CASE STUDY

Late-Presenting Complications After Splenic Trauma

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Abstract

Since the 1970s, the management of blunt splenic trauma has evolved from almost exclusive surgical management to selective use of nonsurgical management in hemodynamically stable patients. Understanding of the spleen's immunologic importance in protection against overwhelming postsplenectomy infection led to development first of surgical techniques for splenic salvage and later to protocols for nonsurgical management of adults with blunt splenic injury. The evolution of nonsurgical management has resulted in new patterns of postsplenic trauma complications.

This article describes a pancreatic pseudocyst, one of several described delayed complications of nonsurgical management of blunt splenic trauma. Along with missed splenic injury and delayed rupture, the development of a splenic pseudocyst represents challenges for any multidisciplinary team involved in trauma care. Detection and management of these complications is discussed, as is postsplenectomy vaccination and return to activity.

Case Presentation

A man, age 19 years, presented to his Primary Care physician with left upper quadrant pain. One month earlier, he had been found to have infectious mononucleosis. Outpatient abdominal ultrasonography revealed splenomegaly with contour irregularity of the spleen. Computed tomography (CT) demonstrated a very large splenic pseudocyst (Figure 1). He was referred to general surgery for further treatment.

The patient was a high school athlete who had been recruited to attend a prominent university on a sports scholarship. He was scheduled to begin training approximately five months after presenting to the general surgery clinic. He requested an intervention that might allow him to return to sports as quickly as possible.

After consultation with an attending trauma surgeon at a local trauma center, plans were made for Interventional Radiology to aspirate the pseudocyst. A clinician easily removed 1500 mL of old blood, and only a small residual fluid collection remained after the procedure. One month later, follow-up CT demonstrated reaccumulation of the fluid. This time, an indwelling drain was placed by Interventional Radiology. Over the next month, the fluid collection resolved and the drain was removed.

One month later, the patient reported increasing left upper quadrant pain. Repeat CT demonstrated recurrence of the fluid collection. It was again percutaneously drained, this time augmented by the use of tissue plasminogen activator administered through the drain. Another month passed, the fluid collection resolved, and the spleen appeared normal on CT. The drain was removed.

The patient did well for one month. He attended training camp after the team physician was contacted and fully apprised of the patient's recent medical history. Unfortunately, the patient became febrile. Laparoscopic splenectomy was attempted and was unsuccessful. He therefore underwent open splenectomy and recovered uneventfully.

Figure 1. Large splenic pseudocyst

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Discussion

This case represents one of several delayed complications of blunt splenic injury encountered by our general surgery team. Along with missed splenic injury and delayed rupture, the development of a splenic pseudocyst represents challenges for any multidisciplinary team involved in trauma care.

Missed splenic injury is the most common cause of preventable death after blunt abdominal trauma.[2]

Since the 1970s, the treatment of blunt splenic trauma has evolved from almost exclusively surgical to selective use of nonsurgical treatment in hemodynamically stable patients. Understanding of the immunologic importance of the spleen and its role in protection against overwhelming postsplenectomy infection (OPSI) led to development first of surgical techniques for splenic salvage and later to protocols for nonsurgical treatment of adults with splenic injury. Presently, >60% of adults with splenic injury are successfully treated without surgery.[1] The evolution of surgical treatment has resulted in new patterns of postsplenic trauma complications.

Missed Splenic Injury

Missed splenic injury is the most common cause of preventable death after blunt abdominal trauma.[2] Compared with patients in whom injury is promptly recognized, those with delay in diagnosis of splenic trauma have a ten-fold increase in mortality.[3] It is therefore important to have a high index of suspicion for this diagnosis when evaluating patients with blunt trauma. The most common finding associated with splenic rupture is left lower rib fractures, which occur in >40% of cases. When such fractures are present, further assessment with abdominal and pelvic CT is required. The classic triad associated with blunt splenic rupture—left hemidiaphragm elevation, left lower lobe atelectasis, and left pleural effusion—is frequently absent and cannot be considered a reliable indicator. Any patient who does have left hemidiaphragm elevation after blunt trauma should be considered to have a splenic injury until it is proven otherwise. Once the diagnosis is made, treatment depends on the hemodynamic condition of the patient. Unstable patients require emergency splenectomy, whereas those in stable condition can undergo nonoperative management.

Delayed Rupture of the Spleen

Delayed splenic rupture was first described in 1902 by Baudet,[4] who noted its occurrence 48 hours after trauma. The incidence is approximately 1%, and it tends to occur between 4 and 8 days after injury.[5] Mortality ranges from 5% to 15%, compared with 1% mortality for acute injury.[6] Potential mechanisms include expansion of a subcapsular hematoma, clot disruption, or rupture of a pseudoaneurysm or splenic pseudocyst. Prompt recognition of the signs and symptoms of delayed splenic rupture is essential. Patients typically exhibit hypotension, tachycardia, worsening abdominal pain and distension, and a decreasing hematocrit. The treatment of choice is splenectomy, as splenorrhaphy can be extremely difficult in patients in whom surgical treatment has failed. Some centers will perform angioembolization in hemodynamically stable patients.

Splenic Pseudocyst

The diagnosis of splenic pseudocyst is becoming more common, probably because of the increasing use of CT and ultrasonography to evaluate complaints of upper abdominal pain as well as the increased frequency of nonoperative treatment of blunt splenic trauma. Thirty percent to 60% of splenic pseudocysts are asymptomatic,[7] causing problems only as they enlarge. Common presenting complaints include left upper quadrant pain and nausea and vomiting because of compression of the stomach. Diagnosis is made in the setting of a history of blunt abdominal trauma, upper abdominal pain, and a perisplenic cyst on abdominal imaging.

The optimal treatment for splenic pseudocysts remains to be defined. Splenectomy was the traditional treatment of choice. With increasing recognition of the immunologic importance of the spleen, this fell from favor. A number of spleen-preserving techniques have been attempted, including watchful waiting, percutaneous drainage (as done in our case), marsupialization/fenestration, splenic decapsulation, and complete cystectomy with partial splenectomy. Marsupialization entails making an opening in the cyst wall to allow drainage to occur. Decapsulation requires near-total resection of the cyst while leaving the spleen intact with part of the cyst wall attached to the capsule.

Small series have been reported in the investigation of various methods for treating splenic pseudocysts. Percutaneous drainage has had varying degrees of success, but most series have shown high recurrence rates, sometimes in 100% of patients. Laparoscopic fenestration has been successful in some cases, as has open decapsulation. One series of seven patients concluded that small cysts (<5 cm in diameter) were likely to resolve spontaneously, although this could take up to three years. Larger cysts in that series required some sort of intervention; percutaneous drainage failed in 10% of patients, necessitating cystectomy with splenectomy or splenorrhapy.[8] In a more recent series of

six patients, the failure rate for percutaneous drainage and laparoscopic fenestration was 100%. The authors believed that complete removal of the cyst, with partial or complete splenectomy, ought to be the procedure of choice in young, otherwise healthy patients with large symptomatic splenic pseudocysts.[9] In retrospect, this probably would have been the best option for our patient, allowing quicker recovery and fewer invasive procedures.

Overwhelming Postsplenectomy Infection

OPSI, typically caused by the encapsulated organisms *Streptococcus pneumonia, Haemophilus influenza,* and *Neisseria meningitidis,* occurs in 0.05% to 2% of patients who have undergone splenectomy.[10] It may develop immediately or as late as 65 years after splenectomy. Mortality is significant and as high as 50%.[10–12]

After splenectomy, reduced levels of immunoglobulin M, opsonins, and splenic tuftsin hamper the body's ability to clear encapsulated bacteria. Vaccination to stimulate immunity against these organisms is commonly done despite the absence of strong data to support its efficacy. As concerns have been raised about the ability to generate an appropriate immune response in the perioperative period, especially in the critically ill, controversy exists regarding the optimal timing of vaccination.

Two prospective randomized, controlled trials have shown that pneumococcal vaccine results in the highest antibody titer response when given 14 days after splenectomy.[13,14] Prospective data support the vaccination of asplenic patients, on the basis of knowledge of the spleen's role in protection against infection by encapsulated organisms.[15] Need for revaccination has been established by prospective studies of antibody levels and efficacy after initial vaccination.[11] There are no data from prospective randomized, controlled trials identifying appropriate timing for vaccination before elective splenectomy. Patients are typically vaccinated 2 weeks before surgery, but this practice is supported only by retrospective data.[13,14]

The Centers for Disease Control and Prevention (CDC) recommends that after splenectomy, all patients receive 23-valent pneumococcal vaccine (Pneumovax 23), meningococcal vaccine (Menactra for patients between the ages of 16 and 55 years and Menomune-A/C/Y/W-135 for those older than 55 years), and *Haemophilus influenzae* type b vaccine (HibTITER). Vaccination should take place two weeks before elective splenectomy or two weeks after emergency splenectomy. A booster dose of pneumococcal vaccine is recommended after five years. Patients who receive the meningococcal polysaccharide vaccine (Menomune A/C/Y/W-135) should be revaccinated every three to five years. Patients who receive the meningococcal polysaccharide diphtheria toxoid conjugate vaccine (Menactra) probably should be revaccinated every three to five years. Long-term studies regarding revaccination are ongoing, and the manufacturers suggest contacting them for their latest recommendation. The HibTITER vaccine does not require repeated administration.

The recommendation to give the vaccines two weeks after emergency splenectomy must be tempered by the patient's reliability. Many trauma centers give the vaccines immediately before the patient is discharged home in case the patient does not return for follow-up care. In addition to vaccination, all patients must be educated about the signs and symptoms of OPSI and must be instructed to seek immediate medical attention for febrile illness. Asplenic travelers are advised to contact the CDC before traveling abroad, to learn about increased risk of contracting meningococcal infections in sub-Saharan Africa, India, and Nepal.

Return to Activity

Another area of controversy in the treatment of patients after splenic trauma is timing of return to activity. Few data exist regarding activity guidelines after discharge from a hospital or trauma center. Traditionally, patients have been told to refrain from physical activity for three months after splenic injury.[16] A survey of members of the Eastern Association for the Surgery of

Table 1. AAST Spleen Organ Injury Scale (1994 revision)

Grade	Type of injury	Injury description
I	Hematoma	Subcapsular, nonexpanding, <10% surface area
	Laceration	Capsular tear, nonbleeding, <1 cm parenchymal depth
II	Hematoma	Subcapsular, nonexpanding, 10% to 50% surface area; intraparenchymal, nonexpanding <5 cm diameter
	Laceration	Capsular tear, active bleeding; 1cm to 3 cm parenchymal depth which does not involve a trabecular vessel
III	Hematoma	Subcapsular, >50% surface area or expanding; ruptured subcapsular hematoma with active bleeding; intraparenchymal hematoma >5 cm or expanding
	Laceration	>3 cm parenchymal depth or involving trabecular vessels
IV	Hematoma	Ruptured intraparenchymal hematoma with active bleeding
	Laceration	Laceration involving segmental or hilar vessels producing major devascularization (>25% of spleen)
V	Laceration	Completely shattered spleen
	Vascular	Hilar vascular injury which devascularized spleen

AAST = American Association for the Surgery of Trauma

Trauma (EAST) was published documenting how members of this society treat their patients after blunt splenic trauma. In patients with grade I or grade II (Table 1)[17] injury, the majority of respondents allowed resumption of light activity in two weeks and full activity in six weeks. These decisions were rarely based on repeat imaging with CT but were primarily based on clinical judgment. In patients with a higher grade of injury (III, IV, or V), half of respondents allowed their patients to return to light activity in four to six weeks. The other half waited two to three months. As for return to full activity, patients were told to wait for four to six months by 20% of surgeons when they had a grade III injury and by 30% of surgeons when they had a grade IV or grade V injury. Five percent of surgeons did not allow return to full activity for high-grade injuries for longer than six months.[18] With higher-grade injuries, there was more reliance on CT findings after discharge in decision making, which is contrary to recommendations in the current literature.[19]

Pediatric trauma series have demonstrated more concrete evidence of timing for splenic injuries to heal. CT has documented that 90% of grade III injuries healed in 76 ± 7 days and that 77% of grade IV injuries healed within 81 ± 8 days.[20] Although there are no studies proving that adult spleens heal at the same pace as those of children, those healing rates suggest that activity restriction for four to six months for adults may be excessive. As this issue can significantly affect quality of life in a typically young and otherwise healthy population, there is a need for a well-designed study to address it.

Conclusion

Delayed complications of blunt splenic trauma may be encountered in settings outside of trauma centers. Practitioners must be familiar with these issues and involve appropriate specialists as needed in the care of patients with splenic injury. ❖

Disclosure Statement

The author(s) have no conflicts of interest to disclose.

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