Surgery of the spleen

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Abstract

A normally functioning spleen is critical in providing adequate immune protection and in regulating blood homoeostasis. Whereas primary disorders of the spleen can attenuate these important functions, absence of the spleen, most commonly as a result of surgical excision, carries the grave and lifetime risk of devastating systemic sepsis. With some historical exceptions, splenic surgery has classically involved removal of the entire organ at open surgery, either following traumatic injury or to supplement the medical management of haematological disorders. Performed primarily for this latter indication, laparoscopy has emerged over the last two decades as the strongly favoured approach for elective splenectomy, with very large splenic size being one of the few remaining reasons for a planned open approach. Even in skilled hands, laparoscopic splenectomy can prove technically demanding, where careful patient selection and recognition of major complications including haemorrhage, portal system thrombosis and pancreatic injury, requires considerable experience. Whether performed under emergency or elective circumstances and undertaken as an open or laparoscopic procedure, an optimal surgical outcome depends on the successful collaboration between surgeon, anaesthetist, haematologist and radiologist in the preoperative and postoperative phases. Finally, it is paramount that in patients undergoing splenectomy, sufficient attention is given to providing effective lifelong prophylaxis against post-splenectomy infection.

Keywords Haematology; laparoscopy; sepsis; splenectomy; trauma

Introduction

With its name derived from the Greek, "splḗn," and Latin, "lien," the spleen was characterized classically by Hippocrates according humorism. This identified the spleen as responsible for the production of yellow bile and, in parallel with the element of fire, corresponded to the choleric, or easily angered, of the four temperaments. Following on from these ancient classifications, the spleen has become recognized as an organ with critical roles in immune function and red blood cell regulation and accordingly is functionally conserved in virtually all vertebrates.

Disorders of the spleen resulting in functional attenuation are rare and result in hyposplenism, most commonly as a consequence of sickle cell disease, coeliac disease or long-term use of corticosteroid. The term asplenism is reserved for those conditions where splenic activity is absent, and can be functional or follow splenectomy. Elective surgery to remove the spleen is most often performed for haematological disease, where combined multidisciplinary care by surgical, anaesthetic and haematological specialists in the preoperative and postoperative phases ensures comprehensive and safe management in these complex patients. However, emergency splenectomy is still undertaken following iatrogenic or traumatic injury, although advances in imaging and interventional radiological techniques have identified an important role for non-operative management.

In the asplenic patient, a critical concern is the appropriate prophylactic management of sepsis. Timely vaccination, combined with antibiotic therapy, reduce the incidence of post-splenectomy infection which can otherwise rapidly progress to multi-organ failure and death. However, despite the presence of anti-microbial guidelines for the routine management of post-splenectomy patients, a significant number of patients remain without adequate sepsis prophylaxis.

Indications for splenectomy

Elective splenectomy

Elective splenectomy is routinely performed laparoscopically if anatomically and technically feasible[1–3] and most frequently undertaken for benign haematological disorders including idiopathic thrombocytopenic purpura, itself accounting for 50–80% of elective laparoscopic splenectomies, and haemolytic anaemia.[1,2,4] Less frequently, splenectomy for oncological purposes is performed in the context of primary or, more rarely, metastatic tumours of the spleen or the very occasional staging of specific haematological malignancies including lymphoma. En-bloc removal of the spleen may alternatively form part of resection for malignancy in pancreatic tail lesions.[5]

Emergency splenectomy

Emergency splenectomy is typically performed using conventional open surgical approaches in the context of trauma or iatrogenic injury to the spleen. Whereas some series have suggested that such splenic injuries constitute the principal indication for splenectomy,[6] there exists considerable variation, with other centres where perhaps elective splenectomy is undertaken routinely reporting that only approximately 16% of spleens were removed for trauma. The spleen is the most commonly injured organ in the abdomen despite the classical description of protection by the lower ribs and costal margin.[7] Although principally associated with road traffic accidents, falls and sporting injuries, spontaneous rupture of the spleen can also occur where the spleen is enlarged as a result of haematological or infectious pathology, such as Epstein–Barr virus infection or malaria, or where there is excessive anti-coagulation.

Iatrogenic injuries to the spleen at laparotomy are not uncommon and occur in approximately 1% of colorectal resections requiring splenectomy in around 85% of cases. In a separate study, after splenic flexure mobilization, unplanned splenectomy was most frequently performed during anti-reflux surgery, left nephrectomy and aortic surgery, particularly where there had been previous surgery or in the obese. The authors reported that approximately 40% of all splenectomies were carried out for inadvertent operative injury. Traction injuries to the lower pole of the spleen following excessive manoeuvring during colonoscopy

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have also been reported, although these instances are rare. A specific danger under these circumstances is that bleeding can be occult and recognized late after haemodynamic deterioration.

Whether iatrogenic or traumatic, injuries to the spleen have been characterized according to the extent of injury[7] (Table 1). Injury grading is anatomical and based on radiological assessment by CT or operative findings and not systematically correlated with clinical outcome. Nevertheless, mortality from traumatic grade V injuries was significantly greater at approximately 23% than with each of the lesser grades, which varied from 6.9 to 9.4%, whereas each grade was significantly predictive of length of hospital stay.[7] Despite these predictive shortcomings, characterizing the extent of injury and assessing the clinical status of the patient provides important information regarding surgical care. This is because in patients who are haemodynamically stable with low grade injuries, successful splenic conservation by non-operative management is both achievable and favourable when compared with open splenectomy in terms of overall morbidity and without the lifelong need for post-splenectomy prophylaxis. Under these circumstances, it is the authors practice that these patients are carefully observed over 72 hours in a high-dependency ward setting, the period within which most failures of non-operative management occur, and urgent laparotomy undertaken where there is any physiological deterioration.[8] It has been reported that approximately 10% of patients selected for non-operative management will progress to surgery.[8] Indeed, failure of non-operative management is associated with high grade splenic injury and in centres where trauma workload is low.

The success of non-operative management is critically dependent on careful appraisal of CT imaging and attention to any alteration in haemodynamic behaviour, since an underestimation of physiological instability or injury severity has been implicated in approximately 40% of failed non-operative cases. As a consequence of comparatively lower grades of splenic injury and perhaps an increased desire to avoid splenectomy, non-operative management is highly favoured in the paediatric setting and successful in over 90% of injuries in children.[9] By contrast, some investigators have suggested that in patients greater than 55–60 years of age, higher grade injuries and failure of non-operative management are more likely and contribute to the greater overall mortality of around 10% observed in this age-group, compared with 5% in younger patients. These data support the notion that in the elderly, surgery might be contemplated early, even in the presence of low grade splenic injuries, whilst patients remain physiologically well. Of those treated without surgery, careful observation only is required following discharge from high-dependency care, with follow-up CT imaging identified as of little clinical value.

Techniques involving interventional radiology are an adjunct to spleen-conserving management following traumatic injury. Recent work has identified a potential role for CT angiography and embolization, suggesting selective use in stable patients with evidence of radiologically active haemorrhage and/or pseudoaneurysm and appropriately severe splenic injury. Whilst some authors have suggested that embolization might improve the success of non-operative management in these patients,[10] others have shown no difference.[11] One small retrospective study has even proposed the use of embolization in patients with high grade injuries who are haemodynamically unstable, whereas the broad consensus is that these patients should always be managed surgically.[8] At present, selection criteria for arterial embolization in patients with splenic injury are poorly defined in non-randomized studies with small patient numbers, where comparative failure rates requiring splenectomy, post-embolectomy sequelae and longer-term outcome require to be clarified.

American Association for Surgery of Trauma Organ Injury Scale for Spleen[7]

Grade		Injury description
I	Haematoma	Subcapsular, <10% surface area
	Laceration	Capsular tear, <1 cm parenchymal depth
II	Haematoma	Subcapsular, 10–50% surface area; intraparenchymal, <5 cm in diameter
	Laceration	1–3 cm parenchymal depth, which does not involve a trabecular vessel
III	Haematoma	Subcapsular, >50% surface area or expanding; ruptured subcapsular or parenchymal haematoma; intraparenchymal haematoma >5 cm or expanding
	Laceration	>3 cm parenchymal depth, or involving trabecular vessels
IV	Laceration	Laceration involving segmental or hilar vessels producing major devascularization (>25% of spleen)
V	Haematoma	Completely shattered spleen
	Laceration	Hilar vascular injury which devascularizes spleen

Table 1

Open splenectomy

Indications

The principal indication for open splenectomy is splenic trauma in the haemodynamically unstable patient, regardless of the severity of injury or planned non-operative management. Alternatively, patients with an iatrogenic splenic injury during abdominal surgery unresponsive to conservative methods including fibrin glue, oxidized regenerated cellulose sheets or fibrinogen/thrombin impregnated patches should undergo splenectomy. Traditional conservative techniques including omental patches, absorbable mesh bags and spleen-conserving resection are rarely undertaken. Open splenectomy may also be undertaken as a primary elective procedure in patients with massive splenomegaly not amenable to a laparoscopic approach.[2,12]

Surgical technique

Following administration of oxygen therapy, fluid resuscitation, antibiotic prophylaxis, with available cross-matched red cells and coagulation factors, adequate exposure is gained through an upper midline or left subcostal incision. In controlling haemorrhage, priority should be given to dividing the lieno-renal ligament to facilitate medial and anterior splenic mobilization,