



## Case report

# A spontaneous retroperitoneal haemorrhage resulting in abdominal compartment syndrome requiring laparotomy: A case report and proposed management algorithm

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## ABSTRACT

**Introduction and importance:** Spontaneous Retroperitoneal Haemorrhage (SRH) is a rare condition, which in its extreme state can result in Abdominal Compartment Syndrome (ACS). The aim of this case report is to provide an overview of the diagnosis and management of SRH and to present an algorithm to inform and guide clinical decision-making in the context of ACS.

**Case presentation:** A 74-year-old woman with multiple risk factors for SRH developed a tense abdomen in ICU post-cardiac graft study. Radiological imaging confirmed multiple bleeding points to the contralateral side of the graft access site. She underwent endovascular treatment for her condition, however, developed ACS necessitating surgical evacuation of the haematoma.

**Clinical discussion:** SRH is a rare condition that may be difficult to diagnose on physical exam. Medical, endovascular and surgical approaches are recognised treatments. ACS is an extreme variant of SRH and although endovascular management can specifically address the acute bleed, surgical evacuation of the haematoma is the only treatment that can effectively reduce abdominal compartment pressures.

**Conclusion:** SRH can cause abdominal compartment syndrome with subsequent multiorgan failure. Ultimately, as outlined in this case, surgical evacuation of the haematoma was the only treatment able to reduce abdominal compartment pressures.

## 1. Introduction

The World Society of the Abdominal Compartment Syndrome<sup>1</sup> (ACS) defines the condition as a sustained intra-abdominal pressure<sup>2</sup> (IAP) greater than 20 mmHg (with or without an abdominal perfusion pressure less than 60 mmHg) that is associated with new organ dysfunction or failure [1]. We describe a rare case of Spontaneous Retroperitoneal Haemorrhage<sup>3</sup> (SRH) causing ACS with subsequent bowel wall ischaemia, acute kidney injury from direct compression of the renal parenchyma and respiratory failure from reduced lung compliance and

decreased tidal volumes. We overview the contemporary clinical management of SRH and present an algorithm to inform and guide clinical decision-making for ACS in the setting of SRH. This report has been reported in line with the SCARE criteria [4].

## 2. Case report

A 74-year-old female presented with a seven-day history of left heart failure symptoms. Medical comorbidities included well-controlled diabetes mellitus (HbA1c = 6.5%) and hypertension. Her regular

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<sup>1</sup> ACS Abdominal Compartment Syndrome

<sup>2</sup> IAP Intra-Abdominal Pressure

<sup>3</sup> SRH Spontaneous Retroperitoneal Haemorrhage

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medications included irbesartan (300 mg mane), sitagliptin/metformin (50 mg/1 mg twice daily), amlodipine/atorvastatin (5 mg/2 mg nocte) and thyroxine (100µg mane). There were no relevant family of genetic history of bleeding diatheses. On presentation, her electrocardiogram revealed ST segment depression in the anteroseptal and inferior leads. Her high-sensitivity troponin assay level was elevated at 276 ng/mL (normal reference range – 0–4 ng/mL), and she was commenced on aspirin and heparin. An urgent transthoracic echocardiogram demonstrated severe mitral regurgitation with a left ventricular ejection fraction of 25%. A coronary angiogram demonstrated severe triple vessel disease. She underwent uncomplicated four-vessel coronary artery bypass grafting and a mitral valve repair. One pooled dose of platelets and Prothrombinex-VF® (1500 international units) was transfused for a post-cardiopulmonary bypass coagulopathy. The initial intensive post-operative course was unremarkable. However, on the first postoperative day, she developed ventricular tachycardia that was refractory to medical therapy. She subsequently underwent an urgent post-cardiac surgery coronary angiogram to assess graft patency. The coronary angiogram was performed via the right femoral artery. The angiogram revealed patent anastomoses of the saphenous vein grafts to the first diagonal branch of the left anterior descending artery and the obtuse marginal vessel of the circumflex artery. The left internal mammary artery to the left anterior descending coronary artery was also patent. A kink in the radial-to-right coronary artery graft, of unknown significance, was visualised. In the context of ventricular irritability a decision was made to stent this with an Everolimus eluting coronary stent system. An intra-aortic balloon pump was also inserted uneventfully into the descending aorta via the right femoral artery for management of her ventricular irritability. No vascular access was attempted on the left side. Ticagrelor (90 mg twice daily) was commenced as the second antiplatelet agent.

Six hours after the graft study, she developed abdominal distention with ACS diagnosed indirectly by intravesical catheter pressures confirming an intrabdominal pressure of 29 mmHg (measurements taken end expiration and complete supine). Urgent computed tomography showed a massive left retroperitoneal haemorrhage (see Fig. 1) with active extravasation of blood (see Fig. 2). There was impaired perfusion to the left kidney and bowel (see Figs. 1 and 3). An urgent microcatheter angiogram of the iliolumbar artery confirmed the extravasation of blood (see Fig. 3), originating from the iliolumbar and gluteal arteries (see

Fig. 4). Coiling of both vessels resulted in the cessation of the bleeding (see Fig. 4). Her abdomen remained tense, and she progressively developed progressive renal failure requiring continuous veno-venous haemodiafiltration, in addition to respiratory failure requiring mechanical ventilatory support. After failed medical therapy for ACS (see Fig. 2), an exploratory laparotomy was performed. A total of 1.9 L of a combination of coagulated and liquified haematoma was evacuated. The patient remained in ICU, where her renal failure resolved over four weeks. She required a tracheostomy, and her respiratory support was also weaned. She was discharged to the ward 29 days later and subsequently discharged from the hospital on postoperative day 39. The patient was followed up after discharge by cardiology, cardiothoracic and general surgical teams. Provision of anaesthesia and surgery were performed by a cardiac anaesthetist and surgeon respectively, a hepatobiliary surgeon and clinicians with expertise in emergency general anaesthesia and surgery. Patient consent was obtained for the use of all de-identified medical images.

### 3. Discussion

This case demonstrates several unique aspects. First, the retroperitoneal haemorrhage was likely spontaneous because the angiogram and graft study, together with the insertion of the intra-aortic balloon pump, were performed on the contralateral right side to the haemorrhage. This was confirmed using CT angiography by the presence of multiple bleeding points originating from the left iliac vessels. SRH is defined as bleeding into the retroperitoneal space without any known trauma or underlying retroperitoneal pathology [2]. In this case, risk factors for SRH included anticoagulation/anti-platelet therapy, female sex, advanced age and renal impairment; these are well described in the literature [3]. The exact mechanism and pathophysiology for the unilateral SRH is unknown; however, in the context of anticoagulation, almost all SRH's appear to be unilateral, with the predominant hypotheses including diffuse small vessel arteriosclerosis, heparin-induced immune microangiopathy and unrecognised minor trauma [2]. In our case, a review of the abdominal vessel angiogram confirmed that the iliolumbar vessels were anatomically symmetrical on both the left and right sides.

The clinical presentation for SRH may be variable, frequently with no inciting history and no evidence of cutaneous bruising; back, lower

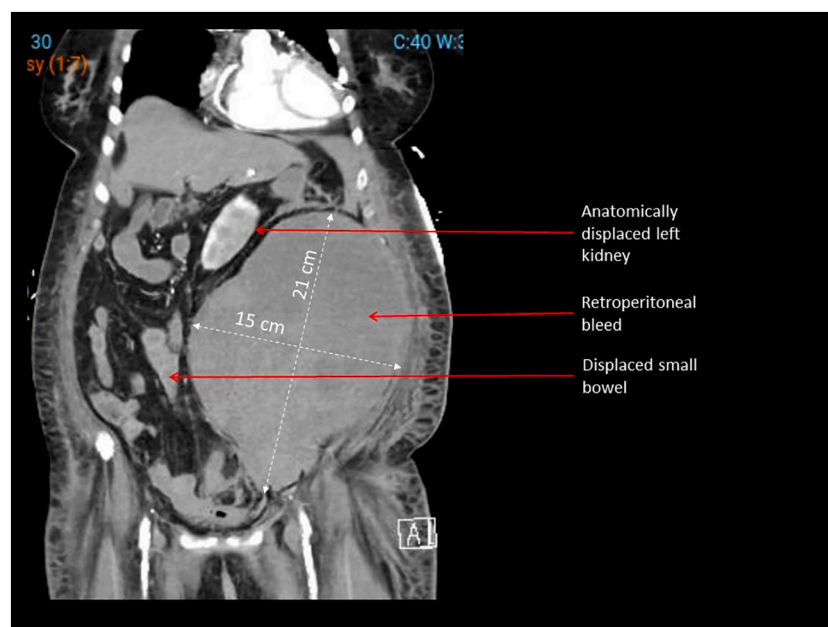


Fig. 1. Axial computed tomography demonstrating a massive right retroperitoneal haematoma.

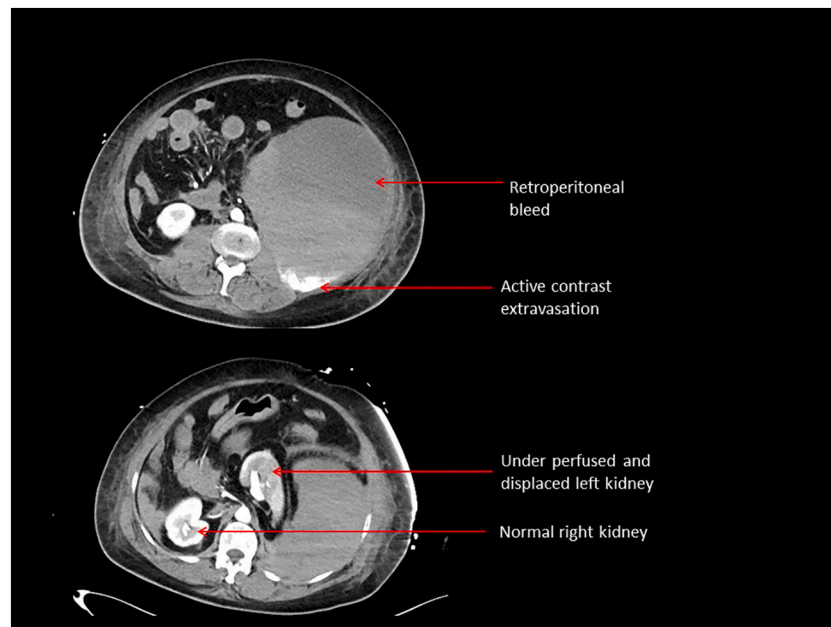


Fig. 2. Coronal computed tomography demonstrating a massive right retroperitoneal bleed.

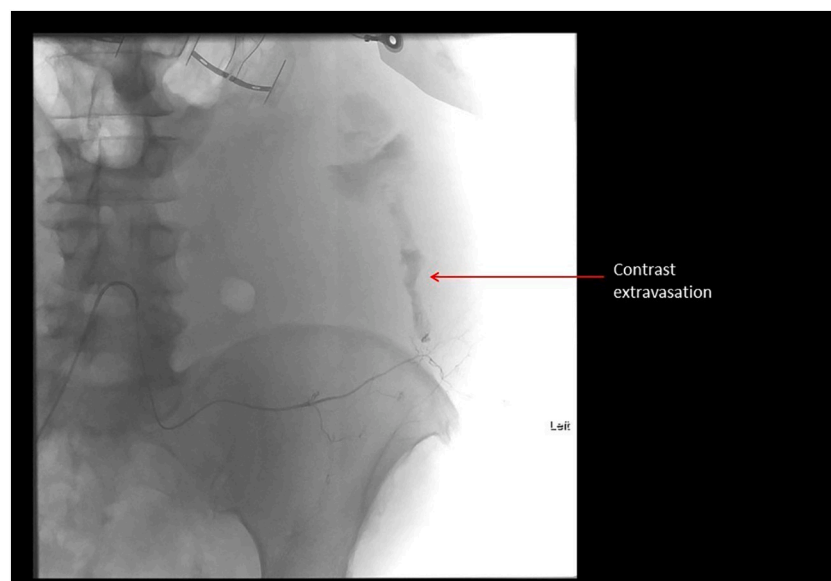


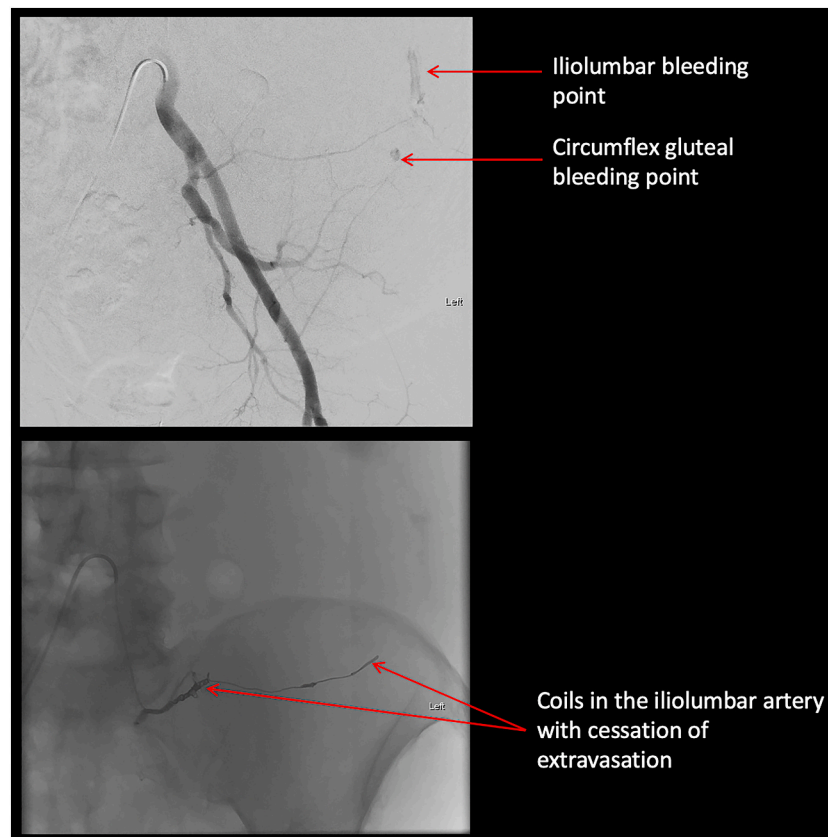
Fig. 3. Microcatheter angiogram of iliolumbar artery shows extravasation.

abdominal or groin pain; haemodynamic instability; or a fall in haemoglobin [5]. The most common complaint is truncal pain [6]. The literature demonstrates that 68% of patients suffer abdominal pain, followed by leg pain (24%), hip pain (23%) and back pain (22%) [7]. Abdominal examination reveals tense abdomen in 8.8% of patients and flank discoloration in 6.3% [7]. SRH should be suspected in patients with acute onset abdominal, leg or back pain or a palpable mass in the abdomen. The gold standard diagnosis is computed tomography of the abdomen and pelvis [3].

SRH may cause a rise in IAP and subsequent ACS. IAP can be measured directly (via a needle or catheter in the peritoneal space), typically using a pressure transducer system; however, this method, while accurate, is associated with bowel perforation and peritonitis. More commonly, as performed in our case, IAP can be measured indirectly using intravesical pressures via an indwelling urinary catheter

placed into the bladder [2]. Diagnosis of ACS in adults includes a sustained IAP greater than 20 mmHg (with or without an abdominal perfusion pressure of less than 60 mmHg) that is associated with new organ dysfunction or failure [1]. The clinical manifestations of ACS are related to the direct consequences of intra-abdominal hypertension and the resultant organ dysfunction [2]. This is associated with significant morbidity and mortality if not recognised and treated promptly [8]. A compartment syndrome occurs when a fixed compartment is subject to increasing pressures, leading to vascular compromise and ischaemia [9]. Typically, IAP in the critically ill intensive care patient is 5–7 mmHg, varying with respiration [8].

The presentation of ACS is varied, but abdominal pain and distension presents early. As occurred in the present case, the patient often develops hypoxia and hypercarbia, due to the effect of abdominal distension on respiratory function, and oliguria due to compromised renal



**Fig. 4.** Catheter angiogram of left common iliac artery showing two bleeding points and coils in iliolumbar artery with cessation of extravasation.

function [8]. Physical examination is not particularly sensitive for detecting ACS. Regardless of the cause, without timely intervention, ACS may lead to multi-system organ failure and, ultimately, death [8]. The mortality rate varies from 29% to 62% [2]. Prompt diagnosis, including bladder pressure monitoring, is critical, and urgent surgical intervention to decompress the abdomen is required to prevent organ failure and death [2].

The treatment of SRH varies considerably based on the underlying cause, haemodynamic status and response to initial measures. Medical, endovascular and surgical approaches are recognised treatments for SRH, with the case-specific approach being highly dependent on several patient and clinical factors. It is reported that fewer than 10% of patients undergo surgical intervention [6,7]. Medical management of SRH, reserved for haemodynamically stable patients, predominantly involves fluid resuscitation, correction of coagulopathy and blood transfusion [9]. Endovascular management is considered in cases where patients have ongoing bleeding and haemodynamic instability despite medical management. This involves angiography and selective embolisation or the deployment of stent grafts over the bleeding sites. This interventional radiological approach plays an increasingly important role due to its reasonable success rates and less invasive approach compared to surgery [11]. However, the disadvantage of an endovascular approach is that it cannot alleviate the mass effect of the haematoma caused by the SRH [10,11].

In the present case, we proceeded with open surgical intervention with the evacuation of haematoma and control of bleeding vessels because conservative and endovascular measures were unsuccessful. Surgical intervention for the treatment of SRH should also be considered if the patient is at reasonable risk of deterioration or is very unstable [9]. While angiographic intervention can usually stop any bleeding points, it is seldom able to relieve the IAP. As such, surgical management is often necessary to control bleeding and reduce clot burden, particularly in the

presence of ACS [10]. Limitations of the surgical approach to treat SRH include difficulty and potential inability to localise and control the bleeding vessels. There is also a risk that releasing the tamponade effect of the retroperitoneal haematoma may worsen the bleeding [11]. Regarding the surgical approach, most SRH overlie the psoas and iliacus muscles and are approached via a flank incision, which also facilitates decompression of the nerve roots and avoids violation of the peritoneum. Given the limited information to guide medical practice in patients with ACS resulting in an SRH, we propose an algorithm to guide the management of SRH in the context of ACS (see Fig. 5).

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#### Ethics approval

Austin Health Human Research Committee (HREC) approval was waived as the patient provided written consent for the case report, including use of all de-identified images.

#### Consent

Written informed consent was obtained from the patient for publication of this case report and accompanying images. A copy of the written consent is available for review by the Editor-in-Chief of this journal on request.

#### Research registration

N/A.

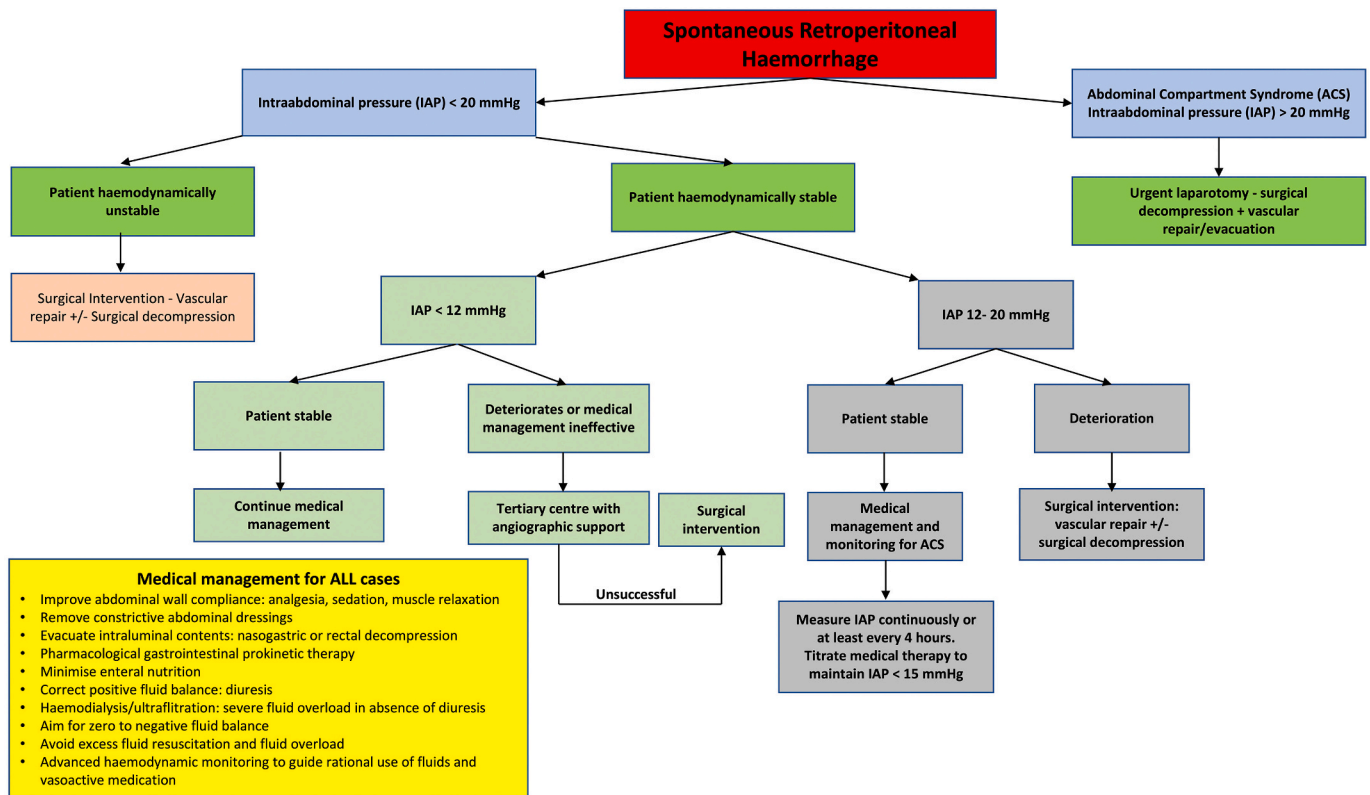


Fig. 5. Management algorithm for spontaneous retroperitoneal haemorrhage in the context of abdominal compartment syndrome.

**Guarantor**

A/Prof Laurence Weinberg is the guarantor.

**Registration of research studies**

N/A

1. Name of the registry:
2. Unique identifying number or registration ID:
3. Hyperlink to your specific registration (must be publicly accessible and will be checked):

**CRedit authorship contribution statement**

Manuscript writing and data interpretation was performed by Dr. Patrick Tully; Clinical interpretation was provided by Dr. James Moshinsky, Dr. Manfred Spanger, Dr. Anoop N Koshy & Dr. Michael Yii; Study concepts, manuscript writing and critical revision was provided by A/Prof Laurence Weinberg; All authors discussed the results and contributed to the final manuscript.

**Declaration of competing interest**

Nothing to declare.

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