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Laparoscopic Splenectomy as A Result of Morbid Consequences in The Treatment of Benign Splenic Disorders and Malignant Splenic Diseases

Hassan A Saad[1], Mohamed Riad[1], Kamal Rabie Eid[2], Ashraf Abdelmonem Elsayed[1], Mohamed E Eraky[1], Rasha S Elsayed[1]

[1]Surgical Department, Faculty of Medicine, Zagazig University and [2] Al-Azhar University, Egypt

Corresponding author: Hassan A. Saad, Telephone: (+20)01221025689,

E-mail: ebramos_2010@yahoo.com, ORCID:0000-0002-6242-7823

ABSTRACT

Background: Both benign and malignant diseases now have more and more justifications for laparoscopic splenectomy, which is currently considered a standard technique for handling practically all disorders necessitating splenectomy.

Objective*:* We aimed to contrast the consequences of benign versus malignant hematological diseases following laparoscopic splenectomy. **Patients and Methods**: We carried out seventy-six laparoscopic splenectomies between 2019 and 2022. 38 patients were handled with the use of a unique method, an anterior approach, but 38 patients have been positioned in a semi-lateral position for laparoscopic intervention.

Result: Malignant disorder patients had older ages (60.1), whereas benign disorder sufferers had younger ages (35.6), P = 0.001. Laparoscopy was used in 72 of 76 cases (94.7%). Four situations (5.2%) have been modified to open cases. Operative time used to be 2.51 h/min for malignant in distinction to 2.30 h/min for benign tumors (P > 0.05).

Conclusions: laparoscopic splenectomy is logically appropriate as a less invasive technique for benign splenomegaly, hematological tumors, or both.

Keywords: Splenectomy, Laparoscopic, Malignant, Benign.

INTRODUCTION

History points: **Delaitre**[(1)]. carried out the first laparoscopic splenectomies in France in 1991, accompanied by **Carroll**[(2)] in the United States in 1992, and **Poulin**[(3)] in Canada three months later that same year (1992) · Following that, several research studies were meant to be drastically used in many countries with the skill of specialists[(4)]. **Laparoscopic splenectomy** (LS splenectomy) has the following benefits: The main advantages of LS in adults encompass less bleeding, shorter hospitalization, rapid recovery to everyday activities, and first-rate beauty results for the treatment of benign diseases, particularly in healthy patients with a small spleen, such as those with hereditary thrombocytopenic purpura, laparoscopic splenectomy (LS) is an extremely common operation. However, there is little experience with LS for hematological malignancies, and there are no trials that compare it to the surgical approach[(5)].

The process is further complicated by the unique clinical characteristics of malignant hematological illnesses, such as splenomegaly, developed patient-years, and more severe symptoms. More challenging could affect the direct results after LS [(6)].

Immune thrombocytopenia is the most an alliance of splenectomy (ITP), followed by systemic hemolytic anemia caused by inherited spherocytosis [(7-8)]. Massive splenomegaly (average pole diameter > 20 cm, spleen weight > 1000 g) has been successfully cured laparoscopically in several studies. LS has been effective at treating individuals with hematological malignancies, but [(9-10)], although there are technical challenges in the situations of lymphoma, hilar lymphadenopathy, or peri splenitis, splenectomy may be worthwhile with size adjustment with the aid of an X-ray [(11)]. So, we have restricted our indications in such cases.

Objective: The current study's objectives included analysing results of 76 consecutive patients (adults and children) who had either benign or malignant diseases and assessing the advantages of laparoscopy for those with lymphomas and other hematological malignancies.

The study's goals were to determine the benefits of laparoscopy with innocuous splenic tumors and hematological malignancies in patients with splenic mass.

PATIENTS and METHODS

Our database used to be as unexpectedly reviewed for patients who had extended, prolonged preceding with the resource of laparoscopic splenectomy. Between April 2019 and November 2022, seventy-six sufferers were subjected to LS for hematological malignant and benign diseases in the Zagazig University Surgical Department. The preoperative activities included blood investigations, coagulation profiles, chest X-rays, ultrasounds, and electrocardiography. Before the operation, ultrasound for the everyday pole diameter, dimension of the spleen, and CT for peritonitis, splenic consolidation, or hilar nodes were necessary. In addition, MRI was necessary to help the CT provide a suited prognosis and a dimension of all suspected hematological malignancies in the abdomen (Fig. 1).

Patients who had received laparoscopic splenectomy were searched for in our database. We dealt with 76

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patients with LS for hematological malignant and benign diseases.

One week before the operation, all patients underwent pre- and postoperative colored Doppler US for feasible postoperative splenic or portal thrombosis, or both. Vaccinations against meningococci, Haemophilus influenzae, and Pneumovax were administered to all victims one week before surgical operation (Meningokokken, Baxter GmbH, Germany; Prohibit, Connaught Laboratories, Inc., Swift-water, USA). In all circumstances, intravenous antibiotic, e.g., unictam 1gm was taken 2 hours before the operation or on operative table to prevent post operative infection[(10)].

Age, sex, postoperative mortality, morbidity (30-day), or reoperations, and time of discharge, histological tumour character, operative duration (determined rom knife blade used to complete suturing), blood transfusions necessary, splenic average diameter interpolar diameter (ID) of the spleen, problems, and factors of transformation for opening. Massive splenomegaly is characterized as splenic weight of 1000 g or splenic interpole diameter (ID) of 20 cm.

In our experience, laparoscopic splenectomy for splenomegaly is possible due to innovations in surgical knowledge, tools, and technique, and improved surgical abilities. Other schools have seen the same growth[(12)].

With the establishment of the and-assisted technique, laparoscopic splenectomy felt substantial improvements. Many of the technological obstacles of laparoscopic splenectomy for splenomegaly have been settled by knowing how the hand is used inside an insufflated abdomen[(13-14)]. In our experience, a hand-assisted technique will be mandatory if the spleen width is higher than 19 cm or the length is 24 cm or more expansive on a pre and post-CT abdomen scan. If a unit specimen is required for pathologic analysis, the hand-assisted approach is also required for a clinical review. At our premises, abdominal CT scanning keeps going to be the most useful preoperative test to gauge splenic volume and screen the splenic hilum for lymphadenopathy. All patients residing examined for laparoscopic splenectomy for malignant disease must undergo evaluation for the aforementioned CT scan criteria to enable them to decide on the most beneficial therapy option while limiting probable intraoperative and perioperative morbidity (Fig. 1)

Inclusion standards:

1. Individuals who were physically fit for laparoscopic surgery.
2. Patients with benign or hematologically malignant splenic tumors who were cognitively stable, aware, and consenting to surgery.

Exclusion:

1. Unfit human beings are a prerequisite for exclusion.
2. Unwanted sufferers or household members perisplenitis.
3. Splenic hilar lymph nodes.

Ethics-Related Matters:

Zagagic University's Academic and Ethical Committee gave this research their seal of approval in terms of ethics. All participants or their guardians provided their written, informed consent. According to the World Medical Association's ethical standard for testing on humans, the Helsinki Declaration, the research protocol complied.

Preoperative assessment:

Each case underwent the following:

1- Take a thorough biography.

2- Systemic evaluation of all body systems

3-Investigations:

1. CBC to look for signs of probable leukemia, thrombocytopenia, anemia, or lymphoma.

2. PT, INR, and PTT in the coagulation profile.

3- All routine investigations, i.e., kidney function, liver function, CBC and blood glucose

4- U/S AND C.T

Surgical procedure:

1-Anterior method (38 patients)

An anterior route used to be used in the first 38 patients. The affected patients were used as soon as possible after being put in the lithotomy posture; the scientific professional stood between the patient's separated legs, and the assistant held on his best side.

A Veress needle, was used to create pneumoperitoneum in majority of the cases that was inserted at the left subcostal margin. A 30-degree laparoscope was usually used. The umbilicus or left subcostal components was the site of the initial 10- to 12-mm hole. (Relaying on the spleen diameter and body weight index). 5-mm subxiphoid was launched. The port was introduced. The fourth outlet used to be many times positioned between the xiphoid and camera ports, depending on the size of the spleen.

First, the abdomen nearby has to be explored for any accessory spleen (in instances of benign diseases), one of a variety of masses, or lymph nodes for lymphadenopathy and liver metastasis. If there was excessive splenomegaly, it would perhaps moreover be essential to restrict the dimension of the spleen first with the really useful aid of dissection and ligating the splenic artery on the roof of the pancreas or at the hilum of the spleen (Figure 2).

With the right-side rotation and reverse Trendelenburg posture, the spleen used to be well exposed. The splenocolic ligament smashed-up at the inferior pole aided in handling. Using clips or the Harmonic knife (Ultracision, Ethicon Endo-Surgery,

Cincinnati, OH, USA), the fast gastric vessels had been shrinking after the splenic-gastric ligament was severed. With the right-side rotation and reverse Trendelenburg posture, the spleen used to be well exposed. The splenocolic ligament smashed-up at the inferior pole aided in handling. Using clips or the Harmonic knife, the fast gastric vessels had been shrinking after the splenic-gastric ligament was severed (Ultracision, Ethicon Endo-Surgery, Cincinnati, OH, USA).

Full splenic mobilization takes place when the spleen is superiorly separated from the diaphragm. The essential splenic arteries had been limited or tied off. At a retrieval bag, and the left-wing port area (Endocatch II, Tyco, USA) used to be inserted as quickly as possible percutaneously. If benign ailments were suspected, they used to be morcellated and put into this plastic bag; however, if malignant ailments had been suspected, it was once rapidly divided into several huge components (2–3 cm) and then retrieved.

2-Semilateral utilize hand-assisted (38 patients)

Laparoscopic surgery to perform the semi-lateral regional approach was typically used for massive splenic masses. Patients were positioned in a reverse Trendelenburg posture with the left hip accelerated at 45 degrees, giving us an endorsed position when the spleen dislocates downward and medially and helping us with our hands.

LS is commonly a two-surgeon procedure, with the direct health practitioner dealing with the patient's abdomen and the exposure located so that it is parallel to the working surgeon's left shoulder. Three ports spaced three to four centimeters apart were used to encircle the splenic vicinity alongside the left subcostal margin.

In a healthy large splenic mass, the region of the most lateral port should be 4 centimeters under the inferior tip of the spleen. The harmonic knife was used to begin the sharp division of the restriction peritoneal attachment. After the inferior pole has been mobilized, the dissection strikes from the lateral to the middle via a way of possibly ligating the fast gastric vessels.

A linear endoscopic stapler with an arterial cartridge was used to splenic vein staple or clipper at the hilar pedicle (Endo-Gia II, 45-2.5, US Surgical) unless the pancreas tip is struck (Figure 3). The hand-assisted operation mentioned by the surgeon was performed as quickly as possible during the mobilization. As the most exceptionally appropriate attachment to stomach and diaphragm division, which is carried out to complete mobilization of the spleen, a hand-assisted technique (without a specialised any device) was used in a few cases of huge spleen, with the surgeon's left hand passing through an expanded umbilical incision (7cm).

Statistical analysis

Continuous variables were presented as mean±standard deviation (SD) and were compared by the Student t-test if normally distributed or by Mann-Whitney test if abnormally distributed. Qualitative data were presented as frequency and percentage and were compared with the use of the Fisher's exact test. $P < 0.05$ was considered significant. IBM SPSS software program version 20.0 was utilized to examine the data that was supplied into the computer (Armonk, NY: IBM Corp).

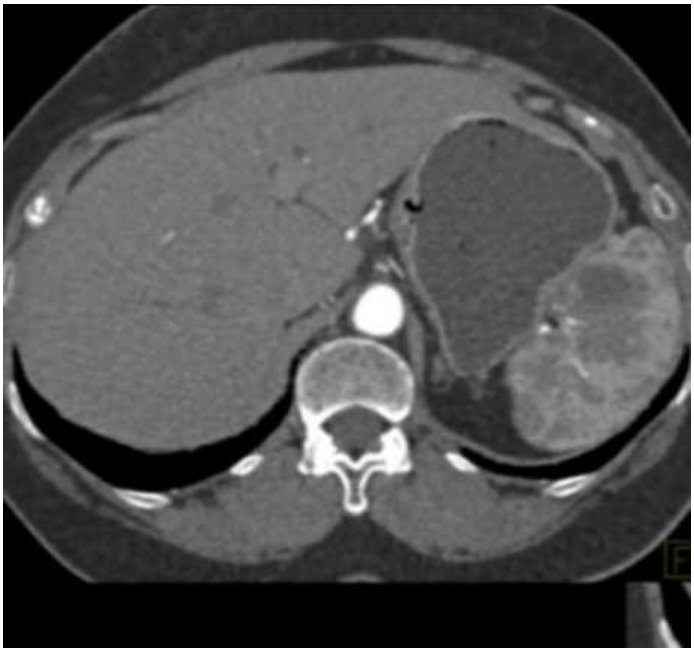

Figure 1: Showing CT contrast with splenic masses metastasis

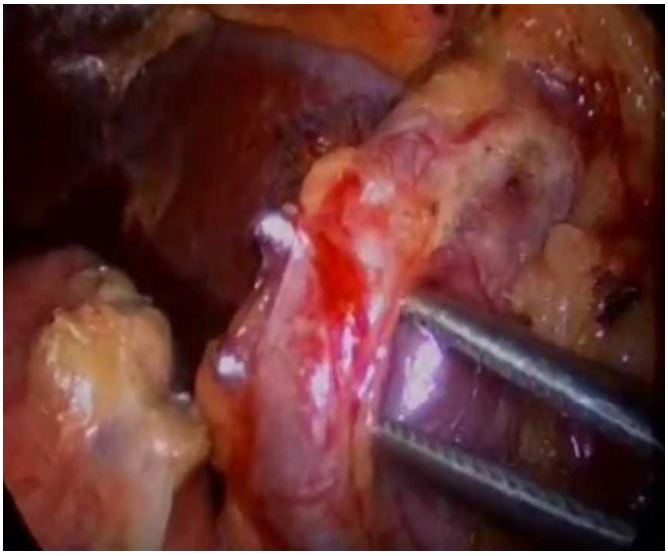

Figure 2: Dissection of the splenic artery

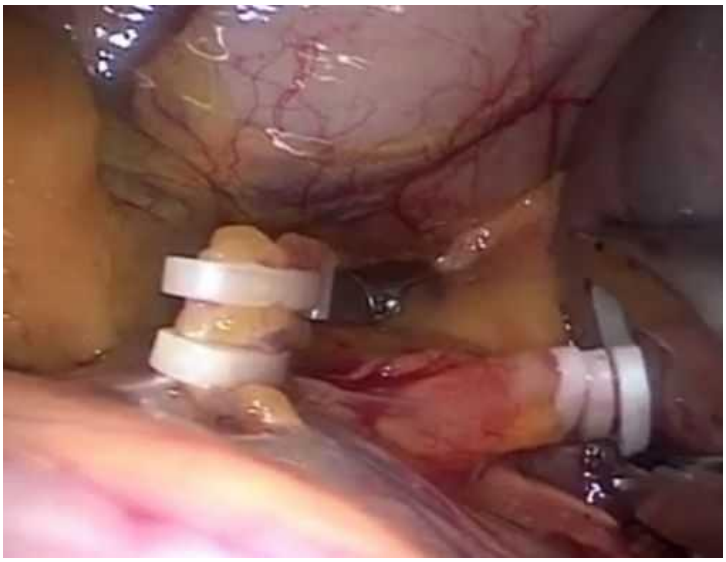

Figure 3: Clipping of splenic veins in malignant spleen diagnosed preoperatively.

RESULTS

The mean aging of 40.2±20.9 years (range, 4 to 73), seventy-six consecutive of us (M = 33, F = 43) underwent LS, and eleven instances (14.5 %, M = 5, F = 6). were under the age of 18 (mean age, 10.8±5.4). The broadly widespread working, mean time was 143.6 ± 42.0 minutes, with a range of 60 to 240, and hospital mean time was 5.5 ±3.2 days (ranging from 2 to 24). Table 1 shows the preliminary scientific and laparoscopic surgical files for sufferers with benign illnesses (group I - 52 patients) and cancer ailments (group II - 24 patients) and the causes of splenectomy are detected in table 2.

Table 1: Patients' demographics with surgical data

Characteristics	Benign (N=52) Group I	Malignant (N=24) GroupII	*P*
Age (years)	32.6±19.0	56.9±14.0	<0.001
Operative time (minutes)	138.5±43.5	151±34.5	NS
Complications during operation	2 (3.8%)	1 (4.2%)	NS, 0.99
Mean pole diameter (cm)	13.7±3.2	18.1±5.8	<0.001
Huge splenomegaly ID* >20 cm	4 (7.6%)	9 (37.5%)	0.003
Open conversion	2 (3.8%)	2 (8.3%)	NS, 0.59

Data are presented as mean±standard deviation or as number (Percentage), NS= nonsignificant.

Table 2: Causes of laparoscopic splenectomy in the studied groups (I, II)

Indications in Benign Diseases	No.	Indications of Lymphoproliferative Diseases	No.
Spherocytosis	17	Splenomegaly: primary diagnosis	8
Cooley's disease	8	Splenomegaly (DL 13–19): primary diagnosis	6
Immune thrombocytopenic purpura	7	Splenomegaly: suspicion of recurrence	1
Autoimmune hemolytic anemia	4	Splenic lesions: primary diagnosis	5
Cyst	2	Splenic lesions: suspicion of recurrence	2
Hematoma	2	Splenomegaly nonresponder to chemotherapy	2
Others	12	—	

Of the 76 surgeries, 72 (94.7%) have been completed laparoscopically. Three patients sustained intraoperative bleeding from major splenic vessels: two in group I (3.8%) and one in group II (4.1%) with Hodgkin's disease (HD) due to the endoscopic linear cutter's (ETS 30/45–2.5, Ethicon or Endo-Gia II 30/45–2.5, US Surgical, Tyco, Norwalk, CT, USA) malfunction. To stop splenic hemorrhage in one patient from group I, conversion was performed. Multiple splenic abscesses with perisplenitis in a patient with non-Hodgkin's lymphoma (NHL), important splenomegaly (ID 25 cm) in one patient with NHL, and enormous splenomegaly (ID 22 cm) in a patient with pancytopenia all required three conversions. Fisher's exact test, F = 0.41, found that the conversion rate was insignificantly higher when LS was used for managing malignant (8.3%) than benign illnesses (3.8%) circumstances. In table 3, postoperative data are presented. Patients began a moderate diet 24 hours after surgery.

Major postoperative complications occurred in six individuals (7.9%). Three instances (two from group II and one from group I) of left subphrenic abscesses had been correctly treated with percutaneous drainage.

On the first surgical day, the affected individual who experienced internal bleeding were quickly managed by splenic artery embolization. Two cases underwent repeated operations, one (group I) for an intestinal fistula and the other for a hemoperitoneum (group II). 15 days after the operation, one case of malignant condition died due to pulmonary embolism.

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Table 3: **Postoperative statistics outcome**

Characteristics	Group I Benign (N.52)	Group II Malignant (N.24)	*P*
Transfusions	2 (3.8%)	2 (8.3%)	NS, 0.59
Postoperative complications	3 (5.7%)	3 (12.5%)	NS, 0.37
Postoperative splenic portal vein thrombosis Pulmonary embolism	2 (3.8%) 0	2 (8.3%) 1	NS, 0.59 NS, 0.32
Recurrent operations	1 (1.9%)	1 (4.1%)	NS, 0.53
Median Hospital stay /days	5.5 (2–11)	5.9 (3–10)	NS, 0.3

NS= nonsignificant , Hospital stay is presented as median (range)

Clips (60%) and staplers (40%) had been used to control the necessary arteries. In 15 cases (19.7%), drains have been left in place for 7 days or longer; 6 of these patients had cancer. Drains were commonly eliminated after three days. Significant peri-splenic adhesions, peri-splenic abscesses, and intraoperative hemorrhage were the causes. The spleen used to be eradicated in two ways: proximally from the left subcostal and anteroposteriorly from the umbilical opening. The use of a 3.5-centimeter opening might be required. A Pfannenstiel incision was used for splenectomy in cases of the severe huge spleen in three females (3.9%), two in group II patients, and one in group I patient.

Thirty-five sufferers had ID, and 20 cases had splenic ID much less than 13 cm (14 cm–19 cm). Thirteen sufferers (17%; implying an ID of 234.1 cm) had big splenomegaly (ID >20 cm).

These most recent cases underwent surgical techniques for a total of 176.630.5 minutes, and their common sanatorium remains used to be 6.63.9 days. Massive splenomegaly (in group I) is typical in 4 situations (pancytopenia, Newman-Pick disease, autoimmune hemolytic anemia, and Cooley disease). However, there have been nine folks in group II, eight of whom had NHL, and one had bushy-tailed cellular leukemia. There was one event of postoperative mortality (1.3% in group II), P 0.32

Four cases (5.2%) required blood transfusions, with two from every cohort. ITP/spherocytosis cases used to be as common as 8.7% (2 of 23 patients). splenic hilum (1.5 cm in diameter) in the greater omentum (7 mm in diameter). 2 other cases of accessory spleen were detected in 2 patients with NHL.

Postoperative Spleno-portal Thrombosis (POST) after LS:

Four cases (9.7%), two from group I (3.8%), and three from group II (8.3%) had partial thrombosis, which was then proven as quickly as any scientific symptom. Only 1 patient with splenoportal thrombosis (group II) had massive splenomegaly. All of the patients were asymptomatic and were given low-weight molecular heparin 100 UI/kg twice daily for 45 days. After one month, Doppler ultrasound examinations printed the whole decision in all cases.

Long Outcome of 52 patients (groupI):

Histological analysis results appear in table 4 for malignant hematological disease.

For benign illnesses, the installed follow-up used to be eighty-four months (range, 24 to 126). One affected patient with splenomegaly who used to be HIV-positive died four years after the operation. Two of the seven ITP cases no longer have rise in their platelet matter (<30000). All type ITP, spherocytosis, and autoimmune hemolytic anemia cases are asymptomatic.

Long outcome of group II (24 Patients):

The favored follow-up dimension used to be 54 months (range, 26 to 138). Three cases died. One affected personality with acute myeloid leukemia from hepatic failure two months later. Two cases with NHL died month later after LS, while three cases with NHD and one affected with HL died after an average interval of one 12 months (12.2 months). 14 human beings had been disease-free at the most modern follow-up, while 3 patients had recurrences and are being treated.

Table 4: Group II (Malignant Diseases) Histological finding

Histological Findings	No.
Recurred of lymphoma	14
Non-Hodgkin lymphoma	5
Hodgkin disease	2
Hair cells leukemia	2
Myelofibrosis	1

DISCUSSION

The gold standard for treating benign hematological diseases with a normal spleen size is typically laparoscopic splenectomy, which is a comprehensive and straightforward procedure. According

to a study published in **James *et al.*[10]** patients with benign disease had more laparoscopic splenectomy procedures (82.4%) than patients with malignant disease (40.4%) (P .001) . In our study, the rates of morbidity and mortality were 7.9% and 1.3%, respectively, in 94.7% of those (conversion rate: 5.3%).

Furthermore, in the study of 57 patients, only 1 conversion was required (NHD with massive splenomegaly, ID 22 cm)**[15-16].**

Numerous excellent studies, including those involving adults and younger people with ITP, found less pain, shorter hospital stays, and lower costs when compared to open splenectomies[17-18].The incidence mentioned in the giant sequence matches our results (8.3% in ITP, 5.2% overall) regarding frequency.

It was found that the methods of laparoscopy are comprehensive and practicable for both benign and malignant diseases after 76 consecutive laparoscopic surgical procedures had been examined**[19-20]**. Due to the spleen's vulnerability and close closeness to vital organs and structures, laparoscopic surgery (LS) must be considered a laparoscopic procedure with particular risks (e.g., organ technique, complete organ removal)[21-22].

Although the transfusion was similar in both groups in our study, high-volume centers, mortality from pancreatectomy and hepatectomy is as low as 1% to 2%, according to numerous reports. It is remarkable that 1.6% of elective splenectomy patients in a big cohort died, making it a procedure with comparable risk [23-24]. **Musallam *et al.* [15]** research included patients who had nonelective procedures, multi-visceral resection, and traumatic intraoperative injury, which may have contributed to the study's high transfusion rates. In our research, we showed that the difference between 3 postoperative complications (5.7%) in benign conditions and 3 (12.5%) in malignancies was insignificant. Transfusion rates after splenectomy were found to be 29.4% by **Musallam *et al.***[15].(11.2% for laparoscopic splenectomy vs. 47% for open splenectomy).

Friedman *et al.* examined 3812 patients who had undergone splenectomy for thrombotic complications. Within 90 days of splenectomy, 71 patients (1.9%) experienced venous thromboembolism, which was greater than the comparison groups of the general population (0.06%) or patients who had undergone appendectomy [16], but we had equal splenoportal thrombosis complication in our groups of patients without significant difference. **Yoshida *et al*.[6]** reported that the splenoportal thrombosis, which was associated with every LS and the open strategy and mildly impacted personality, comorbidity, and mortality, had an unknown frequency and necessitated on-the-spot anticoagulant Therapy. Because ultrasound with Doppler can predict splenoportal thrombus, we decided to implement an insurance plan structure for all LS patients to investigate the real prevalence of splenoportal thrombus in our patients**[13]** .

Targarona *et al*.[18] .where the mortality rate for the benign disease was 1.8% and that for the malignant disease was 9.0% . our research found no mortality from pancreatectomy but only one patient passed away after 15 days from pulmonary embolism. Contrary to **Decker *et al*.[19]** Cohort, 77% of the patients were still alive and 69% were still suffering from hypersplenism. According to these studies, perioperative morbidity and fatality rates after laparoscopic splenectomy in patients with malignant hematologic disease are comparable to those after laparoscopic splenectomy in patients with benign hematologic disease[17].hepatectomy is as low as 1% to 2%, according to numerous reports. It is remarkable that 1.6% of elective splenectomy patients in this big cohort died, making it a procedure with comparable risk One patient in **Decker *et al*.[19]** series lost from grave sepsis, and two patients in **Schlachta *et al.*[20]**series died following a postoperative myocardial infarction. But in our series only one patient lost in the first 2 weeks from pulmonary embolism.

Decker *et al*.[19] were unable to locate significant variations in the perioperative rate of morbidity (27% vs. 15%) and operative mortality rates (0% vs 8%). In their series of 64 patients who received laparoscopic splenectomy, **Schlachta *et al.*[20]** also discovered no notable variations in the levels of challenges after the operation (11% vs. 18%) or operative mortality (0% vs. 9%) between the benign hematologic and malignant groups. Immune thrombocytopenic purpura is not a malignancy. Laparoscopic splenectomy performed for lymphoma had a significantly higher failure risk,

Schlachta *et al*.[20] also discovered no notable variations in the levels of challenges after the operation (11% vs. 18%) or operative mortality (0% vs. 9%) between the benign hematologic and malignant groups. Immune thrombocytopenic purpura is not malignancy. Laparoscopic splenectomy LS can be carried out with very low morbidity and mortality rates, comparable to or lower than those of open splenectomy **[20]** . Even though there are few prospective studies, the results of comparing laparoscopic versus open splenectomy trials or LS events for malignant cases with recently published open splenectomy series, favor LS [23].

Major mortality and transfusion rates are decreased. In recent research, **Nicholson *et al*.[11]** found that a series of 39 patients had a mean hospital stay of 13 days, a morbidity and mortality rate of 41% and 8%, respectively. However, in our research, hospital stays were 5.5 days for benign conditions and 5.9 days for malignancies without significant difference. There have been no intraoperative complications, even though surgical techniques for malignant diseases required longer time than those for benign conditions.

It had been observed that both had issues. The difference in the length of time spent in the sanatorium between the two groups was once barely statistically significant. Lymphoma with a tiny spleen, lymph node dissection, and liver rarely were occasionally obtained.

The reality of this contentious issue is that LS for malignancy and massive splenomegaly were not recalled. Malignancy and splenic size are still important factors in the conversion rate.

In the past, many surgeons shied away from using laparoscopy for splenectomy due to the risks involved with LS. This might also have been the case because they were inexperienced and using it for the first time[22]. **Somasundaram *et al.*[23]** found unexpectedly, massive splenomegaly is not recommended for LS. Today, even in the presence of splenomegaly, amazing outcomes have been reported. We started with a direct approach. properly, especially at some points along the learning techniques. The semi-lateral approach, which enables the rapid release of splenic around attachment also makes it possible to administer the splenic hilum and its surroundings while keeping the area securely closed. The lateral or semi-lateral technique also has the advantage of limiting tissue manipulation while enhancing activity in the organ's protrusion. Due to its ability to "finger control" bleeding and expedite changes, if required, the hand-assisted technique has seen an increase in the new LS use. Given that patients with the malignant disease were older, required more extensive surgery, had splenomegaly, and commonly underwent open splenectomy, this might not work as expected [23]. Additionally, only one conversion occurred in the previous fifty-seven patients; a case of NHD with a large spleen (ID 22 centimeters). However, despite using a hand-assisted technique in some instances, The actual conversion percentage discovered by **Bermas *et al.*.[24]** was higher (41%).

Targarona *et al.* [22]discovered These hand assistant methods were used to operate on five patients, but in our research, only three cases of malignant huge spleen required this technique and our initial assessment is that this device greatly eases the process.

CONCLUSIONS

The current study's findings show that, after the preliminary getting-to-know curve, LS is safe, effective, and potentially safe for victims with benign and malignant splenomegaly, with a negligible conversion rate, minimal complications, and minimal mortality.

Conflicts of interest: None

Funding: None.

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