

# Laparoscopic Splenectomy

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Laparoscopic splenectomy has gained popularity as an option for patients having benign and malignant diseases as well as for trauma patients who are stable. Studies have shown that this procedure is prone to bleeding but with advanced technology and good anatomical knowledge of vasculature, the procedure is not only feasible but can be performed safely. Poulin who did the first laparoscopic partial splenectomy for ruptured spleen in 1995 proved it was possible. The inherent abundant blood supply and proximity of spleen to vital organs make it prone to 5–60% complication during its dissection, and hence utmost care and skills are needed during surgery [1].

## Indications [2]

1. Benign hematologic diseases—mostly children.
2. Malignant hematologic diseases.
3. Splenic Cyst.
4. **Trauma**—a preoperative Computed Tomography (CT) scan is essential to assess the grade of splenic injury and to confirm that

there is no multiple organ injury that would entail a need for laparotomy. Vital signs should be stable with a BP > 90/60 mmHg and HR < 120 bpm [3]. Failure rate for conservative management of splenic injury ranges from 10 to 40% [4].

## Contraindications [5, 6]

1. Portal hypertension secondary to liver cirrhosis.
2. Patient who cannot tolerate general anesthesia.
3. Coagulopathy.

## Pre-OP Assessment and Management

1. CT scan with vascular reconstruction: Spleen size and volume (maximum diameter) [2, 5].
2. Triple Vaccination (Hemophilus influenza, Pneumococcus pneumonia, and Meningococcus): 15 days prior to scheduled surgery or 10 days after emergency surgery.
3. Prophylactic antibiotic upon induction of anesthesia and continued postoperatively for at least 24 hours.
4. Low-dose subcutaneous unfractionated heparin prophylaxis.

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## OT Setup

### Instruments

Trocars: 12 mm, 10 mm, and two 5 mm

30° endoscope

Electrosurgical devices: electrothermal bipolar, advanced energy devices (ultrasonic shears, advanced bipolar)

Stapler or Clips

Specimen retrieval bag

### Position

Patient in right lateral decubitus position.

### Port Placement Fig. 1

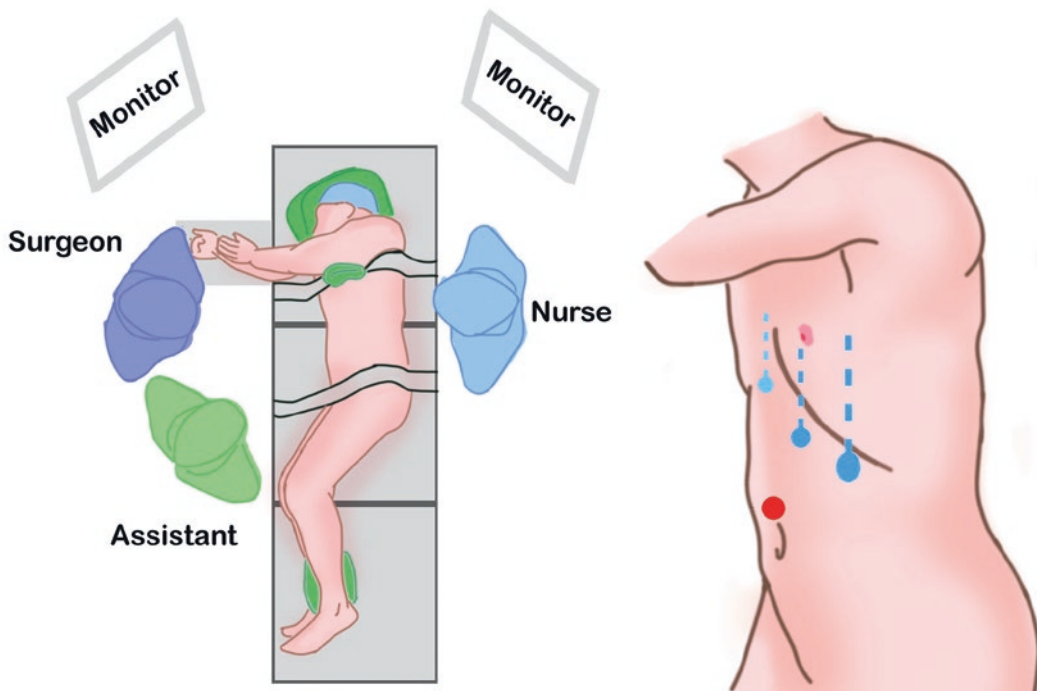
Optical port: 12 mm at umbilical area, 3–4 cm to the left superiorly.

Second 10 mm at left anterior axillary line below the costal margin or on or below the lower edge of palpable spleen.

Working ports: Two 5 mm in the epigastric (exposing hilum) and along midclavicular line (retracting spleen) [7, 8].

### Surgical Technique

It is best to do diagnostic laparoscopy to look for an accessory spleen which is common in 10–30% of the population. Failure to do so may lead to recurrent or persistent thrombocytopenia. 75% of accessory spleens are located at the splenic hilum, 20% at the tail of the pancreas, and the remaining 5% at the gastrosplenic, wall of the stomach and intestines, greater omentum, mesentery, and pelvic area [9].



**Fig. 1** Port placement: (1) umbilical area, (2) anterior axillary line, (3) midclavicular line, (4) epigastric

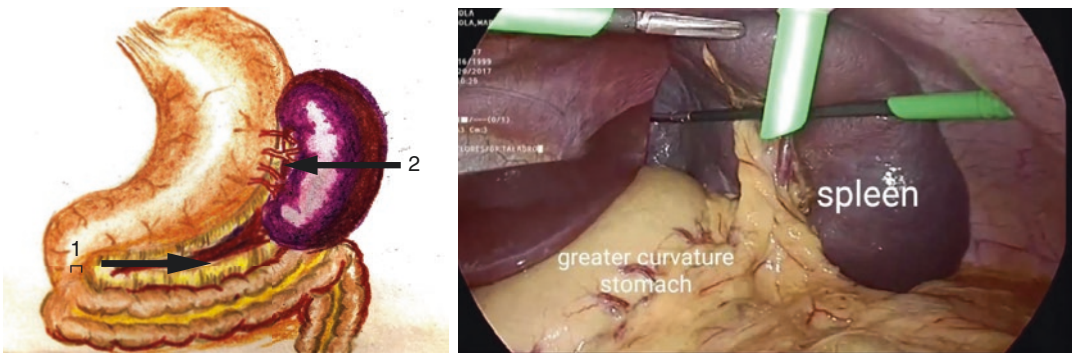
**Approach**

(a) *Anterior approach* has the advantage of having a direct view of the spleen just like what is seen in doing open splenectomy. The downside of this approach is poor visualization of hilum that may lead to vessel injury and bleeding [2, 6]. In this technique, spleen is exposed by downward traction of colon and medial retraction of the greater curvature of the stomach. The lesser sac is entered through the gastrocolic ligament (Fig. 2). The left gastroepiploic and short gastric vessels are divided to completely separate stomach and spleen and subsequent access and clipping of splenic vessels (Fig. 3) [6].

(b) *Posterolateral approach* has better visualization and access to vessels, the pancreas, and accessory spleen. This approach facilitates complete mobilization of the spleen by using gravity as a retractor [2, 6, 8]. The splenorenal and splenocolic ligaments are divided followed by dissection of the hilum, approaching it from the lower pole going to the upper pole (Fig. 4) [6].

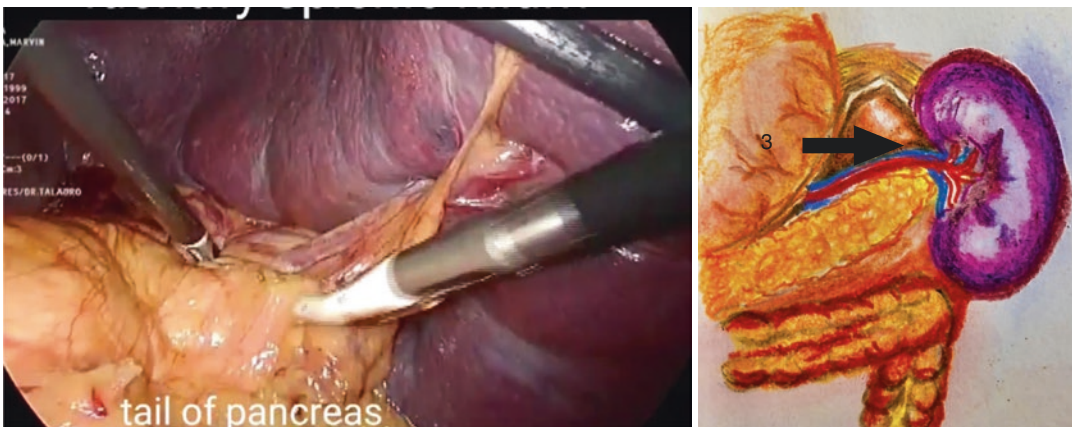
**Parenchymal Resection**

(a) *Total Splenectomy* is indicated for centrally located, multifocal tumors and malignancy [7]. The drawback of infection and vascular



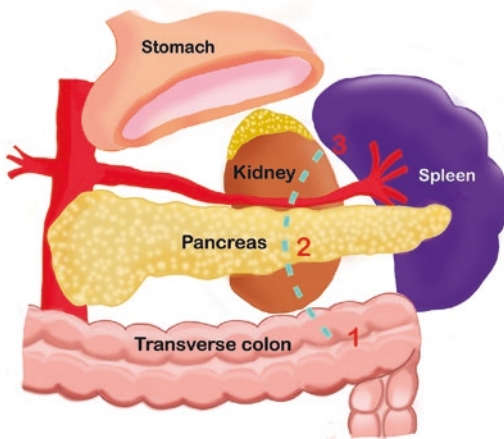
1.Open the lesser sac.  
2.Short gastric vessels divided.

**Fig. 2** (1) Open the lesser sac. (2) Short gastric vessels divided



3.Access to splenic vessels

**Fig. 3** (3) Access to splenic vessels



**Fig. 4** Divide the *splenicocolic* and *splenorenal* ligaments to expose the hilum. Dissection of the *hilum*. Free from lateral attachments

complications like thrombosis are noted in studies.

- (b) *Partial splenectomy*: With the latest tools that are readily available and modifications of technique for improved visibility of structures, partial splenectomy with the removal of the lesion and preservation of function is now considered an option for treatment. The upper pole is often preserved for systemic disease because it is difficult to free from diaphragm as compared to dissecting the lower pole from splenic colon flexure.<sup>20</sup> This procedure makes use of selective devascularization of the splenic vessels and resection along or 1 cm inside the ischemic line to prevent bleeding [10, 11].

**Spleen Remnant Size**: 25–30% preserved spleen parenchyma allows good immunologic response [3, 5]. Studies done by Vasilescu et al. show that a mean volume of 41.4 cm<sup>3</sup> is enough to preserve the spleen's immunologic function, while Stoher et al. noted it to be at 10 cm<sup>3</sup> [10].

### Vessel Dissection

- (a) *Vessel first*: The main trunks of splenic artery and vein are identified at the pancreatic tail

and is the technique commonly used for large splenic vessels [12].

- (b) *Hilar Transection*: The entire splenic hilum is transected as close as possible to the spleen and makes operative time shorter as compared to vessel first approach [12].

## Complications, Prevention, and Management

### Intraoperative Complications [2]

- (a) *Bleeding* secondary to injury of the hilar vessels or splenic capsule. Studies showed that male sex and spleen measuring >19 cm by ultrasound are independent risk factors for intraoperative bleeding [13]. Importance of crucial exposure, knowledge of variations in anatomy, and careful dissection of structures are the initial step to prevention of bleeding. In the eventuality of bleeding from parenchyma, one can apply pressure/packing the area first, while bleeding from hilar vessels can be managed by clamping/grasping the vessel by a grasper and applying clips to bleeding vessel. When using stapler at the hilum, pedicle should be cleared and the stapler fired under direct vision. Splenic artery can be clipped to reduce the splenic size and make the spleen soft for easier extraction [1, 2].
- (b) *Organ injury*: Chand et al. observed a 15% *pancreatic injury* resulting in *pancreatic fistula*. Identification of pancreatic tail and dissecting it away from the hilum avoids this complication. *Bowel injury*, as well as *diaphragmatic injury*, can happen during mobilization of spleen, it is important that these complications are recognized and addressed intraoperatively [1, 2, 10].

### Postoperative Complications

- (a) *Postoperative hemorrhage* may occur at the splenic vessels at the tail of the pancreas, short gastric vessels, or trocar sites presenting as tachycardia, hypotension, decreasing

hemoglobin with abdominal distension. Rapid resuscitation should be done for hemodynamically unstable patients followed by exploratory laparotomy for control of bleeders. If the patient is stable, may opt to do laparoscopy for control of bleeders [1].

(b) *Infection: Subphrenic abscess* is a known complication yet is difficult to diagnose resulting in a delay in management. Patients will usually present with intermittent fever, a chest X-ray may show pleural effusion, raised diaphragm, or basal atelectasis. An abdominal CT scan is essential for identification and as a guide to percutaneous drainage. This complication can be avoided by meticulous hemostasis and suctioning of fluid prior to closure [1]. *Pancreatitis* is also a possibility when there is excessive manipulation or devascularization of the gland. *Overwhelming Post-Splenectomy Infection* is seen in 4.4% of cases with a 50–80% mortality rate, more common in children and more fatal after splenectomy for hematologic disorders. Immunization with pneumococcal vaccine 2 weeks before the scheduled surgery is the standard of care and for children younger than 5 year old who will undergo splenectomy, pediatricians advise a daily dose of penicillin until they reach the age of 10 [1, 14].

(c) *Vascular*: Splenic vein thrombosis can be encountered in 20% of patients who had splenectomy. This is associated with vague abdominal pain and can be documented using an ultrasound or CT scan. Routine postoperative ultrasound identifies 6.3–10% thrombosed portal vein (TPV). The risk of developing TPV is noted to be at 10–50% in patients who had laparoscopic splenectomy for myeloproliferative disorder, hemolytic anemia, and thalassemia. To prevent this complication, it is advised that splenic vein should be ligated as close as possible to the mesentery, routine postoperative ultrasound for high-risk patients. Once detected, the patient should receive systemic anticoagulation immediately as >90% will have recana-

lization of the acutely thrombosed portal or mesentery vein.

- (d) *Respiratory*: pneumonia and atelectasis.
- (e) *Ileus*.
- (f) *Hernia*: Port site hernias usually develop for incisions larger than 10 mm, which can be prevented by meticulous suturing of fascia [1].

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## Post-Op Care [7]

1. Splenic/Portal vein thrombosis—ultrasound screening on seventh postoperative day.
2. Antibiotic prophylaxis—oral Penicillin for 2 years after surgery but for a lifetime for immunosuppressed patients [15].
3. For ITP patients, platelet count evaluation is done 1 month after surgery as *Complete response* (platelet 100,000/mm<sup>3</sup> without splenectomy treatment), *Partial response* (platelet levels 30,000/mm<sup>3</sup>, 100,000/mm<sup>3</sup> or at least twice the basal level), and *Complete unresponsiveness* (platelet below 30,000/mm<sup>3</sup> or twofold below basal level) [16].
4. Vaccination for patients who had emergency splenectomy is done 14 days after the procedure. However, for patients with poor follow-up, it is best to give the vaccination prior to discharge.

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