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Open Vs Laparoscopic Splenectomy among Saudi Patients

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ABSTRACT

The spleen is one of the most frequently injured intraperitoneal organs, and management of splenic injuries may require splenectomy. Traditionally, surgical removal of the spleen was done by an open approach using either an upper midline or left subcostal incision. Open splenectomy is performed in two major clinical scenarios: trauma and hematologic disease. With the advent of minimally invasive techniques, laparoscopic splenectomy has become a standard procedure for elective removal of the spleen for most indications. Nowadays laparoscopic splenectomy is the approach of choice for both benign and malignant diseases of the spleen. However, some contraindications still apply. The evolution of the technology has allowed though, cases which were considered to be absolute contraindications for performing a minimal invasive procedure to be treated with modified laparoscopic approaches. Moreover, the introduction of advanced laparoscopic tools for ligation resulted in less intraoperative complications. Today, laparoscopic splenectomy is considered safe, with better outcomes in comparison to open splenectomy, and the increased experience of surgeons allows operative times comparable to those of an open splenectomy. In this review we discussed the indications and the contraindications of laparoscopic splenectomy. Furthermore, we analyze the surgical techniques.

Keywords: Spleen, Laparoscopic Splenectomy, Open Splenectomy, Technique.

INTRODUCTION

The spleen is one of the most regularly injured intraperitoneal organs, and management of splenic injuries can necessitate splenectomy. Conventionally, surgical removal of the spleen was completed by an open approach utilizing either an upper midline or left subcostal incision. Open splenectomy is performed in two major clinical scenarios: trauma and hematologic disease. The spleen is a wedge-shaped organ that lies in relation to the ninth and eleventh ribs, positioned in the left hypochondrium and partially in the epigastrium; accordingly, it is situated amid the fundus of the stomach and the diaphragm. The spleen is extremely vascular and reddish purple; its size and weight are variable. A normal spleen is not palpable. The spleen's key function is the removal of old red blood cells (RBCs), defective circulating cells, and circulating bacteria. Furthermore, the spleen supports preserve normal erythrocyte morphology by processing immature erythrocytes, removing their nuclei, and changing the shape of the cellular membrane. Further functions of the spleen contain the removal of nuclear remnants of RBCs, denatured hemoglobin, and iron granules and the manufacture of opsonins (properdin and tuftsin). The present tendencies are toward nonoperative treatment of the spleen after trauma [1] and toward laparoscopic splenectomy for hematologic disorders [2]. Nowadays, furthermost elective splenectomies are completed laparoscopically, excluding the case of severe splenomegaly [3].

Even in the setting of massive splenomegaly, there is some indication to recommend that the laparoscopic method is safe and feasible in children [4]. With the advent of minimally invasive techniques, laparoscopic splenectomy has become a standard procedure for elective removal of the spleen for most indications. Since the first report of laparoscopic splenectomy by Delaitre and Maignien in 1991 [5], it has been increasingly used; however, several technical challenges remain related to removing this fragile, well-vascularized organ that lies close to the stomach, colon, pancreas, and kidney.

MATERIALS AND METHODS

- **Data Sources and Search terms**

We conducted this review using a comprehensive search of MEDLINE, PubMed, EMBASE,

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Cochrane Database of Systematic Reviews, and Cochrane Central Register of Controlled Trials from January 1, 1988, through July 28, 2017.

- **Data Extraction**

Two reviewers independently reviewed studies, abstracted data, and resolved disagreements by consensus. Studies were evaluated for quality. A review protocol was followed throughout.

Indications for splenectomy

Splenic rupture is generally caused by penetrating or blunt trauma; delayed rupture of the spleen [6] and spontaneous splenic rupture [7] occur rarely. An analysis by the National Trauma Data Bank (NTDB) found high failure rates and extended hospital stays when high-grade splenic damages were administered conservatively (i.e., with nonoperative management) [8]. Surgical treatment of splenic rupture is indicated for patients who have hemodynamic instability or shock on admission, those who have related injuries requiring operative intervention, and those in whom nonoperative management has failed [9].

Patients with several hematologic ailments can advantage from splenectomy. Splenomegaly is perceived in conditions such as thrombotic thrombocytopenic purpura (TTP), hereditary spherocytosis, and idiopathic (immune) thrombocytopenic purpura (ITP) [10]. ITP is the most common sign for elective splenectomy. In hereditary spherocytosis, the RBCs have a trend to be trapped and damaged in the spleen. The key features of this ailment comprise jaundice, anemia, splenomegaly, and reticulocytosis. The most common indications for open splenectomy in an adult are the following:

- Traumatic splenic rupture
- Blood dyscrasias

In general, the operation ought to be postponed till the patient is at least 6 years old to minimize the danger of overwhelming postsplenectomy sepsis (OPSS; similarly mentioned as overwhelming postsplenectomy infection [OPSI]) [11, 12]. After removal of the spleen, the erythrocytes achieve a normal life span, and the jaundice, if present, disappears in a timely manner. Further less common hematologic indications for splenectomy contain thalassemia and sickle cell anemia.

Indications for laparoscopic splenectomy are similar to those for open splenectomy except when exploratory laparotomy and emergency splenectomy for traumatic injuries are required. Laparoscopic splenectomy is indicated for several benign hematologic diseases, secondary hypersplenism, malignant hematologic diseases, and other anatomic disorders of the spleen. The most mutual benign hematologic disease managed with laparoscopic splenectomy is immune thrombocytopenia purpura, and it is suggested when medical treatment, containing steroids and intravenous gammaglobulin, fail or long-term steroids are desirable. Laparoscopic splenectomy can likewise be necessary in other benign conditions, containing further types of hereditary spherocytosis, thrombotic purpura, sickle cell disease, major and intermediate thalassemia with secondary hypersplenism or severe anemia, and refractory autoimmune hemolytic anemia.

Laparoscopic splenectomy for malignant ailments of the spleen may be used for diagnostic or therapeutic causes. Indications comprise lymphoproliferative diseases, myeloproliferative disorders, hairy cell leukemia, malignant vascular tumors, malignant lymphomas, Hodgkin and non-Hodgkin lymphoma, and lymphangiosarcomas [13]. While the utilization of laparoscopic splenectomy in trauma has been stated [14], its role is restricted as most hemodynamically stable patients with splenic damages are effectively managed nonoperatively, and unsteady patients necessitate emergency laparotomy for control of hemorrhage and to assess conceivable associated traumatic damages.

Contraindications

Contraindications for open splenectomy are few. For elective open splenectomy, the only absolute contraindications are uncorrectable coagulopathy and severe cardiovascular disease that prohibits the administration of general anesthesia.

Contraindications for laparoscopic splenectomy are similar to those for all laparoscopic surgeries. They include the inability to tolerate general anesthesia, uncontrollable coagulopathy, and the need for laparotomy for associated procedures. Although reports on the safety of laparoscopic splenectomy in patients with cirrhosis and portal hypertension have been published [15, 16], many consider this an absolute contraindication to laparoscopic splenectomy [13]. Massive splenomegaly is a relative contraindication; though, the hand-assisted technique may facilitate removal of large spleens in a minimally invasive fashion. Good results are being reported for laparoscopic removal of very large spleens, and it has been suggested that with advances in laparoscopic technology and expertise, laparoscopic splenectomy may become the gold standard operation even for massive spleens and splenic malignancies [17].

Technique

- **Open Splenectomy**

- **Incision and entry into abdomen**

The incisions rely on the size of the spleen, the cause for splenectomy, and the preference of the surgeon. Normally, in trauma or emergency situations, an upper midline incision is preferable since it affords good exposure of the abdominal cavity, can be quickly implemented, and provide access for the evaluation and management of other potential injured organs or structures. In most patients experiencing splenectomy for a hematologic disorder, a left subcostal incision is employed, beginning to the right of the midline and proceeding obliquely to the left approximately two fingerbreadths below the costal margin. This incision yields excellent exposure.

- **Mobilization and removal of spleen**

Upon entry into the abdominal cavity, dissection is done with blunt and sharp technique and with the surgeon's hand following the convex surface of the organ, leading to recognition of the peritoneal attachments. The spleen is moderately grasped and displaced medially toward the incision. The avascular peritoneal attachments and ligaments are incised with an electrocautery or Metzenbaum scissors. These suspensory ligaments are avascular except for the gastrosplenic ligament, which comprises the short gastric vessels. In patients with portal hypertension, any ligaments can have vessels that ought to be ligated. Thoughtfulness is then turned to the hilum, where the splenic artery and veins are recognized, wisely dissected, especially ligated with 0 non-absorbable sutures, and transfixed with 2-0 silk suture ligatures. To prevent damage to the pancreas, the dissection is carried out at the hilum in close proximity to the spleen. Resulting, the short gastric vessels are perceived and ligated. In hypotensive patients, the short gastric vessels typically don't drain, nor does the splenic bed. On account of elective splenectomy, the initial step is transection of the ligamentous connections, including the splenophrenic tendon at the prevalent post and the splenocolic and splenorenal ligaments at the inferior pole. This might be proficient with limit dismemberment, an electrocautery, or, in conditions where the ligaments are thickened, Metzenbaum scissors.

Subsequently the ligamentous attachments are transected; the gastric vessels that run from the spleen to the greater curvature of the stomach are ligated and separated. A Lembert suture is positioned in the gastric wall in a seromuscular fashion to prevent the complication of gastric fistulization when one is unable to classify the source of bleeding from the stomach. After these maneuvers are completed, the spleen is delivered into the wound with blunt dissection of the posterior attachments.

To keep from entering the splenic vein, care ought to be taken not to divide the posterior attachments too far medially. It is similarly significant to evade axial rotation of the spleen before securing the splenic vessels with vascular loop or clamps; such rotation can lead to disruption of the splenic artery or vein. Analyzation is done at the hilum in closeness to the spleen to maintain a strategic distance from damage to the pancreas. Singular ligation of the splenic conduit or blood vessel branches and the splenic vein or venous branches is for the most part ideal. This is refined by methods for twofold ligation and transfixation with nonabsorbable suture ligatures.

After removal of the spleen, hemostasis is achieved and confirmed in a systematic fashion through careful inspection of the left subphrenic part, the greater curvature of the stomach, and the short gastric vessel area, in addition to the splenic hilum. Inspection of these areas is facilitated by proper retraction of the stomach and small bowel to allow clear visualization of the left upper quadrant and surgical bed. When splenectomy is achieved for hematologic disease, a thorough abdominal exploration ought to be done to look for any accessory spleens. Common positions of accessory spleens comprise the greater omentum, the mesenteric region, the hilum, the gastrocolic and gastrosplenic ligaments, and the presacral space. Any accessory spleen is detached to avoid the reappearance of idiopathic (immune) thrombocytopenic purpura (ITP) [18].

- **Completion and closure**

Drains are not normally necessary, excepting in cases where an injury of the tail of the pancreas is assumed. The abdominal incision is closed by approaching the linea alba with 1-0 polypropylene monofilament sutures in a continuous fashion. The left subcostal incision is approximated in layers with 1-0 absorbable sutures. The skin edges are approximated with staples. In injured patients, the abdomen should not be closed until the coagulopathy that is frequently associated with major trauma has been corrected.

- **Partial Splenectomy and Splenorrhaphy**

In Gaucher disease, partial splenectomy is performed by isolating and ligating the segmental vessels to the affected segment, then resecting the segment. Closure is completed by approximating the splenic parenchyma with suture material and an omental patch, utilizing a hemostatic agent, or applying an argon-beam coagulation device.

Splenorrhaphy is still utilized to treat small lacerations or other injuries that are localized to one pole of the spleen. Horizontal mattress sutures placed over pledgets are commonly used. Omentum or a local hemostatic agent (e.g., fibrin glue) may be used as an adjuvant in achieving hemostasis.

- **Laparoscopic Splenectomy**
  - **Standard laparoscopic approach**

The procedure starts with obtaining abdominal access, regularly with an open cut down technique, but the use of a Veress needle is correspondingly allowed, except for patients with massive splenomegaly, due to the high risk of wound. Notwithstanding of checking for accessory spleens, it is suggested that before initiating splenic mobilization, diagnostic laparoscopy must be achieved. Subsequently working trocars are placed; the placement relies typically on surgeon's preference. Generally, one trocar can be placed just off the midline/subxiphoid region in the left subcostal position and another one can be placed in the anterior axillary line in the left subcostal region. After mobilization of the splenic flexure, an further trocar can be positioned laterally off the tip of the 11th rib, as it may be highly assistive in cases of splenomegaly. Then posterior avascular attachments and short gastric vessels are divided and the spleen is retracted in order to obtain complete access to the splenic hilum and the pancreatic tail. The splenic hilum is then divided with an endoscopic stapler with a vascular load. Endovascular stapler provides easy and stable division of hilum [19].

After hilum division, hemostasis is ensured and staple line bleeding can be controlled with clips or hemostatic agents. At this point though, an injury of the pancreatic tail is possible, so when this procedure is not completely safe, the hilar vessels can be alternatively divided with an electrothermal bipolar vessel sealer or ultrasonic coagulating shears. These are stated to be harmless, providing low blood loss and short operative time [20]. Now the spleen can be grasped by the handle of the splenocolic ligament placed into a strong bag. Here it is vital to evade spillage of splenic tissue, particularly in patients with malignancies. The spleen is mostly removed morcellated, except cases where intact removal of the spleen is desirable. A use of drainage is not suggested and of course, when a pancreatic injury has occurred or is suspected, drainage is mandatory [21].

  - **Hand-Assisted Laparoscopic Splenectomy**

Hand-assisted laparoscopic surgery (HALS) is another technique for laparoscopic splenectomy that offers assistances of both open and laparoscopic techniques and has proved useful in patients with splenomegaly (craniocaudal length >22 cm or width >19 cm) [22]. For inexperienced surgeons, HALS may shorten the learning curve; for experienced surgeons, it may facilitate minimally invasive splenectomy for massively enlarged spleens that else would not be amenable to a purely laparoscopic technique [23]. It is normally agreed that the nondominant hand should be placed into the abdomen.

Many commercial hand-assist devices are obtainable. Trocar positions can vary, depending on the hand dominance of the surgeon. For right- or left-hand-dominant surgeons, the hand-assist device can be placed in the midline at or slightly below the inferior pole of the spleen. The incision should be 7-8 cm (or 1 cm less than the surgeon's glove size) and should be located 2-4 cm caudal to the inferior pole of the enlarged spleen. The surgeon stands on the patient's right side, and the nondominant hand is inserted through the hand-assist device, allowing medial retraction, rotation, and elevation of the spleen. Laparoscopic ports are placed as described previously for the lateral approach; nonetheless, when the spleen is extremely large, the trocars should be placed more inferiorly than normal. When all of the anterior and posterior attachments have been divided, the hilum is ligated with an endoscopic stapling device. The spleen is placed in a retrieval sac, brought up through the hand-assist incision, and, if necessary, morcellated.

  - **Single-incision laparoscopic splenectomy**

The rapid advance of technology has led to a struggle for an even more scarless technique. In that principle, single-incision laparoscopic procedures have been introduced, which have been tested successfully in various operations. Laparoscopic splenectomy has been similarly reported that can safely and successfully be done through a single incision, using a single port through which the working trocars are inserted in the abdominal cavity. The basic concepts of laparoscopy are also followed in single-incision laparoscopic splenectomy (SILS); an umbilical or periumbilical incision is made and a specific port system is applied; either 2 or 3 single ports through this incision only or 1 single-incision port are applied. Then the operation is continued just like standard laparoscopic splenectomy. Undoubtedly, a SILS is considered to be more technically challenging; SILS vs standard laparoscopic approach in patients with ITP was compared, and they found that operative time was statistically significant longer in SILS compared to standard

laparoscopy, and the blood loss during SILS was also more [24]. These technical difficulties come as a result of the proximity of surgical tools, which are not specially designed for SILS. However, SILS has almost the same conversion rate, morbidity and mortality rate as standard laparoscopy, and patients who underwent SILS seems to have less postoperative pain [24]. Further technological evolution and more experience on single-incision procedures can make SILS more popular.

CONCLUSION

Laparoscopic splenectomy has been established as a safe and feasible minimally invasive procedure. It can be used in almost all cases that a splenectomy is required, having in the majority of cases better results than open splenectomy in terms of intraoperative and postoperative complications. Nevertheless, there are some special conditions, such as splenic trauma, in which the role of laparoscopy is not widely accepted. The evolution of the technology has allowed though, cases which were considered to be absolute contraindications for performing a minimal invasive procedure to be treated with modified laparoscopic approaches, such as the HALS for splenomegaly.

The further improvement of laparoscopic tools in addition to the increased experience of surgeons in minimal invasive procedures allows lower operative times and conversion rates, along with less intraoperative complications, such as blood loss. Consequently it is strongly believed that laparoscopic splenectomy will become in the near future the standard procedures for almost all cases of splenectomy.

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