Received: 2015.09.20
Accepted: 2015.10.07
Published: 2016.03.18

Authors' Contribution:

- A** Study Design
- B** Data Collection
- C** Statistical Analysis
- D** Data Interpretation
- E** Manuscript Preparation
- F** Literature Search
- G** Funds Collection

Juxtarenal Aortic Pseudoaneurysm – Right Renal Vein Fistula with Circumaortic Renal Collar-Delayed Manifestation of a Gunshot Injury – an Uncommon Entity Diagnosed with CT Angiography

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Background:

Delayed presentation of post-traumatic aortic pseudoaneurysm and its fistulous communication with the right renal vein is a very rare entity. Most of the cases described in literature are due to abdominal aortic aneurysm (AAA) rupture into the left renal vein. To the best of our knowledge, communication with the right renal vein has not been described in published literature. Our patient also had a circumaortic renal collar, which is a rare renal vein anomaly. Aortic pseudoaneurysm, its fistulous communication with the right renal vein and circumaortic renal collar in a single patient is of extremely rare occurrence.

Case Report:

A 29-year-old male presented to the cardiology department with complaints of breathlessness, abdominal pain and hematuria for the last 6 months. On clinical examination there was evidence of audible bruit over the abdomen. He had a past history of a gunshot injury around two years back. CT angiography revealed a large partially calcified pseudoaneurysm arising from the right lateral wall of the abdominal aorta with the neck of the pseudoaneurysm at juxtarenal location with a fistula between the anterior wall of the pseudoaneurysm and the posterior wall of the right renal vein. There was an associated incidental finding of circumaortic left renal vein with gross aneurysmal dilatation of both pre- and retro-aortic part of the renal vein.

Conclusions:

Delayed presentation of aortic pseudoaneurysm with its fistulous communication with the right renal vein is a rare entity. CT angiography is a non-invasive modality for diagnosis of the exact site of communication, length of aneurysm, proximal and distal extent of the affected segment and its relationship with surrounding structures.

MeSH Keywords:

Aneurysm, False • Aorta • Arteriovenous Fistula • Renal Veins

PDF file:

<http://www.polradiol.com/abstract/index/idArt/896032>

Background

Delayed presentation of a post-traumatic aortic pseudoaneurysm and its fistulous communication with the right renal vein is a very rare entity. Most of the cases described in literature are due to abdominal aortic aneurysm (AAA) rupture into the left renal vein. To the best of our knowledge, communication with the right renal vein has not been described in published literature. Our patient also had a

circumaortic renal collar, which itself is a rare renal vein anomaly.

Aortic pseudoaneurysm, its fistulous communication with the right renal vein and circumaortic renal collar in a single patient is of extremely rare occurrence.

Delayed presentation of injuries to the abdominal aorta or the inferior vena cava is uncommon and may manifest as

Figure 1. (A–D) Axial CT images showing a pseudoaneurysm arising from the abdominal aorta (arrow in A) with the site of fistulous communication with the right renal vein (arrow in C). The right renal artery is arising from the aneurysmal part and shows an attenuated caliber (arrow in D). An incidental finding of the circumaortic left renal vein noted with a pre-aortic (arrowhead in B) and retro-aortic limb (arrow in B).

pseudoaneurysms, aortic or visceral branch occlusion or arterio-venous fistula.

The potential complications of an abdominal aortic aneurysm include rupture, fistulas, compression of the surrounding structures, infections and thrombo-embolic events. The most common complication is rupture. Rupture or fistula formation with adjacent venous system is extremely rare. In this rare entity, the most common site of fistula formation is with the inferior vena cava (IVC) (incidence ranging from 0.22 to 6.04% of all AAA). Fistulas involving the renal or iliac veins are of very rare occurrence.

CT angiography has also an important role in surgical planning because it can reveal the location of the lesion, its extension and its relation to adjacent structures. It is also important for endovascular treatment planning allowing precise measurements of the diameters and length of the involved vessels. CT and MRI angiography typically show early contrast filling in the vein during the arterial phase.

Treatment options include surgical or endovascular repair. The aim of the treatment is closure of fistula with preservation of patency of the main vessels. Endovascular techniques include use of stent-graft and coil embolization.

Case Report

A 29-year-old male presented to the cardiology department with complaints of breathlessness, easy fatigability dyspnoea on exertion, abdominal pain and hematuria for the last 6 months. On clinical examination there was evidence of audible bruit over the abdomen. The patient was normotensive (130/90 mmHg) and non-diabetic. He had a past history of a gunshot injury around two years back. At that time he had no evidence of significant internal organ injury.

Chest X-ray and 2D echocardiography revealed cardiomegaly. Colour Doppler revealed a large pseudoaneurysm arising from the abdominal aorta with dilated renal veins and IVC. The right kidney was small and lobulated with poorly maintained cortico-medullary differentiation. The spectral waveform in the renal veins and IVC was triphasic with a high peak systolic velocity suggestive of arterialisation of the veins. A possibility of an aorto-caval fistula was kept on the basis of Doppler findings; however the exact site of communication could not be established.

Renal function test was mildly deranged.

CT angiography was performed for further evaluation on a 256-slice dual source multidetector CT scanner (Siemens

Figure 2. (A–D) Axial CT images showing peripheral calcification in a pseudoaneurysm (A), retr-oaortic segment of the left renal vein (arrowhead in B), shrunken right kidney (arrowhead in C) and cardiomegaly (D). Multiple fragments of pellets noted in the spinal canal and paraspinal muscles showing streak artifacts.

somatom definition). Dynamic acquisition was done to demonstrate the flow across the fistula.

It revealed a large partially calcified pseudoaneurysm arising from the right lateral wall of the abdominal aorta with the neck of the pseudoaneurysm at juxtarenal location. There was a definite communication between the anterior wall of the pseudoaneurysm and the posterior wall of the right renal vein. The flow across the fistula was confirmed on dynamic sequences. IVC was grossly dilated. The origin of the right renal artery was incorporated into the pseudoaneurysm with attenuated calibre. The right kidney was shrunken and lobulated with decreased enhancement – suggestive of chronic ischemia (Figures 1–3)

Cardiac chambers were grossly enlarged; however there were no changes of congestive heart failure in the lung fields. Multiple metallic density structures were present in the paraspinal muscle and also in the spinal canal consistent with pellets from a previous gunshot injury. No pellets were identified near the great vessels (Figure 2).

There was an associated incidental finding of circum-aortic left renal vein with gross aneurysmal dilatation of both pre- and retro-aortic part of the renal vein. There was also

anastomosis between the pre- and retro-aortic component (type III) (Figure 4).

The patient underwent digital subtraction angiography at the cardiology department and CT angiography findings were confirmed. Chimney stent graft was deployed in the aorta to isolate the pseudoaneurysm and preserve the origin of the renal artery.

Discussion

Delayed presentation of a post-traumatic aortic pseudoaneurysm and its fistulous communication with the right renal vein is a very rare entity. Our patient also had a circum-aortic renal collar, which is a rare renal vein anomaly.

Abdominal aortic aneurysm (AAA) with atypical signs at onset should be carefully evaluated with CT angiography. CT or MR angiography is essential to accurately delineate the proximal and distal extent of aneurysm, its morphology, status of branch vessels, signs of impending rupture, post-rupture complications and any fistulous communication.

AAA is defined as dilatation of the abdominal aorta of more than 50% as compared to the proximal segment or diameter

Figure 3. (A, B) Coronal thin maximum intensity projection (MIP) CT images showing: aorta (Ao), partially calcified pseudoaneurysm (P), dilated IVC and origin of the right renal artery from the pseudoaneurysm (arrow in B).

Figure 4. (A, B) Volume rendered images (VRT) showing: aorta (Ao), pseudoaneurysm (P), dilated IVC with fistulous communication between the pseudoaneurysm and the right renal vein (RRV). Pre-aortic (PLRV) and retro-aortic (RLRV) limbs of circum-aortic left renal veins are seen.

of the aorta of more than 3 cm. Aortic aneurysm may be a true aneurysm or a pseudoaneurysm. Most pseudoaneurysms and associated arterio-venous fistulas (AVF) are traumatic or iatrogenic in origin [1]. Traumatic AVFs are usually caused by a penetrating trauma. Gunshot wounds are a common cause of traumatic AVFs.

Delayed presentation of injuries to the abdominal aorta or inferior vena cava is uncommon and may manifest as

pseudoaneurysm, aortic or visceral branch occlusion or arterio-venous fistula.

The potential complications of abdominal aortic aneurysm include rupture, fistulas, compression of surrounding structures, infections and thrombo-embolic events. The most common complication is rupture. The risk of rupture increases with increasing size. It generally occurs into the retroperitoneum or into the abdominal cavity. Rupture or fistula formation with adjacent venous system is extremely

rare. In this rare entity, the most common site of fistula formation is with IVC (incidence ranging from 0.22 to 6.04% of all AAAs) [2]. Fistulas involving the renal or iliac veins are of very rare occurrence. [3].

The classic triad of clinical symptoms and signs in AAA patients with AVF are abdominal or back pain, pulsatile mass, and abdominal bruit. The extent of the clinical manifestations of a fistula between an aortic aneurysm and the venous system depends on the size, duration and location of the fistula. Aneurysmal degeneration of the involved arterial and venous segments occurs due to structural changes secondary to hemodynamic stress.

In chronic AVFs both the artery and the vein dilate and elongate, but the vein dilates more and becomes "arterialized". A chronic large-flow AVF can present with symptoms of high output congestive heart failure, edema and cardiomegaly [4].

Patients with aorta-renal vein fistula present with signs of renal venous hypertension (hematuria, deranged renal function).

Renal function usually becomes abnormal, due to increasing venous pressure in the renal veins, which leads to lower glomerular filtration rates. Hematuria is due to elevated renal venous pressure that leads vascular channels to communicate directly with the caliceal cavity. [5].

Clinical examination and imaging is essential for diagnosis.

In the setting of a suspected AVF, color Doppler, a simple non-invasive method can usually confirm the diagnosis. Turbulent flow is the most notable color Doppler finding. Also, the exact spot of the arteriovenous communication can sometimes be identified. The Doppler waveform in the feeding artery shows a low-resistance pattern with increased diastolic flow. The jet of the arterial flow entering the vein can cause a marked flow disturbance and chaotic waveform or an arterial waveform is present in more severe cases.

CT Angiography has also an important role in surgical planning because it can reveal the location of the lesion, its extension and its relation to adjacent structures. It is also important for endovascular treatment planning allowing precise measurements of the diameters and length of the involved vessels. CT and MRI angiography typically show early contrast filling in the vein during the arterial phase.

Streak artifacts are the major limiting factor of CT angiography to demonstrate AVF after penetrating bullet injuries. The deposited metallic fragments may create streak artifacts that obscure the arteries, commonly at the exact location where the AVF is likely to occur. In such cases, catheter angiography is necessary for an optimal assessment [6].

Treatment

Treatment options include surgical or endovascular repair. The aim of the treatment is closure of a fistula with preservation of patency of the main vessels. Open surgical procedures have high mortality and morbidity rates compared to endovascular techniques.

Endovascular techniques include use of stent-grafts and coil embolization. Careful assessment of the graft size is necessary, because the dimensions of the aorta can be expected to decrease to normal once the fistula has closed. An aortic extension cuff of appropriate diameter and length would close the defect in the aorta. In patients with AVF associated with abdominal aortic aneurysms, the potential for endoleaks exists and, if untreated, may result in persistence of the fistula [4].

Circumaortic renal vein

Both circumaortic and retroaortic left renal veins are the result of persistence of the dorsal limb of the embryonic left renal vein and of the dorsal arch of the renal collar. However, in the retroaortic left renal vein the ventral arch regresses so that a single renal vein passes posterior to the aorta. The approximate prevalence of the circumaortic left renal vein is 0.3 to 3.7%, and of the retroaortic left renal vein is 0.5 to 6.8% [7].

Natsis et al. classified circumaortic left renal vein into 3 morphological types. In Type I one left renal vein splits into 2 branches, a preaortic and a retroaortic, draining into the inferior vena cava (IVC). In Type II, 2 separate left renal veins are formed, one preaortic and the other retroaortic, draining into the IVC. In Type III, there are either anastomoses between the preaortic and retroaortic vein that may be multiple or not, or there may be multiple preaortic or retroaortic renal veins without anastomoses.

The risk of venous injury is higher in patients with a circumaortic left renal vein than in those with IVC anomaly and this is because the large anterior component of a circumaortic left renal vein can easily mislead the surgeon during operation into thinking that the development of the left renal vein is normal and that there is no retroaortic component [8].

Conclusions

Delayed presentation of aortic pseudoaneurysm with its fistulous communication with the right renal vein is a rare entity. Aortic pseudoaneurysm, its fistulous communication with the right renal vein and circumaortic renal collar in a single patient is of extremely rare occurrence.

Early and precise diagnosis is essential in these cases. Colour Doppler is helpful in most of the cases. However, CT angiography is a non-invasive modality for diagnosis of the exact site of communication, length of aneurysm, proximal and distal extent of the affected segment and its relationship with surrounding structures. It is essential prior to an effective endovascular or surgical repair.

Signs of renal venous hypertension should be looked for in such patients as it may constitute early warning signs of an aorta-renal vein fistula.

Diagnosis and exact anatomical delineation of a circumaortic renal vein is essential as these patients are at a high risk of renal vein injury during surgery.

References:

1. Faucherre M, Haftgoli-Bakhtiari N, Menth M et al: Aorto-venous fistula between an abdominal aortic aneurysm and an aberrant renal vein: A case report. *J Med Case Reports*, 2010; 4: 255
2. Cinara IS, Davidovic LB, Kostic DM et al: Aorto-caval fistulas: a review of eighteen years experience. *Acta Chir Belg*, 2005; 105: 616–20
3. Barrier P, Otał P, Garcia O et al: Aorto-left renal vein fistula complicating an aortic aneurysm: preoperative and postoperative multislice CT findings. *Cardiovasc Intervent Radiol*, 2007; 30(3): 485–87
4. Spencer TA, Smyth SH, Wittich G et al: Delayed presentation of traumatic aortocaval fistula: a report of two cases and a review of the associated compensatory hemodynamic and structural changes. *J Vasc Surg*, 2006; 43: 836–40
5. Yagdi T, Atay Y, Engin C et al: Aorta-left renal vein fistula in a woman. *Tex Heart Inst J*, 2004; 31(4): 435–38
6. Miller-thomas MM, West OC, Cohen AM: Diagnosing traumatic arterial injury in the extremities with CT angiography: pearls and pitfalls. *Radiographics*, 2005; 25(Suppl.1): S133–42
7. Tatar I, Tore HG, Celik HH, Karcaaltincaba M: Retroaortic and circumaaortic left renal veins with their CT findings and review of the literature. *Anatomy*, 2008; 2: 72–76
8. Hashizume K, Taniguchi S, Ariyoshi T et al: Circumaortic left renal vein associated with juxtarenal abdominal aortic aneurysm. *Ann Vasc Dis*, 2013; 6(3): 658–61