Surgery in Africa - Monthly Review

Is Splenic Preservation after Blunt Splenic Injury Possible in Africa?

Introduction

The spleen is one of the most commonly injured abdominal organs. Prior to the 1970s the treatment for a traumatic ruptured spleen was splenectomy. The recognition, that patients without a spleen have an increased risk of death from overwhelming infection, led surgeons to consider methods of splenic preservation. (1) Initially operative repair, splenorraphy, was attempted. (2) Subsequently, in North America and Europe, where the majority of abdominal injuries are from blunt trauma, usually road traffic accidents (RTA), and with the introduction of the CT scan, non-operative management (NOM) became popular and then predominant. (3) Today, 90 percent of blunt pediatric splenic injuries and about 60-70% of adult ones are managed non-operatively in the West. This Review will summarize the key aspects of splenic preservation in trauma and consider whether this treatment plan can be applied to the conditions of modern Africa.

Overwhelming post-splenectomy infection and post-splenectomy prophylaxis

Hansen (4) reviewed the condition of sepsis after splenectomy. Patients, mostly children, who had their spleens removed for trauma had a 58-fold increase in risk of sepsis. Overall 2.4% of post-splenectomy patients suffered sepsis; more than 50% of these were fatal. Most infections occur in the first 5 years after splenectomy. Patients with thalassemia and sickle cell anemia are at increased risk of infection and death after splenectomy. Encapsulated organisms – pneumococcus, hemophilus and meningococcus account for most of the infections. Risk of infection and especially mortality rates can be significantly reduced by vaccination and antibiotic regimes of twice-daily Penicillin V. Patient compliance and emergence of antibiotic resistant organisms are two realistic concerns. Patients and family should be taught that all infections should be treated promptly with antibiotics. Pneumococcal vaccination should be delayed until 14 days after splenectomy. (5) Hemophilus and meningococcal vaccination should also be considered. The spleen plays a central role in clearance of the malaria parasite. (68) Numerous cases reports have been published (6, 7, 63) documenting severe malarial infection and fatality in splenectomized patients. Recent reports recommend lifelong prophylaxis for these patients living in endemic areas. (64)

Non-operative management

Children

The age of non-operative management (NOM) began in the 1970s with a report from the Hospital for Sick Children in Toronto, Canada. (1) Initial resuscitation and assessment of the traumatized child follows the ABCs of trauma management. (8) If there are signs of hemodynamic instability, then a bolus of 20ml/kg of warm Lactated Ringers is given. This may be repeated once, if necessary. Continuing shock mandates replacement with whole blood and in those cases, laparatomy is usually necessary to control bleeding. Diagnostic peritoneal lavage has historically been used to identify patients with intra-abdominal injuries in blunt and penetrating trauma and it still may play a role, particularly in the unconscious and unstable patient. However its lack of specificity has yielded to newer technologies. (9) In

the stable patient an abdominal CT scan with oral and intravenous contrast accurately identifies the degree of splenic damage and concomitant injuries.
NOM protocols initially required hemodynamic stability, isolated splenic involvement, low grades (1-3) of CT defined injuries and conscious patients (to allow for assessment of peritonitis). Except for the necessity of hemodynamic stability, all the other criteria have been greatly expanded. While classification of splenic injury on the basis of CT scan has been standardized (10) and correlates with need for operative intervention, (11) all levels of splenic injury have been treated non-surgically. Even children with CT scans showing a contrast blush, indicative of active bleeding, have been managed non-operatively. (12) The success rate in these cases is reduced. (13, 14) Hemodynamic instability remains the single mandatory operative indication. CT scan may miss injuries to hollow viscera. With blunt trauma these occur in less than 3% of cases. (15) This possibility mandates frequent re-examination of the abdomen. (16)
Most children who require laparatomy do so within 5 hours of injury. Failure rates for NOM are in the range of 5% and mortality rates from the injured spleen itself have approached zero. Few cases of delayed hemorrhage are seen, although splenic pseudocyst, abscesses and pseudaneurysms occur with higher grades of injury. The majority of children with isolated splenic injury do not require a blood transfusion and patients treated with NOM have lower blood requirements. Non-operative management of blunt abdominal trauma can also be applied to liver injuries although the mortality rates are higher. (17)
Having proven the utility of non-operative management, recent studies have stressed more uniform application of NOM, (18, 19, 20) improved results with dedicated pediatric trauma units, (21) evidenced-based guidelines for resource management, including restriction of ICU monitoring, (22) and follow-up. Interestingly the value of follow-up imaging has not been proven (23, 24) and recommendations for time to full activity, excluding contact sports, have been reduced to grade of injury plus 2 weeks. (25)

Adults

Following its success in children, NOM has been applied increasingly to adults, although with lower success rates. (26) Again, hemodynamic instability is the main indication for surgery. A multi-institutional study from the USA (27) showed success rates of 54% for NOM. Another large retrospective study (28) showed 27% of patients required immediate surgery and a further 11% failed NOM. Patients older than 55, those with increasing grades of splenic injury and higher trauma scores are felt to be at increased risk for operative management. Bearing the increased risks in mind, these patients can be treated with the standard protocol. (29, 30, 31) Older women were especially likely to fail NOM. (32)
NOM has been applied to patients with associated injuries (33) including head injuries. Meguid (34) recommended 72 hours of observation in the ICU for adults. Ochsner (35) and Velhamos (36) reviewed the factors associated with increased risk of failure of NOM in adults. These include need for blood transfusion, evidence of a large hemoperitoneum on US or CT, contrast blush, and higher grade of splenic injury. As with children, follow-up imaging procedures have not been found useful, (37) although the risk of delayed rupture appears greater in adults. Demetriades (39) comments on these emerging trends and offers some treatment algorithms which are applicable to high technology situations.
Both the pediatric and adult literature on NOM in splenic injury suffers from an almost complete absence of Randomized Controlled Trials. A MEDLINE search from 1966 yields 2500 articles linked to Surgery or Injuries and the Spleen. Not one was a RCT. Retrospective studies do not allow recommendations to be made with confidence.

Additional issues

Penetrating trauma and pathologic spleens

Penetrating abdominal trauma generally continues to be a mandatory indication for laparatomy. (38) However, Pachter (2) has expanded the use of NOM to selected isolated penetrating injuries and also to trauma patients with splenomegaly from HIV. Spontaneous rupture of the spleen is well documented in patients with active malaria (65) as well as other infectious tropical conditions. Hamel et al in 2002 discuss the issue of non-operative management and splenorraphy in these cases. (66) NOM has been practised for over 20 years in Papua New Guinea where a high prevalence exists of ruptured spleens enlarged by malarial infection. In this setting splenic preservation has been possible in over 70% of cases. (67)

Abdominal Ultrasound versus CT scan

Richards et al (40) assessed the value of US in the diagnosis of blunt splenic injury. Using detection of free fluid as the indicator US had an overall sensitivity of 67%. The ability to detect parenchymal abnormalities was much lower. Catalano (41) used second-generation contrast agents to enhance the diagnosis of parenchymal injuries. Using an abdominal US system called FAST – Focused Abdominal Sonogram for Trauma, Ma (42) achieved 90% sensitivity of fluid detection with a 5 view approach. Ochsner (43) cautioned against the sole use of US in abdominal trauma. In a review for the Cochrane Database, Stengel (44) concluded there was insufficient evidence to base a clinical treatment pathway on US alone.

Angiography

Recently, interventional radiologists have attempted to expand the applicability of NOM through splenic artery embolization. (18, 45, 46) These procedures have complications (47) and their role in the treatment algorithm has not yet been established.

Splenorraphy

When splenic injury mandates operative intervention, the surgeon should consider repair of the injured spleen unless the patient's condition requires expeditious splenectomy. Pachter (2) and Upadyaya (1) give very good descriptions of the alternate procedures available. Mobilization of the spleen into the wound is mandatory. Bleeding is then controlled by application of a vascular clamp to the splenic hilum. Direct suture with teflon pledgets, fibrin glue application, mesh splenorraphy, segmental resection, splenic artery ligation are all options to achieve splenic preservation. Auto-transplantation has not been proven. At least 50% of splenic substance must be preserved to maintain function. Keramides (48) showed that patients, undergoing splenic artery ligation, retained splenic function. In a study of 326 splenic injuries (49) from both blunt and penetrating causes, splenorraphy was possible in 45% with a low risk of re-bleeding. Lower grades of splenic injury were more amenable to repair.

Splenic Trauma in Africa

While NOM has been effectively practised in the Europe and North America for over 25 years in children and over 15 years in adults, it is virtually absent from Africa. The pattern of abdominal trauma in Africa is evident in a report from Nigeria (50) in 2003 where more than half of the injuries were penetrating. The spleen was injured in 58% of blunt abdominal trauma. In a study of splenic injuries, also from Nigeria, (51) all patients were subjected to surgery despite the fact that 66% of cases were due to RTA. Of these, only 13% had splenic preservation with splenorraphy. In a final report from Nigeria (52), all but 1 of 32 children with blunt abdominal trauma, were subjected to operation. Splenic preservation was possible in sixty percent of patients with lower grade splenic injuries. The author blamed lack of suitable imaging for the high rate of operative intervention. In a report from the Assir region of Saudi Arabia (53) published in 2004 with 87% of patients involved in motor vehicle accidents and presumably suffering blunt splenic trauma, the splenectomy rate was 95%. Five percent were managed conservatively.

A number of real, but unanswered, questions limit the advisability of applying NOM protocols in Africa. Can the hospital meet the monitoring requirements: frequent and accurate haemoglobin determinations, high-level nursing care and monitoring of vital signs, in-house surgical capability, rapid mobilization of the operating room and transfusion facilities for the small, but real, number of NOM failures? Studies have shown that anemia is widespread in sub-Saharan Africa especially among children and women of childbearing age. (54, 56, 57, 58, 59, 60) Is there a different response to injury and lower tolerance for internal haemorrhage in the average African, with haemoglobin levels of 8-10 compared with 12-14 for their North American counterparts?

Under these conditions of near universal surgical intervention, splenorraphy for splenic preservation has much to recommend it. However, like any surgical procedure, skill in its execution has to be acquired. African surgeons are unlikely to have at their disposal the technical material, like fibrin glue or dexon mesh, which makes splenorraphy more successful.

The huge technological disparity between the developed world and Africa is apparent in the management of trauma. Today, only a tiny minority of injured Africans have access to CT scanning. Diagnostic peritoneal lavage, which now has limited use in western hospitals, still plays an important role in the assessment of blunt abdominal trauma in Africa. (61, 62)

The incidence of overwhelming post-splenectomy infection in Africa is unknown. Certainly, the lack of availability of vaccines or easy and prompt access to antibiotics, makes its prevention more difficult. Is its risk higher than in developed countries? What is the effect of splenectomy on subsequent malaria infection? Under-five child mortality rates in sub-Saharan Africa are 25 times greater than those in Canada and are primarily caused by perinatal factors, malnutrition, malaria and other infectious diseases. (55) The problem of post-splenectomy infection must be seen in this context.

Conclusions

Non-operative management of blunt splenic and liver injuries has become the norm in Europe and North America for both children and adults. Despite the absence of RCTs, NOM has shown itself superior to laparotomy, through practise, in terms of mortality rates, blood transfused and splenic preservation. The management protocols all use abdominal CT scanning to diagnose the degree of splenic injury and to rule out associated abdominal injuries requiring surgery. However the sole indication of need for surgery is clinical – hemodynamic instability. Despite its ability to diagnose free intra-peritoneal fluid, authorities have been reluctant to recommend ultrasound as the sole diagnostic tool.

Splenic preservation in trauma remains a challenge for Africa. Africans suffering from blunt splenic injuries have not benefited from NOM. It is clear that as long as NOM is dependent on the availability of CT scanning, it cannot be offered to most injured Africans. Splenorraphy appears a better alternative. Its success will be dependent on operator experience.

The current epidemic of road traffic accidents in Africa is providing increasing numbers of patients with blunt splenic injury. What is the optimum treatment protocol under the current conditions? This is an important but unresolved question.

Recommendations

1. At the present time one cannot readily recommend the institution of NOM protocols for blunt splenic injury in Africa.
2. African surgeons, in collaboration with western trauma surgeons, should consider developing treatment protocols for blunt splenic injury specific to African conditions, which use NOM, but do not require CT scanning, and apply these in well-designed RCTs. These might logically start with low-risk, pediatric patients.
3. Techniques of splenorraphy should be taught in African surgical training programmes.
4. Research into the impact of splenectomy in Africa, in particular the rate and consequences of post-spenectomy infection should be undertaken. The relationship of splenectomy and malarial disease needs to be studied.
5. All patients who undergo splenectomy should be counselled with regard to post-splenectomy sepsis and offered vaccination and antibiotic prophylaxis. Lifelong prophylaxis against malaria may also be appropriate for those living in endemic regions.

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