



Functional medicine

Endovascular catheter arterial embolization effectively treats secondary hypertension and increased plasma B-type natriuretic peptide level accompanied by idiopathic renal arteriovenous fistula

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ABSTRACT

A 65-year-old woman with a history of hypertension and atrial fibrillation was referred to our hospital following detection of microscopic hematuria.

Physical examination showed continuous vascular murmur with the maximum point on the right side of the umbilicus. Contrast-enhanced computed tomography showed a right renal aneurysmal-type arteriovenous fistula. She underwent endovascular catheter arterial embolization. Following this, her blood pressure was virtually normalized, and her levels of plasma BNP were significantly reduced.

We recommend that patients with microscopic hematuria should be auscultated around the navel, because renal AV shunt is treatable; this may facilitate cure of secondary hypertension and cardiac load.

Introduction

Renal arteriovenous (AV) fistula is a pathological condition characterized by abnormal communication between the renal artery and veins in the absence of interconnecting capillaries. There are three main causes of this renal arterial abnormality: congenital, idiopathic, and acquired.¹ incidence of acquired renal AV fistula has increased concomitantly; however, idiopathic or congenital renal AV fistula is rare. Historically, surgery (e.g., partial nephrectomy or vascular reconstruction) was the only treatment option for these vascular anomalies.² However, technical advances have now positioned the use of endovascular techniques as the preferential management option. This is because an endovascular approach is minimally invasive to the patient and also preserves the remaining renal function.³

Hypertension and increased cardiac load are common complications of renal AV fistula. The patients classified as essential hypertension require lifelong drug treatment. In the case of secondary hypertension due to renal AV fistula, complete cure is possible if the cause is removed. In the present case, endovascular catheter arterial embolization completely cleared a renal AV fistula, practically normalized secondary hypertension, and significantly reduced plasma B-type natriuretic peptide (BNP) levels. We suggest that adopting this approach in the future may prevent the onset of heart failure in patients with similar clinical

characteristics.

Case report

A 65-year-old woman in whom microscopic hematuria was detected during an annual physical check-up was referred to our hospital. Ultrasonography with color Doppler of the abdomen revealed a renal AV malformation that resembled a polycystic lesion. Diagnostic work-up with contrast-enhanced computed tomography of the abdomen revealed a right renal aneurysmal-type AV fistula. Since the patient had no previous history of renal intervention, trauma or tumor, a diagnosis of idiopathic renal AV fistula was made. She had a history of hypertension and atrial fibrillation. The blood pressure was ~140/80 mmHg following administration of antihypertensive drugs. Chest X-ray showed cardiac dilatation with a cardiothoracic ratio of 61%. Echocardiogram showed normal left ventricular systolic function without left ventricular dilation. The left atrium, right atrium, and right ventricle were dilated modestly, and Doppler examination showed mild tricuspid regurgitation with a pressure gradient of 32 mmHg. The patient was treated with endovascular catheter arterial embolization as described below. She did not have serious post-operative complications. Two weeks after embolization, a post-therapeutic examination showed plasma BNP levels decreased (from 161 pg/mL to 80 pg/mL) and blood pressure was also

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reduced to 125/75 mmHg.

Embolization procedure

We punctured the right femoral artery and approached the right renal artery and right renal vein through the aneurysmal AV fistula. As detected by contrast-enhanced CT scan, there were a few bifurcations in the proximal region of the right renal artery and there were no bifurcations in the distal region (Fig. 1). At first, we tried embolization using embolus coils under the control of good flow, but we had difficulty in placing a balloon catheter at correct position. We started embolization gradually while simultaneously stabilizing the guiding sheath. Ultimately, we used three kinds of coils (Interlock-35, Target XXL, and Rubycoil) and twelve coils in total to pack the aneurysm, which was about 2 cm in diameter. In the end, the AV fistula disappeared (Fig. 2). We were able to avoid the additional expense of using n-butyl-2-cyanoacrylate during embolization because the performance of the coils alone was adequate.

Discussion

Cho et al.⁴ classified AV malformations into the following three groups. Type I: fewer than four separate arteries shunting to a single draining vein, type II: multiple arterioles shunting to a single draining vein, and type III: multiple complex AV networks. Based on the contrast enhanced CT findings, we classified the current case as a type I AV malformation. As for etiology, approximately 75% of the cases are acquired due to iatrogenic activities, trauma or tumor. This patient was diagnosed as idiopathic renal AV fistula because she had no history of renal intervention, trauma or tumor.

The most common clinical presentation of AV malformation is macro- or microscopic hematuria. In the present case, the patient was referred to our hospital for further examination of microscopic hematuria. Secondary hypertension may also be seen and may be related to altered flow dynamics within the renal artery. Indeed, our patient had been treated for hypertension for several years. Heart failure is frequently seen in cases with relatively large fistulas. BNP is a cardiac hormone of which production is stimulated by volume and/or pressure overload. Therefore, BNP is currently used as a biomarker for heart failure. In this case, BNP was modestly elevated by volume-overload due to renal AV fistula, indicating this patient had a high risk for heart failure.

Recently, endovascular embolization has been chosen as the first-line therapy due to its efficacy and safety.^{3,4} On the other hand, surgical treatment is performed in limited cases, for example, where it is difficult to use endovascular techniques.⁵ Embolization can be technically difficult when the fistulous portion of the lesion exceeds a certain size and length. In the current case, we opted for the endovascular technique, although two-phase enforcement had also been planned due to the complicated structure of blood vessels. In fact, we did encounter difficulties in closing the proximal and distal ends with an occlusion balloon.

Immediate hemodynamic change can cause progressive venous thrombosis, especially in type I high-flow fistula, and may ultimately lead to delayed fatal complications. In this case, severe complications were not present. Based on contrast enhanced CT findings, we thought this AV fistula had been caused by renal aneurysm, and that increased venous return might explain the increased heart burden and secondary hypertension. After embolization, post-operative BNP decreased due to disappearance of volume-overload by renal AV fistula and secondary hypertension nearly normalized a month later. To examine whether BNP and blood pressure can be normalized without medication, long-term follow-up is needed.

In conclusion, we believe that auscultation around the navel should always be performed for patients presenting with microhematuria. Together with examination for continuous murmur, this may facilitate a diagnosis of renal AV fistula. Otherwise, this potentially lethal vascular

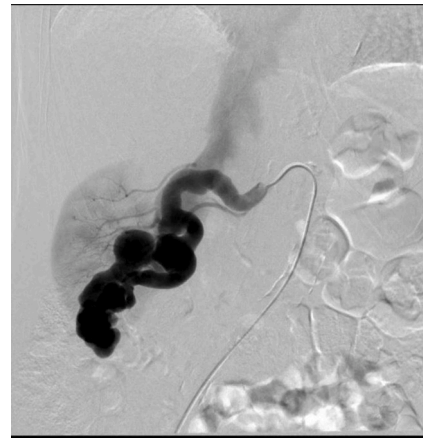


Fig. 1. Right renal selective angiography shows large renal arteriovenous fistula.



Fig. 2. Right renal selective angiography shows no renal arteriovenous fistula after the endovascular embolization therapy. Note that the peripheral kidney tissue is densely contrasted.

anomaly can easily be missed on primary evaluation.

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Declaration of competing interest

The authors have no conflicts of interest to declare.

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