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ORIGINAL PAPER

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Assessment of availability of magnetic resonance angiography (MRA) in renal arteriovenous fistula

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Abstract We report two cases of cirsoid-type renal arteriovenous fistula (RAVF) which were difficult to differentiate from renal pelvic tumor by intravenous pyelogram (IVP) and computed tomography (CT) scan. Two women visited our department complaining of sudden asymptomatic macroscopic hematuria. CT scans showed an irregular mass in the right kidney. Magnetic resonance angiography (MRA) revealed a cirsoid-type RAVF. These patients were treated with transarterial embolization (TAE) using ethanol, geratin sponge, and a coil. It is suggested that MRA is useful for the diagnosis of renal arteriovenous fistula.

Keywords Renal arteriovenous fistula · MRA · Diagnosis

Case report

Case 1

A 76-year-old woman visited our department complaining of sudden asymptomatic macroscopic hematuria without other symptoms. There was no history of trauma, renal surgery or infection. She had no previous disease except for hypertension. Findings on physical examination were normal. Blood pressure was 160/90 mmHg. Hematocrit was 34.3% and hemoglobin 12.7 g/dL. Urinalysis showed hematuria. Cystoscopy did not reveal abnormal mucosa. An IVP revealed filling defect in the collecting system. This suggested urothelial tumor or blood clot. Ultrasonography revealed a small cavity in the middle pole of the right kidney. A CT scan showed an irregular mass (3×2×2 cm) in the right kidney. CT was performed with study of arterial, venous, and parenchymal phases; however, this could not help us to diffentiate this mass. MRA revealed nidus in the middle pole of the right kidney (Fig. 1A). This image was performed with Gadlinium enhancement; therefore, RAVF was diagnosed. Transfemoral renal angiography demonstrated localized tortuous vessels in the middle pole of the right kidney with early opacification of renal vein and inferior vena cava. Subselective arteriogram of the middle pole segmental artery showed large cirsoid RAVF with tortuous channels, multiple fistulous connections, and early filling of renal vein (Fig. 1B). An immediate TAE was performed using geratin sponge, ethanol, and a coil. An angiogram at the conclusion of the embolization showed an intact nephrogram and normal filling of the renal vein. During the ensuing 3 days the patient experienced mild right flank pain. However, the symptom resolved spontaneously. Macrohematuria was no longer present. Post TAE 1 month, blood pressure was 130/80 mmHg. Excretory urography 4 weeks later showed prompt.

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Case 2

A 74-year-old woman presented complaining of sudden asymptomatic macroscopic hematuria without other symptoms. She had acromegaly. Findings on physical examination were normal. There was no history of trauma, renal surgery or infection. Urinalysis showed hematuria. An intravenous pyelogram (Fig. 2A) and retrograde pyelogram revealed filling defect in the collecting system. This suggested urothelial tumor or blood clot. Ultrasonography revealed a small cavity in the middle pole of the right kidney. An enhanced CT scan through kidneys showed tangle of enhancing vessels in the middle pole of the right kidney. MRA revealed nidus in the middle pole of the right kidney (Fig. 2B). Therefore, RAVF was diagnosed. Transfemoral renal angiography demonstrated localized tortuous vessels in the middle pole of the right kidney with early opacification of renal vein and inferior vena cava. Subselective arteriogram of the middle pole segmental artery showed large cirsoid RAVF with tortuous channels, multiple fistulous connections, and early filling of renal vein (Fig. 2C). An immediate TAE was performed using geratin sponge, ethanol, and a coil. An angiogram at the conclusion of the embolization showed an intact nephrogram and normal filling of the renal vein. During the ensuing 5 days the patient experienced mild right flank pain and low-grade fever. The symptom, however, resolved spontaneously. Macroscopic hematuria was no longer present. Excretory urography 4 weeks later showed prompt.

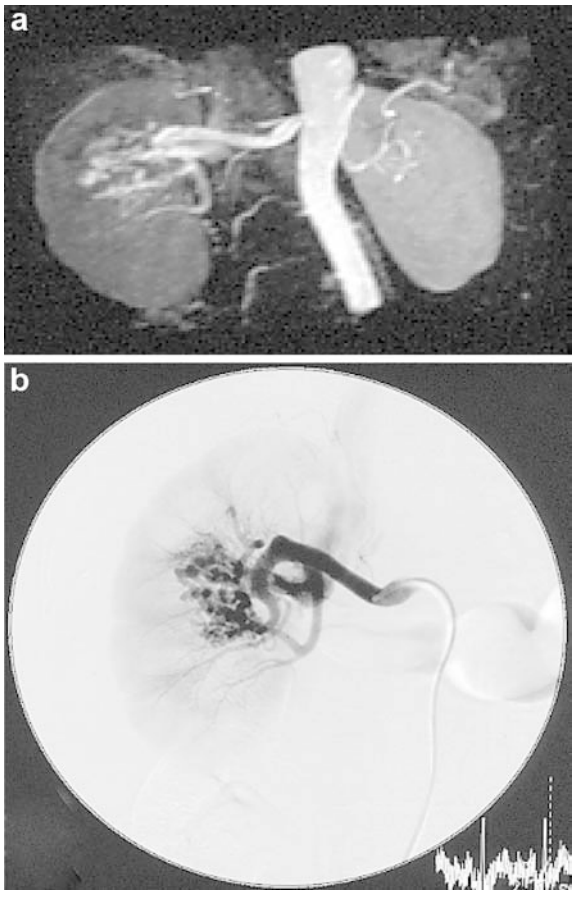

Fig. 1 **A** MRA revealed cirsoid type AVF at the middle portion. Renal vein is seen. **B** Renal arteriogram shows abnormal vascular shadow of cirsoid type and early filling of renal vein

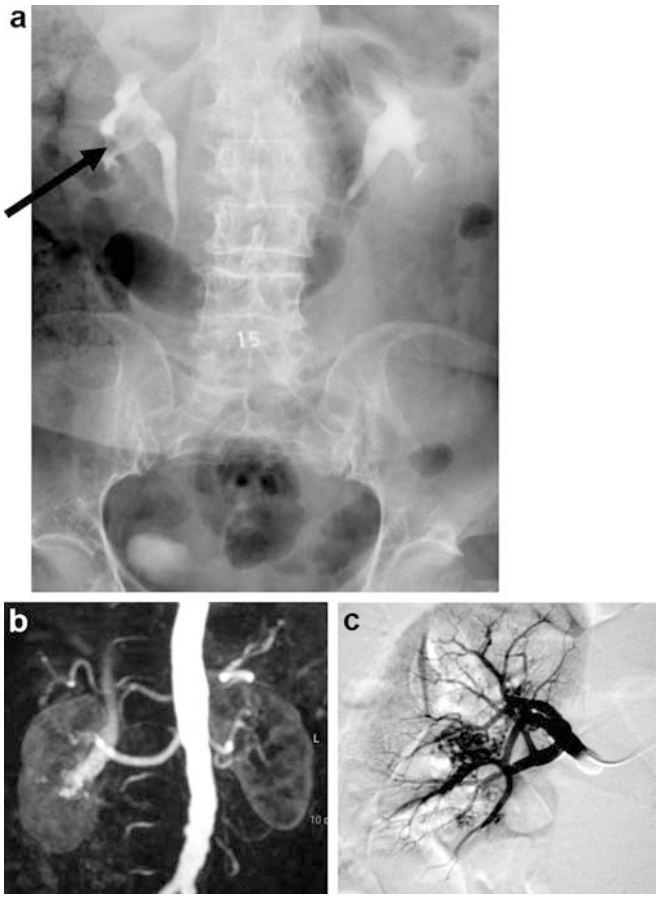

Fig. 2 **A** IVP demonstrates irregular filling defect of right renal pelvis (*arrow*). **B** MRA revealed cirsoid type AVF at the middle portion. Renal vein is seen. **C** Renal arteriogram shows abnormal vascular shadow of cirsoid type at the middle portion

Discussion

RAVF are generally labeled congenital, acquired or idiopathic. Congenital lesions typically have a cirsoid appearance angiographically, with multiple arteriovenous communications. Clinicopathologic forms of localized RAVF, so-called cirsoid aneurysm, are characteristically formed by arterial and venous arms and channels, which show abnormal communications between the regional and venous systems. Morphologically, it is considered a local vascular disorder of arteries, veins, and other vessels with structural characteristics of both arteries and veins; microscopically, it is difficult to classify [1]. The malformation is generally located just below the pelvic and calyceal wall, being supplied through the interlobular arteries. They account for slightly less than one-quarter of all RAVF [2]. Acquired lesions usually are aneurysmal, typically with a solitary communications between the artery and vein. They account for almost three-quarters of all RAVF [1] and have been associated with renal biopsy (the most common etiology), other renal operations (nephrectomy, heminephrectomy, nephrolithotomy and so forth), trauma (usually penetrating) and malignant tumors (most commonly renal cell carcinoma) [3]. Idiopathic lesions are aneurysmal, like acquired RAVF, with a single cavernous channel and well-defined arterial and venous elements [4]. They account for 3–5% of all RAVF [1]. Congenital lesions are commonly found just beneath the mucosa of the renal collecting system and, accordingly, often present with gross hematuria. In contrast, acquired and idiopathic lesions, by causing increased venous return and high cardiac output, are more apt to result in cardiovascular signs and symptoms, including abdominal or flank bruits, hypertension, cardiomegaly and congestive heart failure [5].

Arteriography is the definitive procedure for determining the precise location and extent of RAVF. Nonselective imaging shows the number of renal arteries, feeding and draining vessels, and any associated renal disease. Early opacification of the inferior vena cava is also shown when present. Selective imaging is done to show the specific anatomy of RAVF. Cirsoid RAVF appears as a tangle of multiple tortuous vascular channels with arteriovenous shunting supplied by multiple segmental or interlobar arterial branches [6]. Although arteriography is the gold standard for evaluating RAVF, it is invasive and RAVF can now be detected and

monitored by noninvasive imaging techniques such as MRA or duplex sonography. The high flow rates and tortuosity of the vessels in the RAVF produce aliasing or color saturation on color Doppler examination. Spectral analysis with pulsed Doppler interrogation shows increased flow velocity and decreased resistance in the supplying artery and arterial pulsations in the draining vein [7]. Although there are few reports and experiences of MRA used for RAVF, MRA is considered to be a more non-invasive method for evaluating RAVF than angiography. MRA can be performed even for those who have lower function of their kidney or toxicity of enhancement. MRA demonstrated major feeding vessels and multiple intra-lesional vessels in relation to the high flow lesions, features absent in the low flow lesions. MRA also has the strong point in such a case as when venous flow is asymmetric, which is typical of fistula. However, small feeding vessels to the RAVF were not clearly identified. More and more clear images may be emerged soon.

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