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Successful utilisation of angioembolisation and delayed laparoscopy in the management of Grade V post traumatic splenic injury: a Case Report

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I. Introduction

Trauma is a major cause of morbidity and mortality, and in the developed world, motor vehicle accidents are one of the leading causes. Up to 45% of patients with blunt abdominal trauma will have a splenic injury.[1] The management of splenic injuries has evolved over the past few decades with the realisation of the importance of the spleen in immunological defence against encapsulated organisms and a better understanding of the role of non-operative management of splenic injuries. Historically, the most common treatment of traumatic splenic injury was operative management with splenectomy. The idea that a splenectomy is the only appropriate treatment for blunt splenic injuries was based on the concept that the spleen is a fragile, vascular structure unsuitable for suturing lacerations, that there is a risk of uncontrollable bleeding in the absence of surgical removal, and the high mortality rate associated with non-operative management.[2] Currently, however, due to advances in modern medicine, a splenectomy is now one of several possible treatment options along with angioembolisation or non-operative management in the form of active observation. Such management has been aided by better diagnostic and monitoring facilities and by advances in interventional radiology. We report a case of a grade V post traumatic splenic injury successfully managed with the novel approach of combination angioembolisation and delayed laparoscopic abdominal washout.

II. Case Report

A 31-year-old male with no medical comorbidities and normal body mass index (BMI) presented to our emergency department overnight following a motor vehicle accident. On arrival, he was hypotensive and tachycardic with a blood pressure of 99/67 mmHg and a heart rate of 98 beats per minute respectively. On primary trauma survey, he was alert and orientated with a Glasgow Coma Score (GCS) of 15, a patent airway and otherwise normal breathing and oxygen saturations. On physical examination of his abdomen, the patient was focally tender in the epigastrium and left upper quadrant with peritonism. A focused assessment with sonography for trauma (FAST) scan was conducted which was positive for peri-splenic and peri-hepatic intra-abdominal free fluid. Computed tomography (CT) angiogram of the brain, chest, abdomen, and pelvis showed a grade V splenic injury as per the splenic injury scale of the American Association for the Surgery of Trauma (AAST), with large volume four quadrant hemoperitoneum without active bleeding (Fig. 1) as well as left sided ninth and tenth minimally displaced rib fractures.

On routine blood tests, the haemoglobin (Hb) was 127 g/L (reference range of 130-180), platelet count $229x10^9$/L (reference range of 150-450), international normalised ratio (INR) of 1.1 (reference range <1.3) and mild acute kidney injury with estimated glomerular filtration rate (eGFR) of 57 (reference range of >60). The patient was resuscitated with fluid and multiple blood products after activation of massive transfusion protocol (MTP), after which he remained hemodynamically stable. Given the patient's clinical stability after resuscitation and absence of ongoing physiologic impairment, the decision was made for active observation overnight and splenic artery embolization (SAE) the following morning. Digital subtraction angiography (DSA) of the splenic artery was performed into the proximal splenic artery and revealed multifocal contrast pooling of the spleen and a small area of heterogenous splenic parenchymal blush consistent with grade V multifocal traumatic splenic injury (Fig. 2). Proximal SAE was performed with combination of coiling and gel foam with a follow up angiogram showing successful complete embolization. No post procedural complications were noted.

After angioembolisation, the patient was monitored with daily serial haemoglobin and clinical examinations and underwent a planned delayed laparoscopic abdominal washout at 72 hours post SAE to remove the known large volume hemoperitoneum found on initial CT imaging prior to embolization. This is a novel approach to the management of grade V splenic injuries and has been adopted by our hospital institution with good success thus far. In this case, the patient tolerated the procedure well and had an uneventful post-operative recovery. At two weeks after admission, the patient was fully recovered and was discharged home. There were no further bleeding complications on follow up outpatient clinic review and the patient had no evidence of Howell-Jolly bodies indicating splenic preservation post SAE.

III. Discussion

Isolated splenic injuries can be found in about one-third of blunt trauma and in 25-30% of patients who have suffered a motor vehicle accident.[1] Efficient and effective management of traumatic splenic injury is imperative in decreasing morbidity and mortality. Historically, the most common treatment of traumatic splenic injury was operative management with splenectomy. However, in the 1970's, an observed increase in infection rates from encapsulated bacteria in patients who underwent splenectomy prompted re-evaluation of splenic injury management.[2,3] Since that time, mounting data has continued to identify splenectomy as a risk factor for severe infection known as overwhelming post-splenectomy infection (OPSI), supporting the spleen's role in infection prevention.[5,6,7,8] Subsequently, in combination with modern diagnostic imaging and advancement of endovascular techniques, splenic artery embolization has now become more widely used in the management of traumatic splenic injury as a spleen-salvaging treatment for non-operative management (NOM) of splenic trauma.

The decision for operative management in patients with blunt abdominal trauma is heavily based on initial clinical presentation. Patients who present in shock or with haemodynamic instability despite resuscitative efforts are typically triaged for emergent splenectomy.[9,10] For the hemodynamically stable patient, NOM is considered the current standard of care for splenic trauma with an estimated success rate of 80-90%.[11] Imaging assessment is paramount in characterising and grading splenic injury and potentially determining management. The most widely used splenic injury grading system was developed in the American Association for the Surgery of Trauma (AAST) and includes various imaging-based criteria regarding type, size, and location of injury. [12] The grading system was recently revised in 2018 to include additional criteria concerning splenic vascular injury, such as imaging evidence of contrast extravasation.[13] Currently, splenic injury of AAST grade III or higher, or evidence of active extravasation of contrast, splenic vascular injury (eg. pseudoaneurysm), and/or large intraperitoneal blood volume on imaging are all potential indications to proceed with angiographic evaluation and embolization in hemodynamically stable patients.[9, 14, 15, 16]

Our patient had a Grade V splenic injury, which refers to splenic vascular injury with active bleeding extending beyond the spleen into the peritoneum.[13] According to current literature, SAE as part of NOM has demonstrated improved outcomes compared to observation alone for the management of grade IV and V splenic injuries.[17,18] Haan *et al*. reported success rates of 83% for grade IV and V injuries with SAE compared to 67% and 25% respectively, with observation alone.[14] In concordance with the current literature, a NOM approach was also used for our patient described.

NOM has been described as a safe procedure when availability of experienced surgeons, modern imaging modalities, intensive care units (ICU), and other supporting services are assured.[4] While NOM carries the risk of missed hollow visceral injuries or delayed bleeding, operative management (OM) in the form of a splenectomy is naturally associated with the possible side effects of any surgical intervention, depending on a variety of patient, medical, and technical factors. NOM enables reduction of non-therapeutic laparotomies with potential intra-abdominal complications and unnecessary transfusion risks, thereby resulting in overall lower costs and decreased morbidity and mortality compared to splenectomy alone.[8, 19]

Moreover, data from the Splenic Injury Outcomes Trial, a multi-institutional study by the AAST, patients were followed at 30, 90, and 180 days. The risk of splenectomy was only 0.3% after 180 days.[20] A separate review of 26 patients who received follow-up at a mean time of 36 months after embolization did not show any interim medical consultations, hospitalisations, procedures related to rebleeding, or other embolization-related complications.[21]

Our case demonstrates that combination SAE and delayed laparoscopic abdominal washout at 72hours post SAE is an effective management strategy for blunt splenic trauma in hemodynamically stable patients with grade V splenic injury with associated hemoperitoneum. Persistent large volume hemoperitoneum in grade V splenic injuries are a cause of ongoing abdominal pain and possible peritonitis even after successful angioembolisation. Accordingly, in our institution, the primary role of surgery has shifted in select patients from laparotomy and splenectomy to delayed laparoscopy post SAE in order to address the aforementioned complications. In this way, abdominal pain secondary to hemoperitoneum is managed and splenic immune function is preserved, with an overall decrease in morbidity and mortality compared to operative management

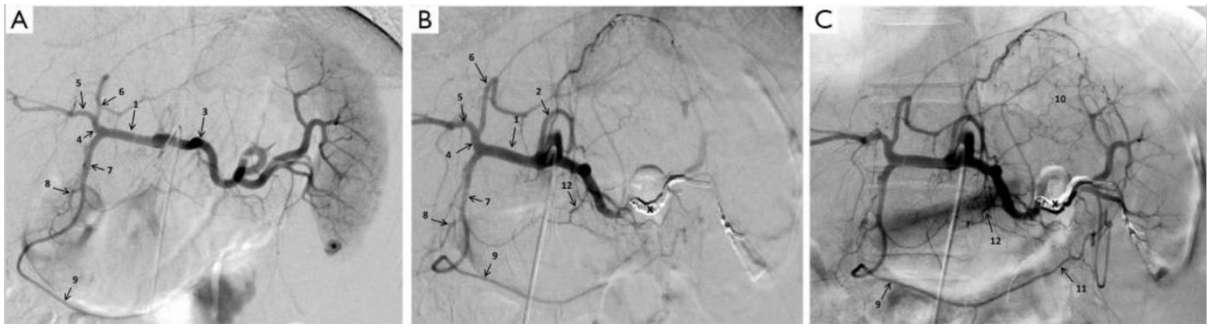
with splenectomy. Preservation of immune function is an important consideration favoring SAE over splenectomy. Several studies suggest that splenic immune function is preserved after SAE, both in pediatric and adults. In accordance with these studies, the immune function was tested in our patient as well by measuring general blood counts, Howell-Jolly bodies, as well as antibody response to the PPV-23 vaccine after SAE – and preservation confirmed.

IV. Conclusion

Splenic injury, as reported in the literature, is the most common visceral injury in closed abdominal trauma- particularly following motor vehicle accidents. Non-operative management of blunt injury to the spleen in adults has been applied with increasing frequency. Our case illustrates that splenic artery angioembolisation in combination with planned delayed laparoscopic abdominal washout of hemoperitoneum can be a quick, safe, and effective method of managing grade V traumatic splenic injury. Importantly, the preference of conservative treatment must be based on the haemodynamic stability of the patient and their clinical status. The conservative treatment of splenic embolization has the advantage of being performed under local anaesthesia and represents a feasible, safe, and effective therapeutic alternative to splenectomy with reduced morbidity and mortality. In conclusion, we present the novel approach of SAE and delayed laparoscopic abdominal washout in the successful management of grade V post traumatic splenic injury with splenic perseveration.

Fig 1. CT angiogram of the abdomen and pelvis in Coronal (right) and Axial (left) views showing a grade V splenic injury as per the splenic injury scale of the American Association for the Surgery of Trauma (AAST) with peri-splenic and peri-hepatic hemoperitoneum

Fig. 2 DSA images demonstrating haemorrhage in the inferior splenic pole (asterisk) before (A) and after (B, C)



proximal coil embolization

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