

Superselective Endovascular Embolization of Congenital Renal Arteriovenous Malformation

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ABSTRACT

Renal congenital, idiopathic, or acquired arteriovenous (AV) malformations are uncommon entities. Most symptomatic congenital renal AV malformations require active treatment. Arterial embolization is currently considered the treatment method of choice.

The authors present a case of a 33-year-old male who presented with renal colic and macroscopic hematuria. Investigation showed renal AV malformation, which was successfully treated with selective embolization of the vessels using coils and glue.

KEYWORDS: Renal arteriovenous malformation; Selective embolization

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INTRODUCTION

Renal arteriovenous (AV) malformations are uncommon entities. They are divided into congenital, idiopathic, and acquired types, the latter of which is the most common. Seventy-five percent of AV malformations are iatrogenic in origin (based on renal biopsy), or caused by trauma, inflammation, tumors, or renal surgery.

Most symptomatic congenital renal AV malformations require intervention. Arterial catheterization and embolization of the vessels of the malformation are considered the treatment methods of choice [1].

CASE REPORT

A 33-year-old male presented with gross hematuria, right flank pain, and fever up to 38°C (100.4°F) at the hospital's emergency department. He had no history of hypertension, trauma, renal surgery, or hematuria. However, he reported increased physical strain during the past several days.

Physical examination was unremarkable. Blood pressure was 120/80 mmHg, heart rate was 82 beats/minute, respiratory rate was 12 breaths/minute. Urinalysis showed abundant red blood cells. Blood count showed mild leukocytosis (10.800 K/ μ L); urea and electrolytes were normal.

The patient was treated conservatively with hydration and intravenous antibiotics. Due to the gross hematuria, his hemoglobin dropped gradually to 8.8 g/dL. Therefore, he was transfused with 4 units of red blood cells.

The chest X-ray, electrocardiogram, blood tests, blood and urine cultures (including B. Koch), and urine cytology showed no abnormal findings. Cystoscopy revealed blood coming from the right ureteral orifice, but imaging studies did not reveal the cause of his hematuria. Computed tomography (CT) of the abdomen and magnetic resonance imaging (MRI) showed an increase in the size of the right kidney with moderate edema. There were blood clots inside the renal pelvis, but no evidence of malignancy was found.

An arteriogram of the right kidney was then performed. It showed a large high-flow AV malformation in the middle lobe of the kidney with 3 major arterial branches (Figure 1). Selective embolization was then performed under local anesthesia. Two major arterial branches were embolized using 0.035 inch coils (Cook Medical, Bloomington, IN, USA). The third branch was embolized using synthetic cutaneous N-butyl-2-cyanoacrylate glue (Gluebran 2®, GEM Srl, Viareggio, Italy). After embolization, a small vessel remained open. However, it did not communicate directly with the large vessels of the malformation (Figure 2).

Hematuria dissolved in the next 2 days and the patient was discharged in good condition. A dimercaptosuccinic acid (DMSA) renal scan was performed 1 month after embolization. The scan showed decreased size of the right kidney and impaired function (26.86% of the total renal function). The patient was asymptomatic at a 1-year follow-up. A slight increase in right renal function was observed (29.58% of the total renal function).

DISCUSSION

Approximately 25% of renal AV fistulas are congenital in origin. Their exact causes are unknown. It is believed that they develop during embryogenesis because of errors in vascular morphogenesis, or appear as a result of a rupture of a congenital arterial aneurysm into a vein. They are usually

asymptomatic until the second to third decade of life. Acquired renal AV fistulas are more common. They are caused by trauma, inflammation, renal surgery, renal artery angioplasty, cancer, or transdermal renal biopsy. Idiopathic renal AV malformations are solitary, not cirroid, and have an appearance similar to acquired malformations. However, their origin is unknown [2].

Clinical presentation of renal AV malformations varies. Primary symptoms are hematuria, hypertension, abdominal pain, and murmur in abdominal auscultation; congestive heart failure may occur in cases of large malformations with a flow up to 20% to 50% of cardiac output [3]. Infrequently, AV malformations present with palpable abdominal masses or as an acute abdomen because of spontaneous rupture [4]. In the present case, obstructive uropathy due to blood clots was the main clinical finding.

Imaging studies helpful in the diagnosis are renal Doppler ultrasound, CT, and MRI. Definite diagnosis is made using renal angiography, which can rule out other conditions with a similar clinical picture such as stenosis of the renal artery [3].

The indications for intervention in AV fistulas include renal failure, cardiac failure, hypertension, hematuria, and a progressive increase in the size of the fistula. The treatments of choice are selective catheterization and embolization of the vessels of the malformation. The advantage of embolization is

Figure 1. Angiography of Renal Arteriovenous Malformation (Arrow).

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Figure 2. Angiography of Renal Arteriovenous Malformation After Embolization (Arrow).

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closure of the fistula, while preserving as much of the healthy renal parenchyma as possible. Occlusion of the nidus is essential or the malformation will recanalize using collateral pathways.

Using the Seldinger technique, a catheter is inserted into the renal artery and a baseline angiography is obtained. The catheter is then inserted into the arterial branch of the malformation, which is embolized using a variety of occluding agents such as microcoils, detachable balloons, gelatin sponges, alcohol, or glues [1,5,6,7]. In cases of large high-flow malformations, where pulmonary embolism may occur because of escape of the embolization material into systemic circulation, a *stop-flow* technique can be used. This technique occludes the afferent vessel of the fistula and prevents escape of the embolizing agent [8]. In the present case, microcoils and glue were used for embolization with good results.

Surgical treatment is used for malformations in which elective catheterization is impossible or may lead to complications [3]. In these cases, ligation of the feeding vessels of the malformation is performed. Otherwise, partial or even radical nephrectomy can be performed when bleeding is uncontrollable, keeping in mind that an ex-vivo surgical correction of the malformation can be done [9].

CONCLUSIONS

Congenital renal AV malformation is a rare clinical entity with a variety of presenting symptoms. Development of embolization techniques has made it possible to treat even large high-flow malformations, thereby avoiding the need for open surgery. Early diagnosis with a renal arteriogram and primary treatment with selective embolization are of paramount importance for the best outcome.

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