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Balloon-Assisted Endovascular Embolization of High-Flow Renal Arteriovenous Fistula

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High-flow renal arteriovenous fistula (AVF) can lead to complications such as hematuria, hypertension, high-output cardiac failure, and renal insufficiency.[1,2] A 52-year-old female patient with no prior risk factors presented with dull aching pain in right lumbar quadrant for 1 month and hematuria for 7 days. There was no history of trauma to abdomen. She was hemodynamically stable at presentation. Her hemoglobin was 6.9 g/dL. Abdominal ultrasound showed a large anechoic cystic lesion in the right lumbar quadrant with only upper pole of right kidney being visualized and intense color flow within the lesion in color Doppler with low resistance biphasic waveform (►**Fig. 1A**). Chest radiograph was normal. Computed tomography angiography revealed a large vascular pouch in the right kidney with a large arterial feeder and dilated early draining renal vein suggestive of renal AVF with large venous pouch (►**Fig. 1B**). Diethylenetriaminepentacetate (DTPA) scan showed severely impaired renal perfusion and cortical function in right kidney with functioning parenchyma seen exclusively at upper polar region. She was counseled for endovascular treatment as upper pole of right kidney could be preserved.

Right renal artery angiogram showed high-flow AVF involving the right mid and lower pole with single large dilated, tortuous arterial feeder from main renal artery with large venous pouch (►**Fig. 1C**), draining through dilated renal vein into inferior vena cava and normal parenchymal blush of remnant residual upper pole of right kidney. Through a 6Fr guiding sheath via right common femoral artery access, the arterial feeder was selectively cannulated using a 5F diagnostic cobra catheter and microcatheter. Initially, an interlocking detachable coil (IDC, Boston Scientific, Massachusetts, USA; size 12mm*20cm) was deployed without detachment; however, due to high flow, the coil could not completely occlude arterial feeder and had high risk of embolization into venous pouch if detached and hence, the coil was retrieved back. Subsequently, to arrest the high flow, a balloon catheter (Ultraverse, Bard Peripheral Vascular, Arizona, USA; size 10mm*40mm) was introduced through contralateral femoral artery access and was inflated across the large arterial feeder, following which a mixture of 70% of N-butyl cyanoacrylate (NBCA) glue and lipiodol was injected. However, there was residual filling of the venous pouch (►**Fig. 1D**). Hence, two additional 0.018" pushable coils (Micronester, Cook Medical, Indiana, USA; size 8mm*14cm) were deployed proximal to the glue cast. Post-deployment angiogram showed complete arrest of flow through the arterial feeder without any residual filling of the large venous pouch. There was normal contrast opacification of the upper polar segmental branch with normal renal parenchymal blush in the upper pole (►**Fig. 1E**). Post-procedural ultrasonography showed complete thrombosis of large venous pouch (►**Fig. 1F**). Immediate post-procedure course was uneventful. On 6-month follow-up, she was asymptomatic.

Acquired renal AVFs are uncommon entities that are hypothesized to occur due to erosion of an aneurysm of an intraparenchymal renal artery into an adjacent vein.[1] These can be treated by surgery or by endovascular techniques. Surgical techniques such as nephrectomy are more invasive as compared with transarterial embolization and also incur higher blood loss. The risk of pulmonary nontarget embolization and possibility of renal deterioration post-embolization of AVFs with large venous pouches demands careful planning prior to endovascular therapy. Various embolic agents have been used for treating high-flow renal AVFs such as IDC, Amplatzer vascular plug, and atrial septal occluders.[3–7] The use of liquid embolic agent like NBCA glue is counterintuitive in high-flow AVFs and previously

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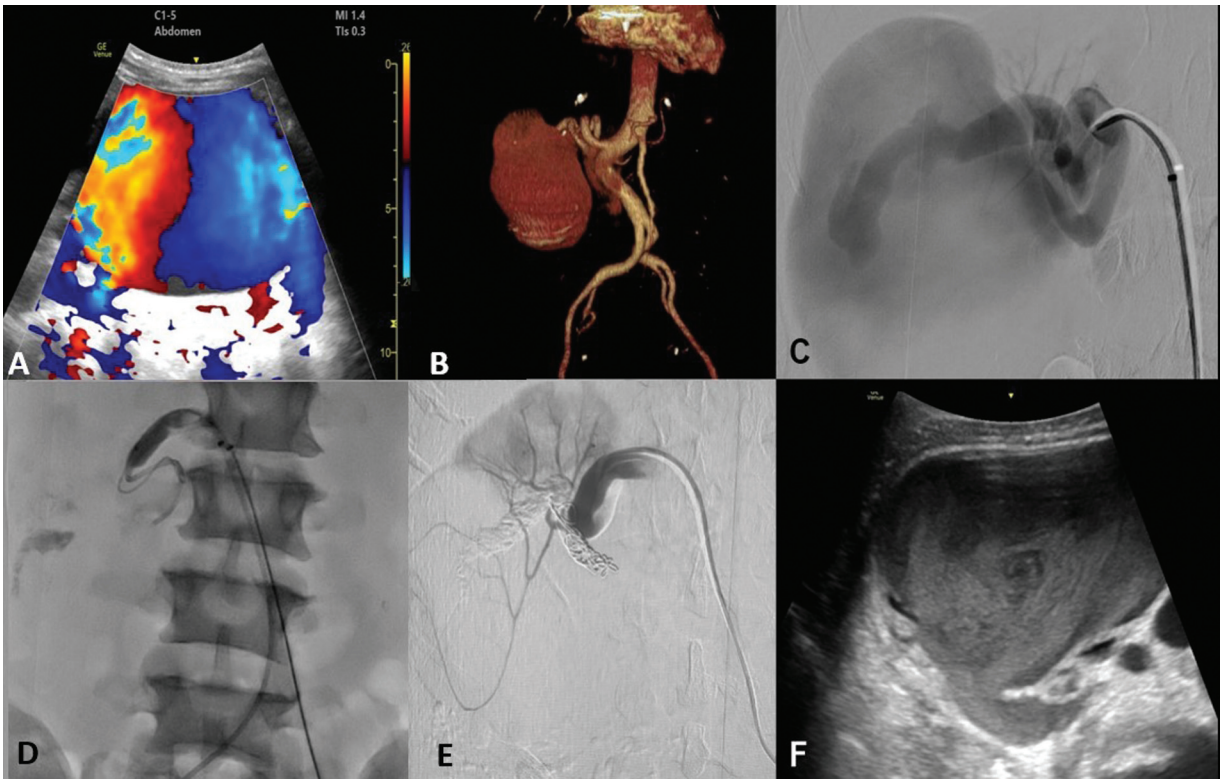

Fig. 1 A 52-year-old female patient with high-flow renal arteriovenous fistula (AVF): (**A**) ultrasonography (USG) Doppler showing turbulent flow within the large venous pouch, (**B**) volume rendered image of the computed tomography angiogram showing the high-flow AVF with large venous pouch, (**C**) right renal angiogram showing the AVF with a single dilated tortuous arterial feeder from right renal artery, (**D**) fluoroscopic image showing proximal occlusion with balloon catheter and distal glue cast in the feeding artery, (**E**) angiogram showing complete cessation of antegrade flow in the AVF and filling of the normal upper polar branches, and (**F**) post-procedure Doppler USG showing echogenic contents with no flow suggestive of complete thrombosis.

sparsely reported in literature.[8] However, with complimentary techniques like flow arrest, liquid embolic agents can be safely used in these situations.

Conflict of Interest

None declared.

References

1 Khawaja AT, McLean GK, Srinivasan V. Successful intervention for high-output cardiac failure caused by massive renal arteriovenous fistula-a case report. Angiology 2004;55(02):205–208

2 Fung KFK, Wong SW, Chan EY, et al. Embolisation of an aneurysmal high-flow renal arteriovenous fistula in a paediatric patient: simultaneous arterial and venous approach. CVIR Endovasc 2022;5(01):24

3 Kawashima A, Sandler CM, Ernst RD, Tamm EP, Goldman SM, Fishman EK. CT evaluation of renovascular disease. Radiographics 2000;20(05):1321–1340

4 Sundarakumar DK, Kroma GM, Smith CM, Lopera JE, Suri R. Embolization of a large high-flow renal arteriovenous fistula using 035″ and 018″ detachable coils. Indian J Radiol Imaging 2013;23(02):151–154

5 Idowu O, Barodawala F, Nemeth A, Trerotola SO. Dual use of an Amplatzer device in the transcatheter embolization of a large high-flow renal arteriovenous fistula. J Vasc Interv Radiol 2007;18 (05):671–676

6 Balasubramanian K, Keshava SN, Lenin A, Mukha R. Endovascular management of a patient with massive renal arteriovenous fistula: challenges and tricks. BMJ Case Rep 2021;14(02): e236358

7 Chen X, Zeng Q, Ye P, Miao H, Chen Y. Embolization of high-output idiopathic renal arteriovenous fistula primarily using an atrial septal defect occluder via venous access: a case report. BMC Nephrol 2019;20(01):15

8 Becker LS, Hinrichs JB. Fogarty-assisted transcatheter embolization of a large renal high-flow arteriovenous fistula. CVIR Endovasc 2022;5(01):19

