Case Report

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Endovascular Management of a Penetrating Zone III Retroperitoneal Gunshot Wound Injury; A Case Report

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ABSTRACT

Traumatic iliac vessels injuries secondary to gunshot wound can often be fatal at the scene. One of the intriguing complications of vascular injuries is arteriovenous fistula. If the patient survives, these lesions may often not be diagnosed on first evaluation and patients may present with clinical signs and symptoms years later. Open surgical repair can have prohibitive morbidity and mortality and endovascular techniques, an effective treatment alternative, can interrupt the abnormal vascular communication and preserve artery vein patency. We describe a unique case of iliac arteriovenous fistula (AVF), secondary to a bullet injury, identified by imaging studies and subsequently treated with endovascular surgery. In conclusion, traumatic AVF are rare. Traditional teaching mandates that zone III pelvic retroperitoneal hematomas secondary to penetrating trauma be explored.

Keywords: Endovascular; Penetrating injury; Retroperitoneal; Gunshot injury.

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Introduction

Acquired iliac arteriovenous fistulas are usually secondary to penetrating trauma [1]. If the patient survives, these lesions often not be diagnosed on first evaluation and patients may present with clinical signs and symptoms years later. Open surgical repair can have prohibitive morbidity and mortality and endovascular techniques, an effective alternative, can interrupt the abnormal vascular communication and preserve artery vein patency [2]. We describe a unique case of iliac arteriovenous fistula (AVF), secondary to a bullet injury, identified by imaging studies and subsequently treated with endovascular intervention.

Case Report

A 19-year-old male presented with a gunshot wound to the left flank. On arrival the patient was anxious and diaphoretic complaining of flank pain. He was alert and oriented in time, place and person and had bilateral clear breath sounds on auscultation. His initial vitals were recorded as BP 120/70 HR

140, saturating 100% on face mask. He underwent a pelvic radiography in the trauma bay (Figure 1). He was started initially on 2 liters of ringer lactate which seemed to improve his tachycardia. Contrast enhanced (intravenous, oral and rectal) CT scan (Figure 2) of the abdomen-pelvis was performed which showed a large left retroperitoneal hematoma displacing the left kidney anteriorly. Inferior vena cava (IVC) was collapsed, consistent with hypovolemic shock. There was extravasation of contrast from the left iliac artery with prompt opacification of the left iliac vein. Oral contrast passed freely and no bowel wall thickening was appreciated. Left L4-L5 transverse process fractures were seen. Multiple pockets of air were seen adjacent to the left psoas muscle.

The patient was optimized and transported to the operating room. An incision was made over the left femoral vessels. With sharp and blunt dissection, the left common femoral artery was isolated. An angiogram of the iliac vessels revealed traumatic AVF between the femoral artery and the iliac vein (Figure 3A). Under fluoroscopic control a wire was advanced into the abdominal aorta and a repeat aortogram was performed which identified the traumatic AV fistula at the level of the common iliac/external iliac bifurcation.

Under fluoroscopic guidance, a No. 8 stent graft, subsequently an 8 mm (diameter) × 5 cm (length) and a second stent graft 9 mm × 5 cm were deployed with an overlap of 2.5 cm. An angioplasty balloon was utilized to mold the stent graft. The repeat angiogram revealed complete occlusion of the

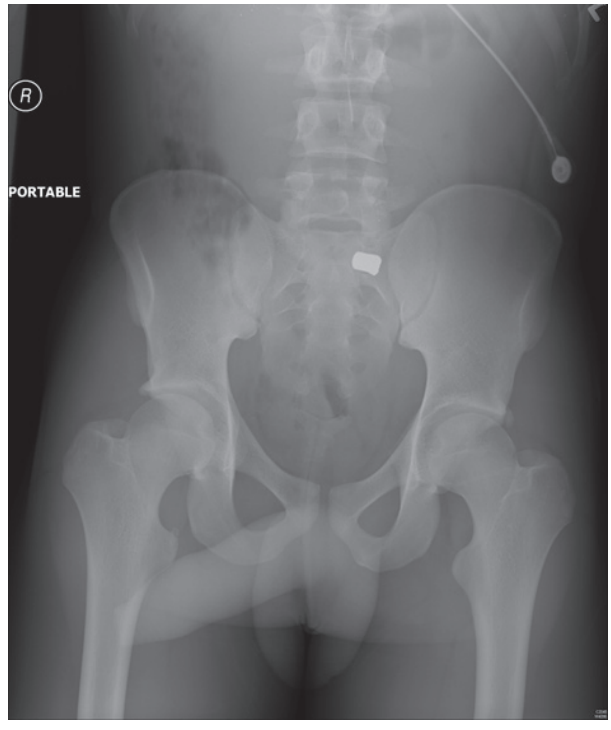

Fig. 1. The portabale anteroposterior radiography of the pelvic in the emergancy bay demonstrating the hyperdense object (bullet) in the pelvic cavity.

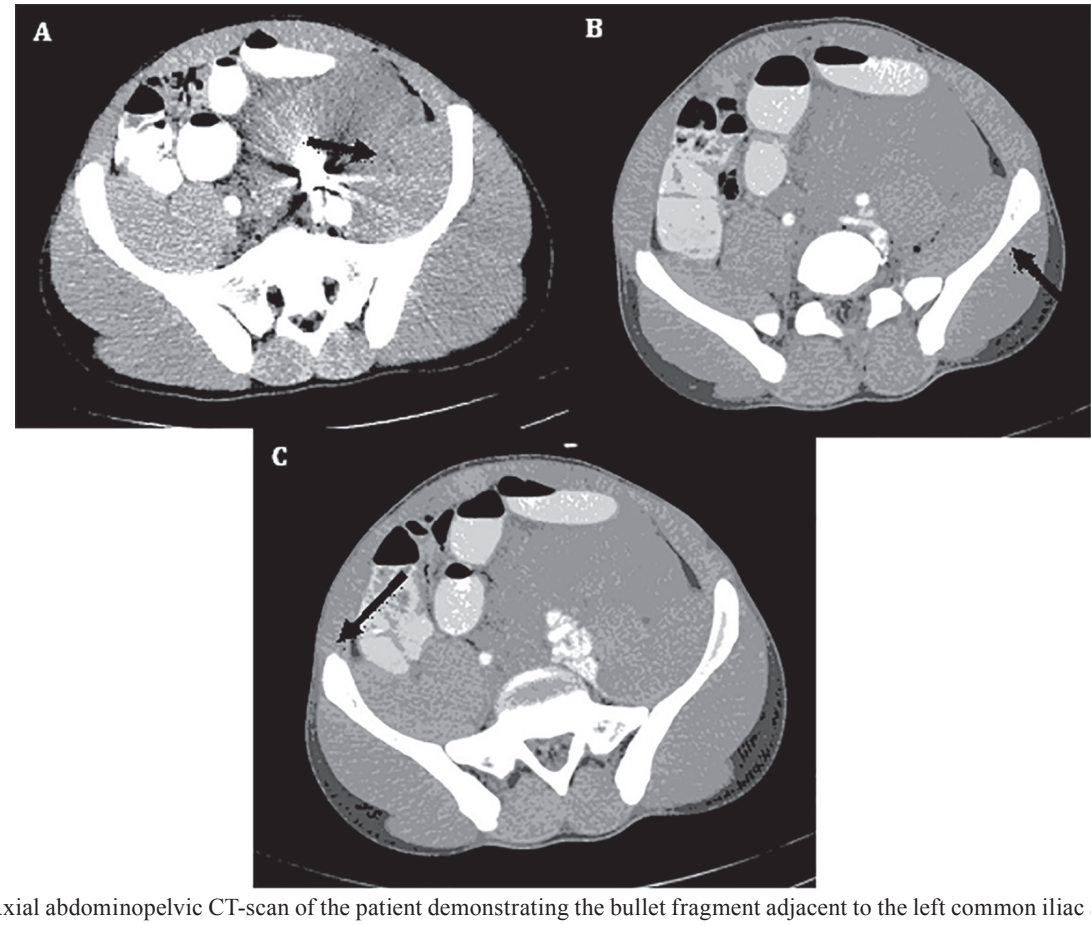

Fig. 2. Axial abdominopelvic CT-scan of the patient demonstrating the bullet fragment adjacent to the left common iliac artery (A); large left retroperitoneal hematoma (B); extravasation of intravenous contrast from injured left iliac artery suggestive of arteriovenous fistula formation to the common left iliac vein.

traumatic AV fistula and no evidence of intravascular bleeding (Figure 3B). 300U of heparin was given. Post operatively the patient was admitted to the ICU for close monitoring. However, on post-operative day 1 his abdomen became more distended, with increased abdominal pain along with a drop in Hgb to 5.8 for which he received 4U PRBC and 2 FFP. The repeat CT showed the retroperitoneal hematoma has minimally changed. Subsequently the patient remained hemodynamically stable and managed conservatively in the SICU. Although he signed out AMA he showed up in trauma clinic 2 weeks later where his vitals and labs continued to be stable. However, a follow up CT post endovascular stent placement of left iliac artery, showed questionable clot in the distal IVC. The right IJV was punctured under ultrasound guidance and exchange was made over a Bentson wire for a #5 French pigtail catheter which was advanced through the SVC, right atrium and IVC to the level of the IVC bifurcation and an inferior venacavogram was performed. A Berenstein catheter was positioned in the left common iliac vein and a left pelvic venogram was performed. The stents in the left iliac artery was noted but no definite clot was noted in the IVC. The renal veins were both visualized. Segmental occlusion of the left iliac vein at the level of the bullet with extensive cross pelvic collaterals were seen. Decision was made to anticoagulate, no IVC filter was placed at that time.

Discussion

AVF between the external iliac artery and the iliac vein following trauma is rare [3]. An AVF is an abnormal communication between an artery and a vein which does not pass via the capillary network. AVF s can be congenital or acquired; may be single, multiple or associated with other vascular malformations. All types can cause local, regional and systemic effects, depending on size, location and duration of the fistula. The complications vary depending on the size and duration of the resultant shunt.

William Hunter first described the existence of arteriovenous fistula in 1757 [3, 4]. Historically one of the largest series were published by surgeons managing war inflicted wounds during World War II, and the Korean and Vietnam wars. In the Korean conflict approximately 215 fistulas and aneurysms were reported. Traumatic fistulas and pseudoaneurysms accounted for 7 % of the Vietnam War casualties [4]. Most arteriovenous fistulas and pseudoaneurysms were treated conservatively in wartime and operated in a delayed fashion. The treatment modalities have significantly evolved over the years as evidenced by predominant endovascular technique during the Iraq and Afghanistan wars.

AVFs secondary to penetrating injuries are often associated with injuries to adjacent visceral organs, with hemodynamic instability secondary to uncontrolled bleeding, needing urgent or emergent exploratory laparotomy [3]. Usually peripheral AVF are commoner, the usual sites being arteries and veins of the neck, upper and lower extremities. On the contrary the central AVFs are relatively rarer and are found on the chest and abdominal aorta or even supra aortal branches [5].

90% of the traumatic AVFs are caused by penetrating trauma (GSW and stab injuries - Cold weapons and small caliber bullets) while blunt trauma account for the remaining 10%. Percutaneous procedures, e.g. renal biopsies and orthopedic procedures are responsible for a bulk of iatrogenic causes [4].

Penetrating traumas account for majority of the acquired fistulae and since they involve high risk of complications, eg congestive heart failure or venous hypertension of the extremities, diagnosis should be made and surgical treatment effected as early as possible. The treatment goal is closure of the AVF, with preservation of the patency of the main vessel.

Arteriography is the gold standard for diagnosing traumatic AVFs [4]. Dynamic catheter based angiography can accurately demonstrate the filling

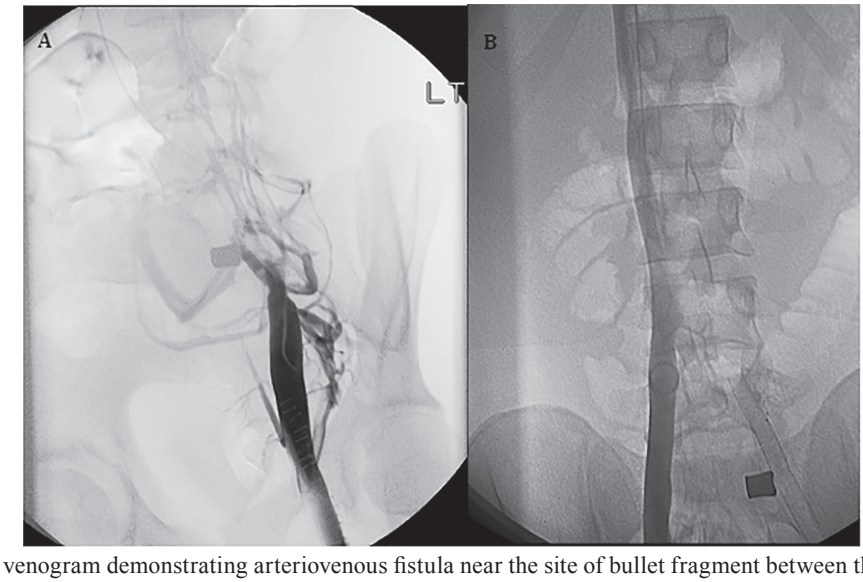

Fig. 3. Preoperative venogram demonstrating arteriovenous fistula near the site of bullet fragment between the internal iliac artery and the femoral vein (A); postoperative venogram demonstrating complete occlusion of the fistula (B).

of the arteries and the exact point of arteriovenous communication [4]. CTA is also a convenient noninvasive modality to diagnose AVFs after blunt or penetrating trauma. The development of helical CT scanners with a multidetector row configuration 3D post processing has added to the use of CTA in the evaluation of a suspected vascular trauma. Contrast enhanced CT can identify the location of the lesion, relation to adjacent structures, its extension thus allowing precise measurements of the diameter and length of the involved vessels.

Surgical exposure for the treatment of traumatic abdominal or pelvic AVF can be difficult and even challenging, especially in delayed diagnosis. Elevated venous pressure and surrounding tissue inflammation make the local area hostile for open surgical repair. Large collateral vessels with a complex venous anatomy are often encountered, increased risk for substantial blood loss and high morbidity and mortality [2]. Depending on the diameter of the vein, ligation can be used as also ligation- excision followed by complex reconstruction [4]. Late presentation of AVF can often result in alarming intraoperative bleeding. Limb ischemia, gangrene, limb loss, thrombosis of the IVC, pulmonary embolism, venous stasis are reported [4, 6].

Endovascular treatment has several advantages particularly since it is both diagnostic and a therapeutic, hence invaluable in bleeding, difficult thoracic and abdomen access sites; poly-trauma patients; or for iatrogenic vascular injuries in critical ill patients [7]. Zajko *et al*., [8] reported the first endovascular repair by a percutaneously placed stent graft of a right common iliac artery to IVC fistula following the repair of the right iliac artery injury resulting from a laparoscopic trocar placement. Follow up CT scans at 3 and 7 months showed clinical improvement. Treatment includes embolization of fistulae with agents, eg autologous blood clots; Gelfoam sponges; microfibrillar collagen; polyvinyl alcohol sponges;coils--copolymer covered; cyanoacrylate, detachable and non-detachable balloons [7]. Some authors have used other endovascular devices eg septal occluders, coil embolization, thoracic endograft, or covered stents for the treatment of iliac AVF [9-12].

Some of the advantages of covered grafts, angioplasty and embolization in endovascular treatments are the following; the catheter being inserted away from the injured area is less invasive and hence with a lower infection risk. Access is gained appropriate to the site of injury and results in less pain and thus faster post-operative recovery; less expensive (if recovery and hospital admissions are taken into account); As direct dissection of the surgical field is avoided, there is less nerve damage and may be done with only local or regional anesthesia [7, 13] Thrombosis of the stent graft (endoprosthesis); late stenosis and mal placement are some of the documented disadvantages [14].

In conclusion, traumatic AVF are rare. Traditional teaching mandates that zone III pelvic retroperitoneal hematomas secondary to penetrating trauma be explored.

Conflicts of Interest: None declared.

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