
Splenectomy: Indications, Techniques and Physiological Implications – A Comprehensive Review

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Abstract: Spleen is present between diaphragm and stomach's fundus part behind the 9th and 10th ribs. It is sponge like with reddish purple color. It is the largest lymphoid-organ present in the human body. Spleen protects the body by filtering the blood and support immune system by joining both innate immunity and adaptive immunity. When spleen is taken out through surgery it is known as splenectomy. Splenectomy can be done when there is cyst or abscesses in the spleen, irregular eradication of spleen, and if there is any enlargement in the spleen. There are two types of splenectomy techniques- Open Splenectomy and Laparoscopic splenectomy (LS). LS is minimal invasive technique. Vaccination to counteract pneumonia, influenza and meningitis is advised before or after the splenectomy to protect the body. Patients who have gone through splenectomy takes more time to recover than normal people. There are also complications after the spleen removal like elevated chances of infection and high levels of platelets and leukocytes in the blood of the human body.

Keywords: Spleen, Indications, Laparoscopic splenectomy, immune function

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1. Introduction

When spleen is taken out through surgery it is known as splenectomy. Once not having spleen was believed to be all right till 1952, at that time someone emphasized the dangers of post-splenectomy infections in large amounts [1]. Spleen has potential to connect the both adaptive and innate-immunity and also protect our body from pathogens. Therefore, it is important to maintain the immune-homeostasis [2]. Structure of spleen contain 2 linked chambers – 1) white pulp, and 2) Red pulp [3]. Red pulp region of spleen is similar to sponge in shape whereas white pulp is spread alongside the central-arteriole. Spleen also acts as a filter and helps to get rid of various pathogens, old and injured cells and form immunoglobulin [4]. Due to properties of spleen like production of immunoglobulins and eradicating pathogen, individuals who does not have spleen usually have diminished immunity [5, 6]. As a consequence, people who have gone under splenectomy takes longer time-period to recover from various diseases like spinal-meningitis, pneumonia, diseases caused by ticks, parasites and biting of animals [7, 8, 9, 10]. Even though this role can also be carried out by liver in people lacking spleen, but it needs specified antibodies and a complement-system [6]. Spleen eradicate and alter the unusual RBCs, isolate thirty to forty percent platelet-pool from the

circulation and regulate the quantity of plasma, spleen is generally associated with blood related disorders [11].

1.1 Anatomy of spleen

Spleen is present in upper-left section in body beneath diaphragm. Three ribs that is, ninth, tenth, and eleventh protect the spleen and hanged by several peritoneal-reflections [12]. It is the widely acknowledged largest lymphoid-organ present in human body. Main roles of spleen are- filtering blood, providing immunity, reservoir and blood cells production. It is the important place for the production of Ig-M. When spleen is removed, Ig-M volume decreases remarkably [13]. Connective tissue capsule encircles the spleen and Trabeculae strengthen the blood vessels [14]. In red pulp, blood is filtered and damaged red blood cells are eradicated [15]. In this, RBCs and haemoglobins are broken down and haem is liberated. It is again broken and iron is liberated [16]. While the white pulp has T-cell and B-cell sections near the branches of arteries [17].

The signs that are absolute involve cyst in spleen, spleen rupture and splenic abscess where whole organ is damaged. Other signs are over active spleen, trauma, enlarged spleen, symptomatic-splenomegaly and irregular eradication of RBCs in spleen [18].

Table 1: This table shows different functions of spleen in the body

Absolute signs	Relative signs
Spleen trauma (rupture in spleen)	Acquired or Congenital hemolytic anemia
Cyst in spleen	Lymphoma
Abscesses in spleen	ITP
Pancreatic cancer	Inflammatory disorders (Felty syndrome)
Angioma	Infectious diseases (Malaria)
Hypersplenism	Leukemia
Neoplasm	Thalassemia
Splenic artery aneurysm (SAA)	Gaucher's disease

Indications

The main indications for the splenectomy are shown in Table 2.

It is hard to determine either the people require spleen removal or not in case of trauma, when the patient has low injury to the abdomen and show hemodynamic stability [19]. People with hemolytic-anemia will have splenectomy because unusual RBCs are eradicated too early via macrophage of spleen. Spleen removal can improve this condition [18].

Splenectomy

In patients with trauma, blood disorders and other conditions mentioned above, when spleen is removed surgically it is regarded as a life sustaining intervention [20].

Table 2: Signs for splenectomy

1.	Phagocytosis of damaged or old red blood cells in the circulation
2.	Hematopoiesis
3.	Iron storage
4.	Red pulp macrophage decontaminate blood from pathogens
5.	Immune mediator formation like opsonins
6.	B cells of spleen produce antibodies
7.	Formation of immunoglobulin M by IgM B memory B cells

There are about 6.4 to 7.1 spleen removal cases per one lakh individuals every year and people with trauma and blood disorders becoming more widespread [21]. Trauma to the abdomen can cause ruptured spleen and hemorrhage which leads to spleen removal [22]. Different types of splenectomy techniques include: Open Splenectomy and Laparoscopic Splenectomy

Laparoscopic Splenectomy

This technique involves proper measurement of mass and size of spleen through sonograph of abdomen before operation. These details are important in order to diagnose any other condition present and to plan correct method. Furthermore, fifteen days before splenectomy, it

is advised that to counteract pneumonia, influenza and meningitis vaccines must be given [23]. Mostly in case of any urgent surgery, you can also administer the vaccine 10 days after the splenectomy [24]. Different types of laparoscopic splenectomy are present like standard laparoscopic method, HALS for splenomegaly and single incision laparoscopic splenectomy (SILS).

Patient position: 3 different types of positions are there for surgery. 1. Anterior 2. Hemi-lateral 3. Lateral [25]. When the patient is in anterior position then the hilum of spleen and omental pouch both have best visibility. Additionally, other operations can also be carried out simultaneously with this [26]. Hemi-lateral position involves placing the person at 45° angle. In this it is quick and simple to divide gastric vessels and it provide greater access to spleens posterior surface [27]. Nowadays most of the surgeons favor this position due to its globally adaptable nature [28]. While lateral-position involves positioning abdomen of patient upright to surgical bed. In this, you can avoid any kind of wound or tearing to the pancreas and it is very simple to dissect ligament [29].

SILS can be achieved by a one-incision and working trocars are introduced into the cavity of abdomen with the help of single-port. In this, cut is made around or in the navel and specialized port-system is used [30].

Complications after Splenectomy

Currently removal of spleen has shown to cause elevated threat of infections [31]. Components that cause elevated cases of infections after spleen removal is due to slow and damaged antibody formation, and reduced amount of macrophage in spleen [21]. Platelet and white blood cells (Leukocytes) amount get elevated in the blood right after the spleen removal [32]. The complication that is crucial and prolonged after the spleen removal is overwhelming post-splenectomy infection and it can cause shock due to sepsis within two days [33].

2. Conclusion

As we know spleen is an important organ for both innate and adaptive immunity. Hence removing spleen can make you more susceptible to the pathogens and different types of diseases. Patient who had gone through splenectomy takes more time to recover from even cough and fever due to diminished immune system. Laparoscopic splenectomy is considered most secure and practical approach with minimum invasion. This approach shows much better result than open splenectomy. There are less complications present after operation via laparoscopic splenectomy. Complications involve infection, elevated platelet and white blood cells count in the blood.

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