Received 9 February 2018; Received in revised form 24 April 2018; Accepted 9 May 2018

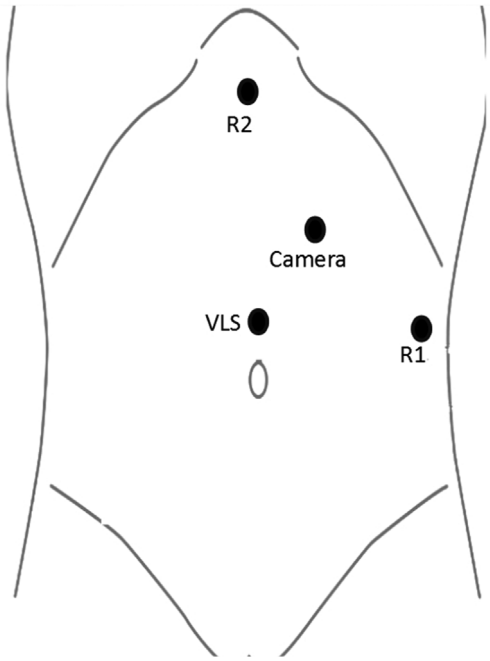

Fig. 1. Position of trocars in robotic splenectomy. R1 and R2, robotic arms. VLS, laparoscopic assistance.

and time to first flatus.

As reported by the clinical practice guidelines of the European Association for Endoscopic Surgery (EAES) [2], splenomegaly was defined by a maximum splenic diameter exceeding 15 cm at preoperative imaging. Postoperative morbidity was defined as any complication occurring within 30 days after surgery and was graded as described by Dindo et al. [8]. Postoperative mortality was defined as deaths after surgery during hospital-stay or within 30 days after surgery.

2.2. Surgical procedure

All patients who had laparoscopic procedure underwent splenectomy with lateral approach as described elsewhere [9].

For the robotic procedure, the patient was positioned in an incomplete right lateral decubitus position at a 45-degree angle with a reverse Trendelemburg inclination. Trocars were placed as shown in Fig. 1. The surgical procedure started with a laparoscopic exploration in order to confirm the feasibility of the procedure and to perform the adhesiolysis if required. In severe obese patients with hypertrophic left hepatic lobe an additional operative arm was placed mainly for retraction/exposure. The operative table was fixed and the surgical cart was placed over patient's left shoulder. Robotic splenectomy was performed by means of selective and sequential ligation of arterial and venous vessels at the splenic hilum. Dissections were performed through monopolar hook cautery (EndoWrist™ robotic instruments) and bipolar clamp (Cadiere™). The spleen was inserted in a plastic bag in order to limit the risks of splenosis in the peritoneal cavity and in the abdominal wall during the extracting maneuvers. In malignant diseases, the entire spleen was extracted through a subcostal or suprapubic accessory incision. Otherwise the organ was extracted in pieces from a 10–12 mm trocar. Abdominal drainage was always placed in left hypochondrium and usually removed 24–48 h after surgery.

2.3. Statistical analysis

The whole cohort was divided in two groups according to the type of surgical approach used (laparoscopic vs robotic). Continuous variables were presented as median and interquartile range (IQR) and were compared using Mann–Whitney *U* test. Categorical variables were expressed as numbers and percentages and were compared with Fisher Exact test. A p-value of < 0.05 was considered significant. Statistical analysis was performed with MedCalc Statistical Software version 15.8 (MedCalc Software bvba, Ostend, Belgium; https://www.medcalc.org; 2015).

Table 1
Patients' characteristics.

Variables	Laparoscopic (n = 27)	Robotic (n = 12)	p
Age – median - (IQR)	56 (42–64)	54 (46–60)	0.879
BMI – median – (IQR)	24.1 (21.8–27.7)	26 (23.9–32.1)	0.149
ASA score – median – (IQR)	3 (2–3)	2 (2–3)	0.025
Malignant disease – n - (%)	18 (66.6)	8 (66.6)	1.000
Previous abdominal surgery – n - (%)	3 (11.1)	5 (41.6)	0.079
Splenic diameter (cm) -median – (IQR)	20 (18–23)	21 (17–23)	0.9757

3. Results

A total of 39 patients (27 laparoscopic vs 12 robotic splenectomies) were included in the study. Patients' preoperative characteristics are reported in Table 1. Median ASA score was significantly higher in the laparoscopic group (3) than in the robotic one (2) ($p = 0.025$). Median preoperative platelets counts were comparable between the groups (119000 per µl, IQR 79000–149000 laparoscopic vs 135000 per µl, IQR 106000–245000 robotic group, $p = 0.289$).

Operative time was significantly longer in the robotic group (270 min vs 180 min, $p = 0.007$) (Table 2). Median intraoperative blood loss was 350 ml for laparoscopic procedures while it was 100 ml for the robotic ones ($p = 0.032$) (Table 2). The four cases of conversion to open surgery in the laparoscopic group were due to intraoperative bleeding.

Postoperative variables are reported in Table 2. No significant differences were seen in postoperative morbidity and mortality between the groups.

Two patients who had undergone laparoscopic splenectomy developed postoperative complications Clavien-Dindo grade 2 (1 retroperitoneal hematoma, 1 postoperative pneumonia). One patient in the laparoscopic group, who was re-operated for massive hemoperitoneum on the first postoperative day, died 24 h later for multiple organ failure.

Table 2
Intraoperative and postoperative outcomes.

Variables	Laparoscopic (n = 27)	Robotic (n = 12)	p
Operative time (min) – median - (IQR)	180 (146–238)	270 (190–300)	0.007
Conversion to open surgery – n - (%)	4 (14.8)	0 (0)	0.539
Blood loss (ml) – median - (IQR)	350 (100–800)	100 (100–250)	0.032
NG tube (days) – median - (IQR)	1 (0–1)	1 (1–2)	0.092
Time to first flatus (days) – median - (IQR)	3 (3–5)	3 (2–3)	0.073
Peritoneal drainage (days) – median - (IQR)	2 (2–3)	3 (3–3)	0.231
In-Hospital stay (days) – median - (IQR)	6 (4–8)	6 (5–6)	0.922
Postoperative complications – n - (%)	3 (11.1)	0 (0)	0.539
In-hospital mortality – n - (%)	1 (3.7)	0 (0)	1.000