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Angiographic Embolization of a Post-Traumatic Splenic Pseudoaneurysm

Case Report

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Abstract

After the liver, the spleen is the second most commonly injured organ in blunt abdominal trauma. The past two decades have witnessed a trend towards non-surgical management of these injuries, and transarterial embolization (TAE) has greatly contributed to avoiding unnecessary laparotomies, especially in haemodynamically stable patients. We present the case of a 21-year-old male patient involved in a motor accident with subsequent injury of the left thorax and fracture of the left ulna. Abdominal computed tomography revealed the presence of a parenchymal haematoma and a pseudoaneurysm of the splenic artery. Since the patient was haemodynamically stable, he was admitted to the clinic and the pseudoaneurysm was treated with distal selective TAE. Six months later, he remains asymptomatic without signs of pathology on Doppler ultrasound at follow-up. The use of these modalities can contribute to better success rates of NOM and should be readily available at any hospital treating trauma patients.

Key words:
Splenic trauma, Angiographic embolization, Splenic pseudoaneurysm, Embolization of splenic artery.

Introduction

The spleen is a highly vascularized organ in the left upper quadrant of the abdominal cavity and the second most frequently injured organ in abdominal trauma, after the liver[1]. Motor and sport accidents, along with falls from a height are the most common causes of splenic trauma. Surgical splenic salvage procedures and non-operative management (NOM) with the aid of transarterial embolization (TAE) have been increasingly adopted in the last two decades owing to the significantly increased risk of sepsis in otherwise normal hosts following traditional splenectomy [2-3]. This is particularly true for haemodynamically stable patients and for those who develop rare complications like arteriovenous fistulas and pseudoaneurysms. The advances in interventional radiology and imaging techniques and the availability of these modalities in more hospitals have helped many patients who would otherwise have undergone traditional laparotomy and splenectomy. We present the case of a 21-year-old male patient who suffered a motorcycle accident, leading to splenic haematoma with subsequent development of a pseudoaneurysm, which was treated with distal selective splenic artery embolization.

Case report

Written informed consent was obtained from the patient for the publication of his personal data. A 21-year-old Caucasian male patient was admitted to our emergency department after a high-speed motorcycle accident. He was haemodynamically stable with a haematocrit level of 41% and a Glasgow Coma Scale score of 15. He had lacerations on the left part of his thorax and a fracture of the left ulna. The fracture was stabilized. Focused Assessment with Sonography for Trauma (FAST) revealed the presence of a small amount of blood in the peritoneal cavity as well as a small haematoma in the centre of the splenic parenchyma, without signs of active haemorrhage. The patient remained haemodynamically stable with no change in his haematocrit level; a computed tomography (CT) scan of the abdomen was ordered. A 2 cm intraparenchymal haematoma AAST/Baltimore grade 2 was detected, with no active contrast extravasation or other findings to suggest ongoing bleeding. Non-operative management was decided upon, and the patient was admitted to the clinic for observation. During the following days, the patient's clinical status remained stable, and though follow-up ultrasound examinations of the spleen showed that the haematoma was in remission, they also revealed the presence of a pseudoaneurysm of a small branch of the splenic artery. An angiogram for possible selec-

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tive embolization of the splenic artery was scheduled. Flush arteriography via the common femoral artery confirmed the presence of a pseudoaneurysm at an intrasplenic ascending branch of the splenic artery. Micro-catheters were introduced and distal selective embolization of the pseudoaneurysm was performed using coils. The patient suffered no post-embolization complications. At follow-up, ultrasonography detected the presence of reduced blood flow through the pseudoaneurysm, which eventually disappeared. The patient was dismissed three weeks after admission to the hospital. He remains asymptomatic 6 months after embolization with no signs of pathology on Doppler ultrasound at follow-up.

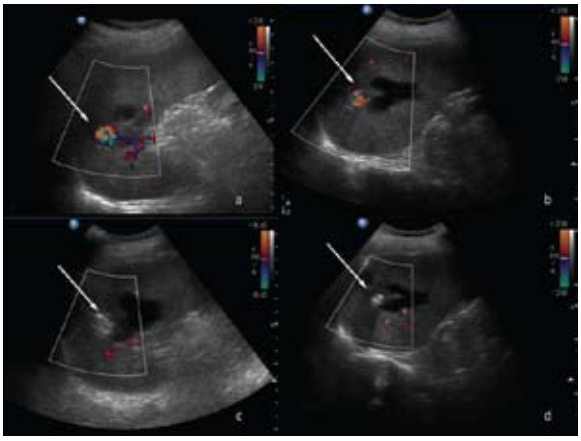

Fig. 1 a. Doppler ultrasonography showing the pseudoaneurysm before AE
b. Follow-up Doppler 4 days after TAE. Significant residual flow.
c. Follow-up Doppler 8 days after TAE. Blood flow through the pseudoaneurysm has almost disappeared
d. Follow-up Doppler 12 days after TAE. No residual blood flow. The white shadow at the tip of the arrow are the coils in place.

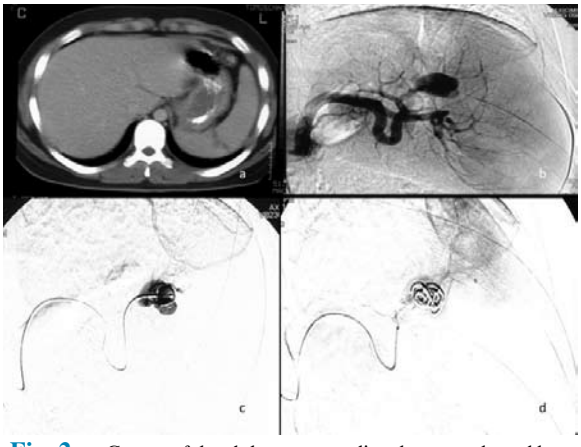

Fig. 2 a. Ct scan of the abdomen, revealing the parenchymal haematoma of the spleen
b. Arteriography showing the pseudoaneurysm of an ascending branch of the splenic artery
c. Coils being placed with reduction of the blood flow through the pseudoaneurysm
d. Multiple coils placed in the pseudoaneurysm

Discussion

In 2005, a study by Smith et al reported that 32% of all abdominal trauma cases included the spleen [1]. Most trauma centres prefer the use of FAST as the first means of detection of life-threatening injuries and intra-abdominal bleeding. Although its sensitivity for detecting haemoperitoneum is 90-93% [4], and the use of CT is debatable when a FAST exam has yielded a negative result, the FAST exam has very low sensitivity for splenic injury. Computed tomography is the most precise imaging modality for detecting and grading splenic injury and post-traumatic splenic complications. A study in 2006 found that CT had a sensitivity of 100%, specificity of 88% and overall accuracy of 93% in detecting splenic injury and predicting the need for intervention [5], although post-traumatic splenic vascular injuries (e.g., pseudoaneurysms or arterio-venous fistulas) may be difficult to differentiate since they are isodense or slightly hypodense in the parenchymal phase of the CT scan compared to the normal splenic tissue. The American Association for the Surgery of Trauma (AAST) developed a grading system based on the anatomic disruption of the spleen as shown on CT scans or during laparotomy [6]. However, this system has proved unreliable in predicting the outcome or helping the surgeon to discrimininate between patients in need of surgery and those who can be managed by conservative treatment and TAE [7-9]. Moreover, vascular injuries including active splenic bleeding, pseudoaneyrysms and arteriovenous fistulas are not included in this grading system. It was with this in mind that Marmery and colleagues designed the “Baltimore” grading system [10] based on the experience of multiple trauma centres. It seems to be better at predicting which patients require laparotomy or TAE, and also includes vascular injuries which are associated with rates of failure for NOM as high as 82%, according to Gavant and colleagues [11].

Splenic pseudoaneurysms following blunt abdominal trauma usually arise from direct damage to the splenic wall, or from rapid deceleration resulting in damage to the intima and elastic lamina of the splenic artery. They may be intrasplenic or extrasplenic and usually present as a pulsatile mass, a continuous bruit and thrill and, more seriously, with delayed rupture and bleeding. Some patients may be asymptomatic, as was our patient. In the event of progression to a long-standing fistula, portal venous hypertension or high output cardiac failure may result from an increase in intravenous pressure from the increased blood flow or arterialization of the portal venous system. Non-operative management includes observation with bed rest, and serial haematocrit levels with

subsequent CT scans every 48-72 hours. Deterioration of the patient's clinical state status is an indicator of the need for additional imaging or intervention. NOM usually fails due to delayed haemorrhage and, thus, definitive treatment is either embolization or splenectomy.

Sclafani et al [12] and Hagiwara et al [13] were the first to describe the successful use of arterial embolization in haemodynamically stable patients with success rates of up to 90%. Overall success of NOM with the use of embolization ranges from 86-100% [12-16]. These studies favour the use of arterial embolization in the presence of the following CT findings: active contrast extravasation, pseudoaneurysm or arteriovenous fistula, large haemoperitoneum, and a high grade of injury (grade III–V), although vascular injuries and large haemoperitoneum exhibit a higher rate of failure of NOM.

TAE is usually performed by catheterization of the common femoral artery. Flush aortography is usually performed initially to evaluate the arterial anatomy of the patient; this is followed by angiography of the splenic vessels to assess arterial injury. The radiologist must then decide whether to perform a proximal splenic artery embolization (PSAE) or a selective distal splenic artery embolization (DSAE) and what material to use.

When performing PSAE, a technique whose surgical equivalent is splenic artery ligation [17], the catheter's tip reaches the splenic artery at a point beyond the origin of the dorsal pancreatic artery and accomplishes haemostasis by lowering intrasplenic blood flow and promoting clot formation. However, adequate blood flow for splenic perfusion is provided by the short gastric vessels. This technique is used for patients with diffuse bleeding, multiple bleeding vessels or when tortuosity of the splenic artery will not allow selective embolization.

Selective distal embolization uses a micro-catheter to advance as close as possible to the site(s) of vascular injury and embolize only selected branches of the splenic artery or pseudoaneurysms and fistulas. This technique is reserved for patients with a few focal bleeding vessels in the spleen and those whose anatomy and haemodynamic situation allow the use of the technique. There is evidence to suggest that distal embolization may be associated with more frequent and larger splenic infarcts (as seen on CT scans) and higher rates of failure than proximal embolization. For these reasons, proximal embolization has recently been used more extensively than distal for the management of blunt splenic injuries. Nevertheless, both techniques have been used successfully, sometimes combined in the one patient.

Transarterial embolization with coils acts primarily by inducing thrombosis rather than directly occluding the lumen of the vessel. Gel foam, a biodegradable material which does not produce permanent embolization but is associated with a higher failure rate than coils, can alternatively be used.

Major complications after embolization of the splenic artery have been reported to occur in 6-20% of patients. The Western Trauma Association trial reported a major complication rate of 20% [16]. These complications included persistent bleeding or rebleeding (11%), missed injury (3%), and splenic abcess (4%). Two percent of the patients had coil migration at the time of angiography, without sequelae in any of these patients. Infarctions after embolization occurred in 21% of patients in this study. Puncture site-related complications (haematoma, dissection, thrombosis) after angiography are relatively rare.

Finally, it must be stated that TAE is not associated with significant change in the immunological function of the spleen [18-20], in contrast to the 2% post-splenectomy risk of sepsis which carries a mortality rate of 33%. [2-3]. No vaccination is indicated, except in those cases where the embolized spleen is found to be completely shattered. [21]

Conclusion

Angiographic embolization is gaining ground in many aspects of modern trauma management since these techniques can increase the success rates of NOM and splenic salvage. All hospitals treating trauma patients should provide an interventional radiology department. Nevertheless, well-designed prospective studies are required to define the specific indications for either embolization or laparotomy, and to establish clinical guidelines.

Conflict of interest

The authors declare that they have no conflict of interest.

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Ενδαρτηριακός Εμβολισμός Μετατραυματικού Ψευδοανευρύσματος της Σπληνικής Αρτηρίας

Ενδιαφέρουσα Περίπτωση

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Περίληψη

Οι κακώσεις του σπλήνα είναι μετά τις ηπατικές κακώσεις, οι δεύτερες πιο συχνές κακώσεις στα τραύματα της κοιλίας. Τις τελευταίες δυο δεκαετίες κυριαρχεί μια τάση προς την μη χειρουργική αντιμετώπιση αυτών των κακώσεων. Ο ενδαρτηριακός εμβολισμός έχει συμβάλει σημαντικά στην αποφυγή περιττών σπληνεκτομών ειδικά σε αιμοδυναμικά σταθερούς ασθενείς. Ασθενής 21 ετών, διεκομίσθη λόγω τροχαίου ατυχήματος με κάκωση αριστερού ημιθωρακίου και κάταγμα αριστερής κερκίδας. Ο ακτινολογικός έλεγχος ανέδειξε ενδοπαρεγχυματικό αιμάτωμα σπληνός και ψευδοανεύρυσμα σπληνικής αρτηρίας. Καθώς ο ασθενής ήταν αιμοδυναμικά σταθερός εισήχθη για παρακολούθηση και αντιμετωπίστηκε με ενδαρτηριακό εμβολισμό με microcoils. Ο ασθενής εξήλθε μετά από 3 εβδομάδες νοσηλείας χωρίς να χρειαστεί σπληνεκτομή. Είναι ασυμπτωματικός 6 μήνες μετά χωρίς παθολογικά ευρήματα. Η χρήση ενδοαγγειακών τεχνικών μπορεί να συμβάλει στην αύξηση του ποσοστού επιτυχίας της μη χειρουργικής αντιμετώπισης των κακώσεων του σπληνός και είναι απαραίτητο να είναι διαθέσιμη σε κάθε νοσοκομείο στο οποίο νοσηλεύονται πολυτραυματίες.

Λέξεις κλειδιά

Σπλήνας, Τραύμα σπληνός, Εμβολισμός σπληνικής αρτηρίας, Ψευδοανεύρυσμα σπληνικής αρτηρίας

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