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Review

Benefits and risks of splenectomy

Elroy P. Weledji*

Department of Surgery, Faculty of Health Sciences, University of Buea, PO Box 126, Limbe, Cameroon

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ABSTRACT

Splenectomy is a powerful therapeutic procedure in a wide variety of medical disorders provided that it is not undertaken lightly and the risks are weighed against the potential benefits in each individual case. Most of this risk seems to be due to the underlying splenectomy indication and not to splenectomy alone. There has been an increased tendency in recent years towards splenic preservation to prevent not only the risk of subsequent overwhelming post-splenectomy infection (OPSI) but the long term risk of cardiovascular complications. As there is no condition that can be cured by splenectomy, this paper reviewed the rationale behind the indications for, and the associated risks.

Method: Electronic searches of the medline (PubMed) database, Cochrane library, and science citation index were performed to identify original published studies on splenectomy. Relevant articles were searched from relevant chapters in specialized texts and all included.

1. Introduction

Since the first deliberate removal of a diseased spleen by Quittenbaum in 1826 splenectomy has become a well established surgical procedure.[1] A spleenless existence was considered to be quite safe as the spleen was considered unnecessary for life until 1952 when King and Schumacher drew attention to the risk of overwhelming post splenectomy infection (OPSI).[2] Since that time enthusiasm for splenectomy has diminished. The spleen clearly serves extremely important haematological and immunological functions. As part of the reticulo-endothelial system and by receiving 25% of the cardiac output, it plays a major part in the immediate immunological response to blood-borne antigens akin to the phagocytic role of 'Kupffer' cells of the liver in the portal circulation.[3] As the spleen is responsible for making antibodies and removing bacteria, aged, antibody-coated and damaged blood cells, those without a spleen have an impaired immune system.[4,5] Because of this, splenectomized patients have a more difficult time recovering from pneumonia, meningitis, haemophilus influenzae (Hib) flu, sepsis, nosocomial infections, babesiosis (a tick-borne disease), malaria and other parasitic diseases and gram-negative bacterial diseases from animal bites.[6–8] Although the liver can perform this function in the absence of the spleen, higher levels of specific antibody and an intact complement system are probably required.[5] As the spleen also destroys and modifies abnormal red cells, sequesters 30–40% of the circulating platelet pool and plays a role in the regulation of plasma volume, the spleen is usually involved in haematological disorders.[9,10] Infact, the most frequent medical indication for splenectomy is a haematologic disorder.[11] Overwhelming bacterial sepsis as a complication in persons with asplenia, is now infrequent because of pneumococcal vaccinations, prophylactic penicillin, and prompt medical attention at the first sign of fever.[12,13] However, during the past decade evidence has emerged that an increased risk of thrombosis, both venous and arterial, may result from splenectomy.[14] The increased risk of venous thromboembolism is particularly within the splenoportal system. This complication has been described in diverse asplenic states including hereditary spherocytosis (HS), thalassaemia, other haemolytic anaemias, and trauma.[14–16] In thalassaemia and sickle cell disease, another vascular complication, pulmonary hypertension (PH), has also been described following splenectomy, with some studies reporting PH prevalence as high as 75%.[17,18]

Splenectomy may have an impact on immunological function but there is no increased cancer risk among patients splenectomized because of trauma.[1] A recent study revealed an increased risk for some specific cancer sites in patients who underwent splenectomy for non-traumatic reasons, although the effect of treatments for the underlying disease and lifestyle habits such as cigarette smoking could not be ruled out in explaining these excess risks.[19]

In most institutions, trauma is the primary indication for splenectomy, although it is becoming less common in recent years with more non-operative management of splenic injury.[20]

* Tel.: +237 99922144.
E-mail address: elroypat@yahoo.co.uk.

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2. Role of the spleen in haematological disorders

The normal spleen may serve as a major site of destruction of abnormal cellular elements of the blood, e.g. in hereditary spherocytosis, autoimmune anaemia, neutropenia and thrombocytopaenia. In the last two situations the spleen serves as the major site of antibody production. The abnormal or diseased spleen gives rise to two major syndromes; hypersplenism and symptomatic splenomegaly. Hypersplenism refers to anaemia, neutropenia and/or thrombocytopaenia arising singly or in combination as a direct result of enlargement from whatever cause of the spleen. The diagnosis is confirmed retrospectively by correction of the cytopenia after splenectomy.[1,9] Hypersplenic thrombocytopaenia results largely from increased platelet pooling within the spleen. As many as 98% of total blood platelets may be sequestered in an enlarged spleen and there is some evidence that splenomegaly shortens platelet survival.[10,11] The neutropenia of hypersplenism probably results purely from an increased margination pool of granulocytes in the vessels of the enlarged spleen. Hypersplenism often also occurs in conditions that result in bone marrow failure. Extramedullary haematopoiesis may occur in the inherited haemolytic anaemias which soon leads to hepatosplenomegaly and bone expansion.[9] Symptomatic splenomegaly is most commonly encountered in lymphoproliferative and myeloproliferative disorders. Increased metabolism may give rise to weight loss, fever, hyperhidrosis, and vague left upper quadrant pain associated with reduced blood flow and resulting infarction.[21]

3. Indications for splenectomy

3.1. Absolute indications

The absolute indications include ruptured spleen, treatment of splenic cysts and abscesses as all organ is usually affected, and tumour resection involving adjacent organs (Table 1).[1,9,22]

It can be very difficult to decide whether a patient needs an emergency splenectomy after trauma, particularly when the patient is haemodynamically stable and has minimal signs of abdominal injury. Special investigations do not provide absolute answers and the risk of delayed and unnecessary laparotomies will remain. Focused assessment with sonography for trauma (FAST) is an excellent investigation for haemoperitoneum in blunt trauma with a sensitivity of 88%.[23] An emergency laparotomy is indicated for a positive FAST in the shocked patient. A CT scan with intravenous contrast is the single most useful investigation in the haemodynamically stable patient as it can assess for intraperitoneal fluid, solid organ injury and retroperitoneal haematoma. Repeated scanning (ultrasound or CT) have been found particularly helpful in assessing splenic bleeding or haematoma especially if patient is slowly dropping her haemoglobin.[24–26] Laparoscopy has no role in trauma (Table 2).[24]

Table 1
Absolute indications for splenectomy.

Splenic trauma
Splenic rupture
•Spontaneous (tropical splenomegaly)
• Delayed rupture (subcapsular haematoma from trauma)
Splenic abscess (e.g. tuberculous infection)
Splenic cysts
Neoplasm
• As part of radical surgical oncological clearance of adjacent tumour. e.g. locally advanced gastric carcinoma, pancreatic carcinoma
• Angioma
• Primary (rare)
Aneurysm of splenic artery

Table 2
Grading of splenic injury – spleen injury SCALE (1994 Revision).[24]

Grade	Injury type	Description of injury
I	Haematoma	Subcapsular, <10%
	Laceration	Capsular tear, <1 cm parenchymal depth
II	Haematoma	Subcapsular, 10–15%, intra parenchymal, <5 cm d
	Laceration	Capsular tear, 1–3 cm parenchymal depth, trabecular vessel not involved
III	Haematoma	Subcapsular, >50% or expanding, ruptured subcapsular or parenchymal haematoma, intra parenchymal haematoma >5 cm or expanding
	Laceration	>3 cm parenchymal depth or involving trabecular vessels
IV	Laceration	Involving segmental or hilar vessels producing major devascularisation (>25%)
V	Laceration	Completely shattered spleen Hilar vascular injury with devascularised spleen

❖ Advance one grade for multiple injuries up to Grade III.

Because the risks of uncontrolled haemorrhage and major transfusion are greater than OPSI, splenectomy should be performed without delay if splenic bleeding is not controlled during laparotomy. However, if a splenic tear is found which is not actively bleeding with adherent clot it should be left undisturbed.[22,24,25] The growing awareness of possible long term complications and the increasing reports of the failure of prophylactic measures have led increasingly to the use of partial splenectomy with retention of some splenic tissue wherever possible, especially in children following splenic trauma.[26,27] Splenic salvage techniques are more feasible in children because of the greater ratio of splenic capsular tissue to pulp tissue. They include partial splenectomy, splenorrhaphy, ligation of segmental vessels and capsular repair.[1,28] Partial splenectomy may be considered with deep tears to the hilum but should only be performed if there are no other life-threatening injuries as it is a complicated surgery.[26,28] Thus, the conservative thing to do in splenic trauma is splenectomy and it is prudent to err on the side of splenectomy in all major multiple trauma and military cases.[24,25] Superficial splenic tears may be sutured using absorbable mattress sutures buttressed with Surgicel, teflon or omentum. Ligation of segmental vessels at the splenic hilum may be useful in obtaining haemostasis from a splenic tear. Topical haemostatic agents e.g. microfibrillar collagen (fibrin glue) and absorbable envelopes have also been used successfully to preserve the spleen.[1,28] Splenosis and auto transplantation may have some minor immunological function but have not been shown to be effective in preventing overwhelming post splenectomy infection.[27] It seems likely that the normal splenic vasculature is crucial for maximum protection. Indeed there has been some uncertainty of the level of splenic function achieved by partial splenectomy especially if more than half the spleen is removed or the splenic artery has to be tied as the patient probably loses most immunological benefit.[3] It would be prudent to institute similar prophylactic measures in these patients to prevent infection as for asplenic individuals.[29]

3.1.1. Non-operative management

The current management of trauma is usually dictated by the age of the patient, the experience of the institution, the individual surgeon and the type of trauma.[1] Non-operative management of splenic trauma has also become an option. 20–40% of laparotomies performed for haemoperitoneum reveal that bleeding has stopped and that the injuries do not require surgery.[20] The practice began in the 1970's in paediatric patients and was highly successful with an average failure rate of 10.8%. The majority of failures occurring in the first 24 h.[30] In an isolated splenic trauma in a haemodynamically stable patient with no evidence of continuous bleeding, regular observations and haemoglobin measurements may be suitable for at