CASE REPORT

Splenic rupture following synchronised direct current cardioversion

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SUMMARY

Atraumatic rupture of the normal spleen is a rare entity. Often, a triggering factor or minor physical event can be ascribed as the aetiology for rupture, including coughing, vomiting or minor medical procedures not involving the spleen. A 65-year-old man who was hospitalised for eosinophilic pneumonia developed haemodynamically unstable atrial flutter that necessitated urgent synchronised direct current cardioversion (DCCV). Two hours after successful cardioversion, he developed signs of an acute abdomen with free intraperitoneal fluid identified on bedside ultrasonography. Exploratory laparotomy revealed gross haemoperitoneum and splenic rupture requiring splenectomy. With exception of capsular defects and haemorrhage suggestive of organ rupture, the gross and histological examination of the spleen was otherwise unremarkable. The patient denied recent trauma. The cause of his spleen rupture was attributed to cardioversion and subsequent abdominal muscle contraction. This represents the first known case of splenic rupture associated with DCCV.

pneumonia had rapidly improved with corticosteroid therapy, but during hospitalisation, he spontaneously developed a tachycardia at 150 beats per minutes in association with his underlying AFL, which resulted in hypotension (blood pressure 80/57 mmHg), altered mentation and dyspnoea. He underwent synchronised DCCV using 250 J, which resulted in immediate conversion back to normal sinus rhythm. His tachycardia, hypotension, altered mental status and dyspnoea resolved. However, 2 hours after the DCCV, he acutely developed diffuse abdominal pain and exquisite tenderness to palpation on exam.

INVESTIGATIONS

At the onset of acute abdominal pain, point of care laboratory investigations showed a new lactic acidosis (pH 7.10 and lactate 8 mmol/L) with a sudden drop in haemoglobin from baseline 13 g/dL to 9 g/dL. The patient developed haemodynamic instability. Focused abdominal ultrasonography at the bedside revealed free fluid in the spleno-renal recess.

DIFFERENTIAL DIAGNOSIS

The differential diagnosis for acute abdominal pain, new lactic acidosis and free intraperitoneal fluid following cardioversion for AFL or atrial fibrillation (AF) can include mesenteric embolism, renal infarction, splenic infarction and other less likely complications such as bleeding in conjunction with anticoagulation use.^{1 2} The overall incidence of thromboembolism following cardioversion for AF is less than 1% in the 30 days following cardioversion in patients properly anticoagulated as this patient was.³ Embolism resulting in acute mesenteric ischaemia has been associated with cardioversion for AF; 96% of patients will present with abdominal pain, which can occur soon after sudden loss of mesenteric arterial blood flow.^{1 4} A rare thromboembolic complication of AF is splenic infarct, which can present as acute abdominal pain and tenderness to palpation in the left upper quadrant.^{2 5} An autopsy series of 96 splenic infarcts demonstrated that 67% of cases arose from an embolic source and cardiovascular diseases including AF were commonly implicated.² It is also important to note that cases of splenic infarct resulting in laceration and haemoperitoneum have been reported.^{6 7} However, the underlying acute, subacute and chronic infarcts should be evident on histopathological evaluation of the spleen when acute embolism is the cause.^{2 6}

BACKGROUND

Splenic rupture is commonly associated with blunt abdominal trauma. Atraumatic rupture is less common and is frequently associated with underlying pathology of the spleen that can result from infectious, haematological, malignant or inflammatory conditions. Atraumatic rupture of the normal spleen is rare. Referred to as atraumatic-idiopathic splenic rupture, a minor physical event is often identified as a precipitating cause. There are no previous reports that identify synchronised direct current cardioversion (DCCV) as a cause for splenic rupture.

CASE PRESENTATION

A 65-year-old man with history of atrial flutter (AFL) and two prior ablation procedures presented with dyspnoea and fever lasting 1 week and was found to have new pulmonary infiltrates, peripheral eosinophilia and hypoxaemia. Of note, he had no history of abdominal surgeries. He was admitted to the medical intensive care unit for his severe hypoxaemia, which was secondary to acute eosinophilic pneumonia; intravenous corticosteroids were administered for treatment. Metoprolol and amiodarone were started as part of a rate control strategy for AFL and apixaban continued for stroke prophylaxis, with plans for delayed cardioversion following discharge. The patient's eosinophilic

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Figure 1 Microscopic image of resected spleen (H&E stain) showing splenic capsule with adjacent extraparenchymal and intraparenchymal bland haemorrhage.

While embolic and ischaemic complications can occur, the free fluid on ultrasound exam along with hypotension and sudden drop in haemoglobin was suggestive of haemoperitoneum. In the setting of blunt abdominal trauma, the use of ultrasound has a sensitivity of 78.6% and specificity of 98% for detecting haemoperitoneum, and as the study can be obtained and interpreted rapidly, it is an excellent choice for initial evaluation.^{8,9} Positive results on focused abdominal ultrasound examination in the setting of haemodynamic instability necessitated the urgent need for exploratory laparotomy rather than additional confirmatory imaging such as CT.

TREATMENT

The patient underwent urgent exploratory laparotomy. Intraoperative findings included a laceration of the spleen with greater than 1 L of haemoperitoneum. There were no intra-abdominal adhesions identified. Splenectomy was performed, which facilitated haemostasis and improved patient stability.

OUTCOME AND FOLLOW-UP

Subsequent gross and histological examination of the spleen showed a weight of 62 gm (normal 155–195 g), dimensions of 8.0×7.2×4.5 cm and multiple capsular disruptions measuring up to 4.5 cm, which demonstrated recent haemorrhage on microscopic examination (figure 1). Congo red, Epstein-Barr virus and cluster of differentiation (CD) immunostains were negative for underlying splenic pathology. No haematological or other disease processes associated with splenic rupture were identified. The patient made a full recovery and was discharged from the hospital.

DISCUSSION

There are many reported cases of atraumatic rupture of a normal spleen with various underlying aetiologies and contributing factors. However, this is the first known case of electrical cardioversion causing splenic rupture.

Four criteria were proposed in a review by Orlaff and Peskin to qualify for spontaneous rupture of the spleen, including (1) absence of trauma, (2) no evidence of disease in organs other than the spleen known to affect the spleen adversely, (3) no scarring or perisplenic adhesions suggesting prior trauma or rupture and (4) other than haemorrhage, a normal microscopic and macroscopic examination.¹⁰ Though in many cases impractical to obtain, a fifth criteria was proposed by Crate and Payne for spontaneous rupture that included full virological studies in order to rule out viruses known to infiltrate the spleen. A less specific term of non-traumatic splenic rupture was therefore recommended.¹¹ Later, the term ‘atraumatic-idiopathic splenic rupture’ was proposed to describe the rare cases of exclusion that are without a clear aetiology and have normal spleen histological appearance, although there is debate whether this is a truly distinct clinicopathological entity or simply an unrecognised traumatic or pathological process.¹²

Atraumatic splenic rupture is an important clinical entity to recognise early. In one study, there was a pooled mortality rate of 12.2%, including worse outcomes for patients over the age of 40 years, those with splenomegaly and those with underlying malignancy.¹² True atraumatic rupture with no clear aetiology and a normal spleen occurs in roughly 7% of all atraumatic splenic rupture, but this patient group was demonstrated to have a significantly lower mortality of only 2%.¹² An extensive review of 607 cases of splenic rupture by Aubrey-Bassler and Sowers identified that the most common causes included underlying infection involving the spleen, medical procedure, neoplasm and haematological diseases.¹³ Among the cases of splenic rupture in the setting of a medical or surgical procedure, 96% of these (107 out of 112) were related to gastrointestinal or genitourinary procedures, or surgeries not directly involving the spleen.¹³

One potential mechanism for atraumatic rupture of a normal spleen is a result of sudden increase in intra-abdominal pressure following muscle contraction of the abdominal muscles and diaphragm.^{14,15} Other known causes for splenic rupture that likely involve this mechanism include coughing, vomiting, seizure and minor medical procedures such as electroconvulsive therapy, colonoscopy or extracorporeal shock wave lithotripsy.^{13,16–18} Akin to these previously reported causes, our patient experienced a sudden muscle contraction as a result of shock delivery during DCCV. Without any other appreciable aetiology for splenic rupture, normal macroscopic and microscopic spleen appearance (other than capsular rupture) and short time interval (2 hours) from DCCV to development of acute abdomen, the cardioversion itself was deemed to be the underlying cause for our patient’s ruptured spleen. Well-known complications of electrical cardioversion include induced arrhythmias, superficial skin irritation and embolism; however, there are no previous reports of internal organ damage including splenic rupture and haemorrhage.¹⁹

The use of anticoagulation medications has been associated with splenic rupture. Our patient was taking the direct oral anti-coagulant medication apixaban for stroke prophylaxis in the setting of underlying AFL. There is one known case of spontaneous haemorrhage resulting from cough in a patient receiving apixaban.²⁰ Other anticoagulation medications including thrombolytic agents, heparin and low-molecular weight heparin products, and warfarin have also been implicated as factors leading to spontaneous splenic rupture.^{13,21,22} While there is clearly an association between use of systemic anticoagulation and splenic rupture, some of these cases also describe existing underlying splenic pathology or other causative factors. In other cases, histological review of the ruptured spleen is not described,

which should be employed in order to rule out other contributing causes. One of the mechanisms proposed for these idiopathic cases of splenic rupture in the setting of anticoagulation medication use suggests that an altered haemostatic state may aggravate previously unrecognised 'micro-trauma' that results in haemorrhage.²³

While this patient's concomitant use of apixaban may have contributed to the extent of haemorrhage following splenic rupture, the injury itself appeared to be directly associated with the administration of DCCV, based on the short time in which his acidosis and haemorrhage manifested from acute intraperitoneal bleeding after shock delivery.

Learning points

- ▶ Atraumatic splenic rupture is a rare occurrence that is usually associated with underlying haematological, infectious or anatomic abnormalities, and should prompt investigation to ascertain the root cause.
- ▶ Atraumatic-idiopathic splenic rupture can be considered when there is no clear factor and normal spleen appearance on macroscopic and microscopic evaluation.
- ▶ The use of anticoagulant, thrombolytic and antiplatelet agents are associated with splenic haemorrhage and have the potential to worsen splenic injuries.
- ▶ This is the first known association between electrical cardioversion and splenic rupture, likely caused by a sudden increase in intra-abdominal pressure as a result from sudden abdominal muscle contraction during shock delivery.

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