

# Two Stage Complex Embolization of an Arteriovenous Fistula between the Right Common Iliac Artery and the Inferior Vena Cava

Marc Gingell Littlejohn<sup>1\*</sup>, Nile Allaf<sup>2</sup>, Stephen Butterfield<sup>3</sup>

1. Department of Surgery, Western Infirmary, Glasgow, United Kingdom

2. Department of Surgery, Manchester Royal Infirmary, Manchester, United Kingdom

3. Department of Radiology, Wythenshawe Hospital, Greater Manchester, United Kingdom

\* Correspondence: Marc Gingell Littlejohn MRCSEd, Western Infirmary, Dumbarton Road, Glasgow G11 6NT, United Kingdom. (✉ marc.ging@gmail.com)

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## ABSTRACT

We present an interesting case of a symptomatic high flow AV fistula between the right common iliac artery (CIA) and the inferior vena cava (IVC), successfully treated by endovascular coil embolization. The patient was found to have a right lower polar renal artery crossing the ipsilateral ureter arising from the CIA, causing pelvi-ureteric junction (PUJ) obstruction and recurrent pyelonephritis. It is hypothesized that this fistula arising from the lower polar renal artery and entering the IVC, may have occurred as a result of trauma during a previous pyeloplasty, or a pathologically induced process of angiogenesis stemming from recurrent pyelonephritis.

## CASE REPORT

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A 47 year old man with a history of pelvi-ureteric junction (PUJ) obstruction associated with urinary calculi underwent open pyeloplasty. The procedure was complicated by infection, resulting in poor renal function, persistent loin pain and an incisional hernia. A total right sided nephrectomy was performed four years later for symptomatic relief.

As expected at operation there was extensive fibrosis making dissection difficult.

Through a retroperitoneal approach, the hilar vessels were secured and the kidney freed from adhesions to the inferior vena cava (IVC). During dissection of the postero-lateral aspect of the lower pole of the kidney, brisk arterial bleeding was encountered, which did not correspond to identifiable anatomy. The area was over sewn with sutures and the operation completed. One and a half hours post-operatively, there was a sudden decrease in systolic blood pressure and the

abdomen became distended. The patient was returned to theatre and profuse bleeding once again noted from the same site. Control was eventually achieved by over sewing and the use of packs. After the procedure, an intra-arterial digital subtraction angiogram was performed which demonstrated a long fistula from the right common iliac artery to the inferior vena cava measuring approximately 5mm in diameter (Fig. 1).

It was felt that endovascular embolization was the treatment of choice, and that embolization of both arterial and venous limbs rather than singular arterial embolization alone should be performed: primarily, since retrograde filling of the fistula from the IVC would allow persistent haemorrhage and secondly, the high output of the fistula may have ended in loss of the coil into the IVC and pulmonary circulation. Another problem encountered was that the AVF could not be traversed from the arterial route alone due to the tortuosity of the nidus.

Using a 7 French sheath, the abnormality was visualized by placing a 5 French Cobra 2 shaped arterial catheter at the origin of the afferent limb and injecting contrast (Fig. 2).

Then, via a separate venepuncture in the right common femoral vein, a 5 French multipurpose catheter was inserted and access was acquired to the IVC. Multiple Gianturco coils of various sizes were inserted, thereby allowing embolization of the efferent venous limb of the deformity from the nidus to the exit of the AVF into IVC. This retrograde approach allowed reassurance, in that it guarded the exit of the AVF and reduced the risk of loss of the wire into the venous system (Fig. 3). The final step involved embolizing the afferent limb in the same manner via the arterial puncture (Fig. 4).

No further bleeding occurred, the packs were removed the following day and the patient eventually made a full recovery.

## DISCUSSION

Arteriovenous fistulae may occur secondary to blunt or penetrating injury, the latter predominating. Clinically they may present as a palpable mass with or without a bruit, and if not repaired may progress to development of aneurysm or even heart failure (1).

The exact aetiology of the abnormality in our patient is undetermined.

A right aberrant lower polar renal artery crossing the ipsilateral ureter and arising from the common iliac artery was causing pelvi-ureteric junction (PUJ) obstruction and eventually recurrent bouts of pyelonephritis. We assume that a fistula into the IVC from the lower polar renal artery may have occurred as a result of trauma during a previous pyeloplasty, or inflammatory angiogenesis due to recurrent pyelonephritis.

From an anatomical point of view, the degree of variation in terms of number of renal vessels and origins varies greatly. Aberrant renal vasculature can be appreciated further when looking at the embryological development of the kidneys. As differential relative growth proceeds, the foetal kidney shifts its position in a cranial direction. This movement results in a continuously varying blood supply, as new branches are induced from the aorta at progressively higher levels until the definitive renal arteries develop at L1 (2).

Case series for the most part are limited, the reason for this being that the anatomy can be so varied that singular anomalies such as lower polar renal vessels alone make up a fraction of the diversity of the anatomy. Some series quote 6.8% of patients that presented with PUJ obstruction were secondary to lower polar renal vessels (3), others quote 18.5% in their paediatric population group, again causing PUJ obstruction.(4) Some case series have quoted anomalies as a whole comprising 30-35% of the total (5). Thus, present literature confirms wide variability in the anatomy of the renal vasculature but seldom gives us the proportions of the type of anomaly.

A few intriguing points do however seem to come to light. Although anatomy of origin, course, distribution and number of renal arteries may vary greatly within their own group, there is a significant proportion whose course results in PUJ obstruction. This may well be an important issue regarding our case, the primary presentation being PUJ obstruction, which was prior to further investigations felt to be due to calculi.

Transarterial embolization is a well established procedure. However, in cases with a more complex AVF, an alternative

approach may be required. As described by Litherland and Ashleigh (6), a post traumatic lateral circumflex femoral artery AVF was successfully treated by transvenous embolization. The idea of this technique was born from the fact that significant arterial collaterals persisted in feeding the AVF. Therefore, a secondary transvenous procedure had to be employed to embolize the AVF, thereby negating the multiple arterial collateral feeders. Transvenous embolization has been described in relation to cerebrovascular lesions (8,9) and this approach has also been employed in embolization of AVFs in the head, neck and lower limbs (8,9,10) and traumatic AVFs in the kidney (7). Idowu et al have reportedly used an amplatzer vascular device for the transcatheter obliteration of these high output renal AV fistulas (11,12). However, the combined use of transarterial and transvenous embolization, in the scenario of a post-nephrectomy patient, whose AVF had arisen as a consequence of a congenital abnormality of circulation has rarely been described.

The evidence supporting aberrant renal vasculature is well recognised and we believe that this case brings to light a multitude of important points. Firstly, aberrant anatomy must be immediately considered for cases in which unexpected bleeding is encountered during primary surgery. This should lead the clinician into requesting urgent angiography to establish the cause and location of the bleed.

Secondly, cases with longstanding PUJ obstruction such as the one described, do beg the question as to the relevance of preoperative assessment with angiography.

Accounting for the presentation of the case initially and the accepted variability of the renal vasculature, routine preoperative vascular imaging may potentially reduce complication rates in cases of nephrectomy for PUJ obstruction. Such cases should be jointly managed by radiologists, urological and vascular surgeons.

Thirdly, the use of combined transarterial and transvenous embolization is a viable and successful technique which should be considered as a primary option in the management of complicated high output AV fistulas.

Finally, many case reports describe altered renal vasculature, but, the prevalence of the more common variables is poorly described. Perhaps a more detailed assessment of the renal vasculature in both cadaveric specimens and post mortem patients would give us a clearer picture.

## TEACHING POINT

Two stage endovascular embolization is a safe and effective alternative to open surgery for the treatment of high output arteriovenous fistulas in major vessels.

## ABBREVIATIONS

IVC = Inferior vena cava  
AVF = Arteriovenous fistula  
PUJ = Pelvi-ureteric junction

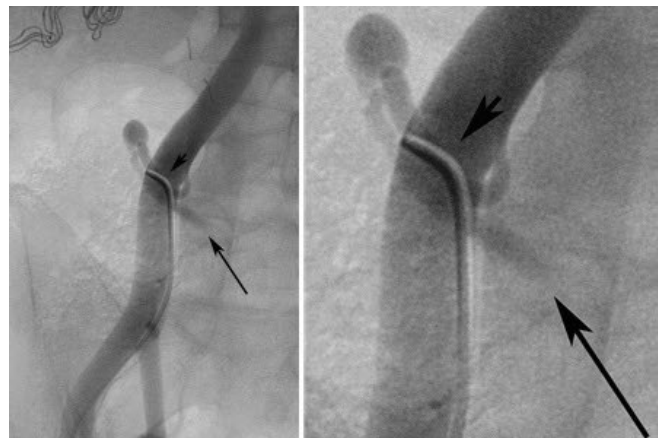
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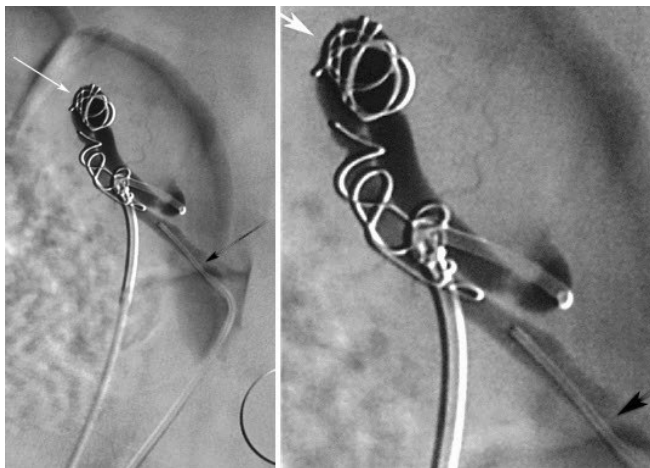
FIGURES



**Figure 1:** 47 year old man with an arteriovenous fistula between the right common iliac artery and the inferior vena cava. Descending aortogram demonstrating the origin of the arteriovenous fistula arising from the right common iliac artery (Arrow, right side magnified view). Proximally the absence of the right renal artery is noted.



**Figure 2:** 47 year old man with an arteriovenous fistula between the right common iliac artery and the inferior vena cava. A 5F Cobra 2 tip catheter sited within the arterial limb of the AVF. The venous component is shown entering the IVC (arrow, right side magnified view)



**KEYWORDS**

Arteriovenous fistula, endovascular embolisation, transvenous embolisation, accessory renal artery

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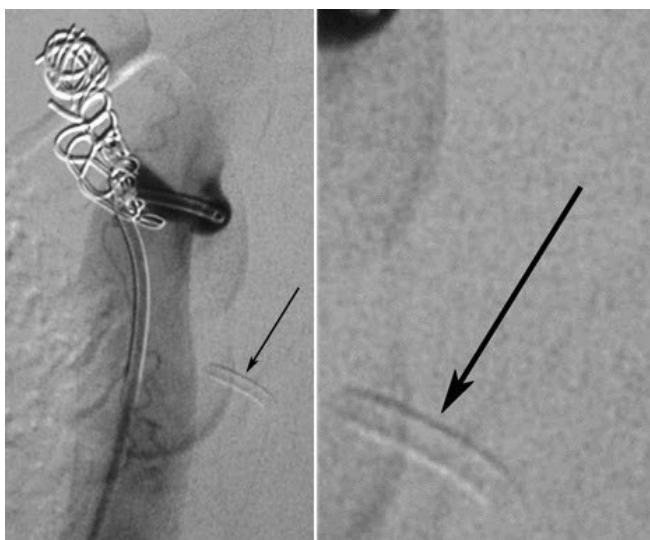
**Figure 3:** 47 year old man with an arteriovenous fistula between the right common iliac artery and the inferior vena cava. Both arterial and venous limbs are demonstrated with their corresponding catheters in-situ. Primary transvenous embolization from the nidus to the exit of the AVF into the IVC is demonstrated. (Arrows: White – Nidus; Black – Venous Limb, right side magnified view)

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**Figure 4:** 47 year old man with an arteriovenous fistula between the right common iliac artery and the inferior vena cava. Contrast injected into the arterial limb of the arteriovenous fistula, shows successful transarterial, transvenous embolization, with no passage of contrast into the inferior vena cava. (Arrow: IVC Catheter, right side magnified view)

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