JAMC, Vol. 1, No. 3, 1988

GENERAL ARTICLE

SPLENECTOMY INDICATIONS, HAZARDS AND ALTERNATIVES

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Historical Developments

The spleen is a friable and highly vascular organ lying in the left hypochondrium within the protection of the rib cage. It contains 25 per cent of the body's lymphoid tissue and has both haematological and immunological functions, the true importance of which have only recently been recognised.

Galen described the spleen as an organ full of mystery,[1] which he thought eliminated the thick, earthy atrabilions humours formed in the liver. This cleansing idea was shared by Maimondies in the twelfth century; he emphasized the blood-purifying properties of the spleen. Observing patients, who were congenitally asplenic yet leading normal lives, Aristotle concluded that the spleen was not essential to life, a contention that remained unchallenged by the experimental work of Wren and Morgagni[4] in the seventeenth and eighteenth centuries.

When the first human splenectomy was performed is unknown. Piny recorded that the Ancients would remove the spleen from athletes to improve their 'wind', but this seems most unlikely. The first total splenectomy for disease is atributed to Adriano Zaccarello in 1549,[5] although it has since been suggested that the excised viscus was an ovarian cyst. Nicholas Mathias is credited with the first total splenectomy for trauma in 1678[7] following an injury which left the spleen viable but outside the abdomen; the patient survived at least six years. In the absence of a clear understanding of splenic function, subsequent reports of healthy survivers led increasingly to the concept that no evil effect followed splectomy. Thus total excision came to be regarded as of little consequences.

The first warning notes were sounded in 1919[11] when asplenic rats were found to be more susceptible to infection and to have a diminished lifespan. The authors admonished surgeons to be cautious about removal of the spleen, but this warning went unheeded for another 30 years untill King and Shumacker[12] reported an increased susceptibility to infection and death from sepsis in infants following splenectomy. The same complication has since been reported in older children and adults.

This review will discuss the current indications for splenectomy, the hazards faced by the asplenic patient and the means by which total splenectomy may be avoided when appropriate.

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Indications for Splenectomy

Traumatic Rupture: Immediate, Iatrogenic, Delayed, Spontaneous.

Hypersplenism: Primary splenomegaly, Secondry splenomegaly.

Neoplasia: Lymphoma including Hodgkin's, Leukaemias and Massive haemangioma.

With Other Viscera: Total gastrectomy, Distal pancreatectomy, conventional splenorenal shunt.

Others: To prevent graft rejection, Splenic cysts, and Splenic abscess.

Trauma: The spleen is the commonest internal organ to be injured in blunt abdominal trauma. Usually a blow or crush injury to the abdomen or left lower thorax or a fall onto a protruding object is the cause. Splenic injury is frequently associated with fractured ribs and often with other internal damage. The spleen is more likely to rupture when pathologically enlarged. Another common cause of splenic rupture is iatrogenic injury during other surgical operations. Rupture of an injured spleen may be delayed for hours or weeks, although in many cases the delay is actually in the diagnosis.

Hypersplenism: Hypersplenism can be defined as a state characterized by splenomegaly plus depression of one or more of the cell counts in the circulating blood which is wholly attributable to the splenic enlargement.

A common cause of splenomegaly and hence hepersplenism in many parts of the world is parasitic infestation, usually with malaria, schistosomiasis or leishmaiasis. The prevalence is very variable, but tropical splenomegaly effects 60 per cent of the population in some areas. Splenectomy may be necessary to relieve the hypersplenism or the cycle of infarction and pain. Careful monitoring and antiparasitic therapy are required to ameliorate the effect of splenectomy on the host's immune defences.

Neoplasia: The spleen is often involved in patients with lymphomas or leukaemias. There is some evidence that splenectomy may induce remission in chronic granulocytic leukaemia. At present nearly 20 per cent of splenectomies occur during staging laparotomy for Hodgkin's disease.

With Other Viscera: Splenectomy is routine part of total gastrectomy or distal pancreatectomy for malignancy. Firstly it facilitates the operation, and secondly it permits a more adequate clearance of the regional lymph nodes. Splenectomy is also undertaken during the construction of a concentional splenore al shunt, but unless the patient has appreciable hypersplenism this procedure can be avoided by the construction of an M graft.

Other Indications: There is some evidence that splenectomy before renal transplanation reduces the incidence of graft rejection. This view has yet to gain widespread acceptance.

Splenic cysts are rare. They may be congenital, degenerative, parasitic or traumatic. Splenectomy is at present the recommended treatment but marsupialization may prove to be as effective without the immune consequences. Splenic abscess is also uncommon, which is fortunate since the mortality rate is over 40 per cent despite the use of antibiotics. Treatment

aimed at early splenectomy and high dose chemotherapy produces the best results.

Effects of Splenectomy: Some 35,000 patients per annum undergo splenectomy in the USA. The precise effect of splenectomy have only recently been delineated, although the first scientific studies were reported from St. Thomas Hospital at the end of the last century.

Haematological: Splenectomy removes the ability of the system to model the red blood cells and increases the number of circulating abnormal forms, shown by an increase in the number of Howell-Jolly bodies and target cells. There is almost invariably leucocytosis and thrombocythaemia which reach their peak 7-14 days after splenectomy. The rise in the patient count results from increased production and is not due to prolonged platelet survival.

Immunological: The immunological effect of splenectomy is dependent on the age at the time of operation, being greatest under one year, IgM levels fall and remain low for one year,[15] before slowly returning to normal four years postoperatively. IgM levels remain constant or increase, while IgA level rise.

Early Post-Operative Risks

Haemorrhage: Elective operations should only be a problem when the spleen is grossly enlarged. Vascular adhesions to the diaphram and peritoneum can bleed heavily, and if this is a problem the splenic artery should be ligated at an early stage.

Pyrexia: Minor degree of collapse of the left lower lobe. Subphrenic absecess is uncommon and usually results from a post-operative haematoma.

Venous Thrombo-Embolism: Splenic and portal venous thrombosis do occur but are most likely in patients with pre-existing. Ischaemic heart disease, increase in whole blood viscosity and decrease in red cell deformability which occur after splenectomy. Both of these factors have been shown by the Franmingham study to increase the risk of developing ischaemic heart disease.

Other Risks: Operative damage to the tail of pancreas or gastric wall can occur, leading to fistula formation.

Mortality: The mortality rate is dependent on the age of the patient and the indication for splenectomy. In elective operations it varies from 2 per cent for idiopathic thrombocytopenic purpura to 20 per cent for myelosclerosis. The risk and dangers of post-splenectomy sepsis are discussed below.

Post-splenectomy Sepsis: Post-splenectomy sepsis frequently starts as an insidious illness, although death can occur within a matter of hours. Well described by Diamond, the features are those of overwhelming infection, including rigors, abdominal pain, shock and disseminated intravascular coagulation.

Prophylaxis: The role of splenosis or splenic preservation in preventing post-splenectomy sepsis will be discussed below. Alternatives if total splenec-

tomy is unavoidable are vaccination and long term antibiotics. Vaccines are now available against 14 types of pneumococci as well as Haemophilus influenzae and Neisseria memingitidis. Unfortunately these polyvalent vaccines do not cover all possible infecting organisms and are ineffective below the age of 2 years.[20] Splenectomy itself reduce the response to vaccination, a response which is further diminished if concomitant chemotherapy or radiotherapy has been administered.

Alternatives to Emergency Splenectomy: Successful splenic repairs were first performed 90 years ago, but it is only in the last few years that interest in the possibility has revived. Preservation of all or part of the spleen is obviously dependent on the extent of the damage to the organ itself and the adjacent viscera. The following means of preserving splenic tissue have been described after traumatic rupture of the spleen.

Conservative Treatment: Surgeons have frequently noted at laparotomy for splenic trauma that clot has already formed and the bleeding has stopped, especially if there is only a small capsular tear. Radio-isotope scanning can be used to monitor the extent of the splenic injury and may be repeated if the haematoma is thought to be enlarging. There have been about 100 case reports of conservative treatment of splenic injuries to childhood with excellent results.

Alternatives to Splenectomy for Trauma:

Conservative management	—	No laparotomy
Pressure plus topical agents	—	Microfibrillar collagen Thrombin and Gelatin foam and Cyanoacrylate Adhesive.
Splenorrhaphy	—	Mattress suture, Omental wrape, Suture tadders and Polyglycolic Acid mesh.
Arterial Ligation	—	Main trunk and Primary division.
Partial Splenectomy	—	Upper Pole and Lower Pole.
Autotransplanation	—	Splenosis and Deliberate implanation.

There have been no adequate studies of the applicability of this approach in adults.

Topical Applications: The most direct approach to simple lacerations for capsular tears is the application of pressure combined with gelatin sponge, thrombin or microfibrillar collagen (Avitene). The use of microfibrillar has long been advocated to prevent the need for splenectomy after iatrogenic injury.

Splenorraphy: More severe injuries require removal of any divitalized splenic tissue followed by an attempt at repair. Simple suture with or without Tellon buttresses, has been recommended by many authors. The technique is simple in children who have a 3 greater reaction of capsule to splenic pulp. The incorporation of omentum, syanoacrylate adhesive or microfibril-

lar collagan into the mattess the haemostatic effect.

Arterial Ligation: Although the main arterial supply to the spleen is via the splenic artery, it is also nourished via the short gastric and left gastro suture, then ligation of the splenic artery is feasible.[5] Division into end arteries occurs outside the spleen, and usually only the effected branches need be tied. In cases of hillar rupture the main splenic artery can be ligated above the body of pancrease without apparent splenic.

Partial Splenectomy: Partial splenectomy can be performed because of the segmental nature of the blood supply. The operation was successfully performed as soon as 1867. Most individuals have two primary lobar intrasplenic branches. So that upper or lower pole splenectomy can be accomplished by a finger-fracture technique. Haemostasis is secured by suture and the use of omentum or microfibrillar collagen.

Splenectomy and authotransplanation: If the spleen is completely separated from its body apply, then splenectomy is indicated. Interest has recently focussed on the ability of autotransplanation to prevent post-splenectomy sepsis. The smaller risk of post-splenectomy has been linked to the presence of functioning splenic cells.

Alternatives to Elective Splenectomy—Staging Lapatotomy: Splenectomy as part of a staging procedure for Hodgkin's disease was first introduced in 1959. Effective chemotherapy was not then available. This apparently benign procedure is not without its problems. There is a 31 per cent minor complication rate (mainly sepsis) and a 4 per cent major complication rate. Laparotomy and splenectomy are clearly essential if local irradiation is being considered as the only treatment.

Tropical Splenomegaly: Problems arise from the increased tendency of enlarged spleens to rupture and from ill health due to the cytopenia. Though splenectomy may be desirable,[11] it does reduce the immune response to the parasite. In patient with malaria a trial of long-term proguanil therapy is warranted, as it may lead to a reduction in spleen size with an improvement in the cytopenia.

Hypersplenism: It results from myeloproliferative and lymphoprolifarative disorders, which may respond in the first instance to chemotherapy, but the critical mass which should be retained is unknown. Furthermore laparotomy is required. Hypersplenism as a result of portal hypertension may be treated by same form of portasystemic shunt. Conventional splenorenal anastomosis with splenectomy may be employed despite the increased risk of postplenectomy sepsis.

Splenic Cysts: Simple external drainage appears to be effective, but the course is often prolonged. Miller treated three patients by marsupialization into the peritoneal cavity with good results. Occasionally the cyst lining can be stripped from the parenchyma. Splenectomy remains the treatment of choice for hydatid disease.

Conclusion

The historical concept of the spleen as a superfluous organ is obviously untrue. It plays an important role in the immune defence system, which is maximal in childhood but remains important throughout life. Techniques of splenic conservation are now well established and total splenectomy should often be avoidable. Post-splectomy sepsis is a serious and often fatal condition against which routine vaccination and or long term antibiotic therapy confer partial protection. The risk is particularly high in young children, warranting a very conservative surgical approach or aggressive prophylaxis if splenectomy is unavoidable. The likelihood of dangerous septic episodes in adults after splenectomy for trauma is certainly of a much lower order, since prophylaxis to every splenectomized patient, but the possibility can not be ignored. Lastly, if conservative measures fail after traumatic rupture, then splenectomy is essential to save life.

REFERENCES

1. Galen: On the Usefulness of the Parts of the Body. May Mt translator. New York: Cornol University Press 1968.
2. Rosner, F. The spleen in the Taimud and other early Jewish Writings. Bull. Mist. Med. 1972; 47: 82-85.
3. Buntain, W.L. and Lynn, H.B. Splenerrhapy: Changing concepts for the traumatised spleen. Surgery, 1979; 86: 743-60.
4. Fioravanti, L. II tesore della Vita Humana. Division un Libri Quattro. Venice: Appresso Gili Heredi ei Melchior Sessa. 1570 I & II. Chapter S.
5. Oakes, D.D. Splenic Trauma. Cur. Prob. Surg. 1981; 18: 343-401.
6. Mattheas, N., De Excise liene ex homine, sine nexa Ephen Med Physician Dec II Ann III 1684. 378.
7. Morris, D.M. and Bullock, E.D. The importance of the spleen in resistance to infection. Ann. Surg. 1919; 70: 513-21.
8. King, M. and Shumacker, M.B. Jr. Splenic Studies. I. Susceptibility to infection after splenectomy performed in infancy. Ann. Surg. 1952; 136: 239-42.
9. Dixon, J.A., Miller, F.M., Clogkey, D. et al. Anatomy and Techniques in segmental splenectomy. Surg. Gynea Obstet. 1980; 150: 516-20.
10. Eichner, E.R. Splenic function normal too much and too little. An J. Med. 1979; 66: 311-20.
11. Glees, J.P., Barr, L.C. McElwain, T.J. et al. The changing role of staging laparotomy in Hodgkin's disease a personal series of 310 patients. Dr. J. Surg. 1982; 69: 181-87.
12. Pitts, B. and Hallance, C.A. Three cases of splenectomy. Clinical surgery's Treatment. 1896; 29: 181-87.
13. Clarat, I., Morales. L., and Montamer, A. Immunological studies in the post-splenectomy syndrome. J. Pediar Surg. 1975; 10: 59-64.
14. Orda, R., Barak, J., Raron, J. et al. Post-splenectomy splenic activity. Ann. Surg. 1981; 194: 771-74.
15. Stock, F.E. The Surgical treatment of cirrhosis of the liver. Qnn. R. Coll Surg. Engl. 1952; 10: 187-207.
16. Robinette, C.D., and Fraumeni, J.F. Splenectomy and subsequent normality in veterans of the 1939—45 War. Lancer. 1977; 2: 129-29.
17. Neier, M.E. Splenectomy and serious infections. Scand, J. Maematol. 1980; 24: 5-12.
18. Walker, W. Splenectomy in childhood a review in England and Wales. 1960-5 Br. J. Surg. 1976; 63: 36-43.
19. Ein, S.M., Shandling, B. and Simpson, J.S. et at. The morbidity and mortality of splenectomy in childhood. Ann. Surg. 1977; 185: 307-310.