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CASE REPORT

Large Renal Artery Aneurysm Treated with Guglielmi Detachable Coils: Procedural and 4-Year Follow-up Results

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Abstract A large aneurysm of the left renal artery was found incidentally during abdominal ultrasound in a 39-year-old woman with no medical or family history of cardiovascular disease. Vascular pathology with a dysplastic appearance was confirmed by magnetic resonance angiography and the patient was offered transcatheter embolization. Since the position and size of the neck of the aneurysm could not be determined at angiography, detachable platinum coils were used for occlusion. The procedure was performed without complications. During a 4-year follow-up no alterations of renal function, recanalization of the aneurysm, or perfusion defects in the rest of the left renal circulation were noted.

Keywords Aneurysm · Renal arteries · Coil embolization

Introduction

Renal artery aneurysms (RAAs) are rare and most are asymptomatic [1–4]. Wider use of multimodal imaging techniques is leading to more frequent detection of these aneurysms, but their diagnosis gives rise to a treatment dilemma. The accepted indications for treatment are the aneurysm size, the tendency to enlarge, possible future pregnancy, and significant correlated symptoms [5, 6]. Surgical or endovascular treatment can be considered. Endovascular treatment is advantageous in terms of a lower morbidity and procedural complexity. In addition, the procedure can be aborted if it proves unfeasible, leaving the possibility of surgical repair afterward. At present, the small number of patients treated and the lack of long-term follow-up prevent firm conclusions as to what method or combination of methods should be adopted.

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Case Report

A RAA was found at color Doppler ultrasound in a 39-year-old woman with no medical or family history of cardiovascular disease who presented with diffuse abdominal pain thought to be due to irritable bowel syndrome. Blood pressure was normal and the patient had had a normal pregnancy 1 year prior to the diagnosis of the RAA.

At physical examination, pulsation over the left kidney and a bruit on auscultation were detected. Color Doppler ultrasound (Fig. 1A) revealed an aneurysmal dilatation of the left renal artery close to the renal hilum; the other kidney vasculature was normal. Contrast magnetic resonance (MR) angiography confirmed the presence of a large (3-cm) saccular RAA. Considering the size of the aneurysm, its probable congenital-dysplastic etiology, and the patient's age, treatment was considered indicated to prevent later complications.

The patient was offered surgery or endovascular exclusion and she opted for the latter. Under general anesthesia, used because of the patient's poor psychological

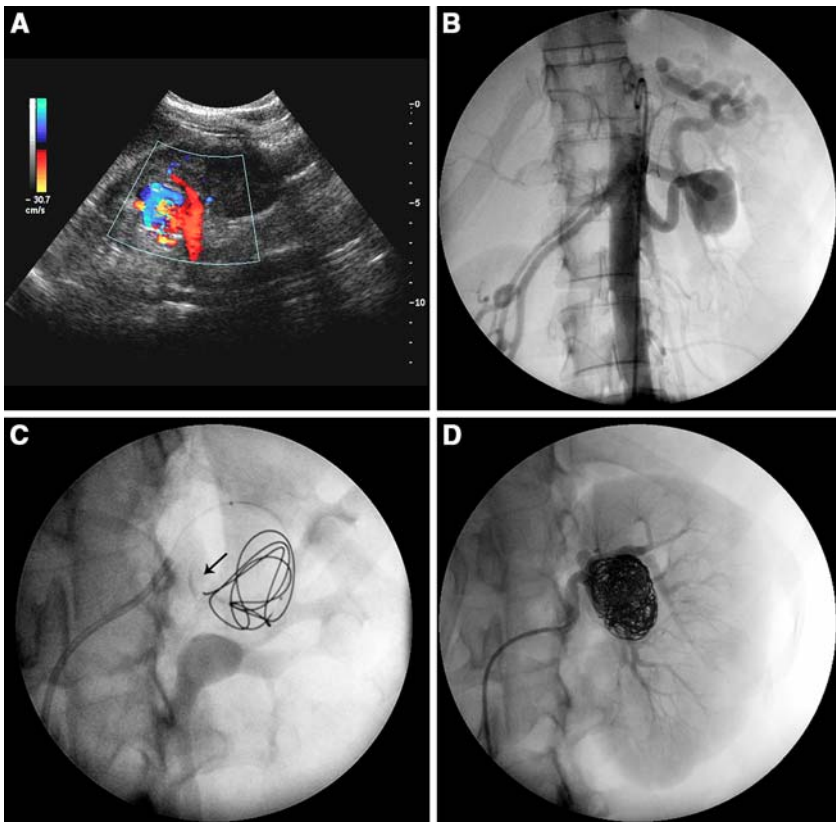

Fig. 1 Left renal artery aneurysm. **A** Color Doppler ultrasound showing turbulent flow in the aneurysm near the hilum of the left kidney. **B** Abdominal aortography. Early division of the right renal artery. Aneurysm in the left renal artery at the hilum, about 3 cm in diameter, originating from the posterior segmental artery. The splenic artery appears exceptionally long and tortuous. **C** A special microcatheter for coil deployment has been introduced into the aneurysm and a first platinum coil is rolled inside it. Note the compression of the upper and middle calyces by the aneurysm, which has a mainly posterior location. Arrows indicate a small parietal calcification. **D** Left renal angiography after placement of 17 coils. No perfusion defects are noted in the extra-aneurysmal renal arterial circulation

compliance, abdominal aortography was performed by transfemoral catheterization (Fig. 1B). Angiography showed an early division of the right renal artery and a single left renal artery with a saccular aneurysm arising from the posterior segmental artery. The size and exact location of the neck and possible involvement of the contiguous renal branches could not be determined. Obliteration by covered stent implantation and embolization with glue were therefore ruled out, whereas treatment with electrolytic detachable coils seemed the method that could be best controlled by the operator. The left renal artery was catheterized with a 5-Fr guide catheter (Guider; Boston Scientific Corp., Natick, MA, USA) and a microcatheter (Excelsior; 150 cm, 2 TIP; Boston Scientific Corp.) was advanced into the aneurysmal sac over a microguide (Transend EX; 0.014 in., 205 cm, platinum; Boston Scientific Corp.) (Fig. 1C). Continuous flushing with heparinized saline was maintained throughout the procedure between the guide catheter and the microcatheter and between the microcatheter and the coils. A total of 17 Guglielmi detachable platinum coils (GDC; Boston Scientific Corp.), varying in diameter and length from 20 mm/30 cm to 7 mm/20 cm, for a total length of 485 cm, were deployed. During detachment of the coils, contrast was injected through the guide catheter to check that perfusion was maintained in the remaining left renal circulation (Fig. 1D). The patient was discharged 2 days after the procedure and followed up clinically and by color Doppler ultrasound, monthly at first, then every 6 months and yearly after the first year. One month after obliteration of the aneurysm, ^{99m}Tc-MAG3 sequential renal scintigraphy showed normal parenchymal perfusion of the radiopharmaceutical agent bilaterally, with a relative uptake of 55% for the left kidney and 45% for the right kidney. Afterward, the patient remained completely asymptomatic. At 3-year follow-up, selective renal angiography confirmed that the aneurysm was excluded, with no significant change of renal vasculature (Figs. 2A and B). The most recent color Doppler ultrasound scan, performed 4 years after the interventional procedure, confirmed a good long-term result (Figs. 2C and D).

Discussion

RAAs can be detected today by noninvasive methods such as color Doppler ultrasound, multilayer computed tomography, and MR angiography, with results similar to those obtained with angiography. The latter technique is therefore more often used at the time of treatment, when indicated. The natural history and prognosis of RAA probably require updating based on the data accumulating during

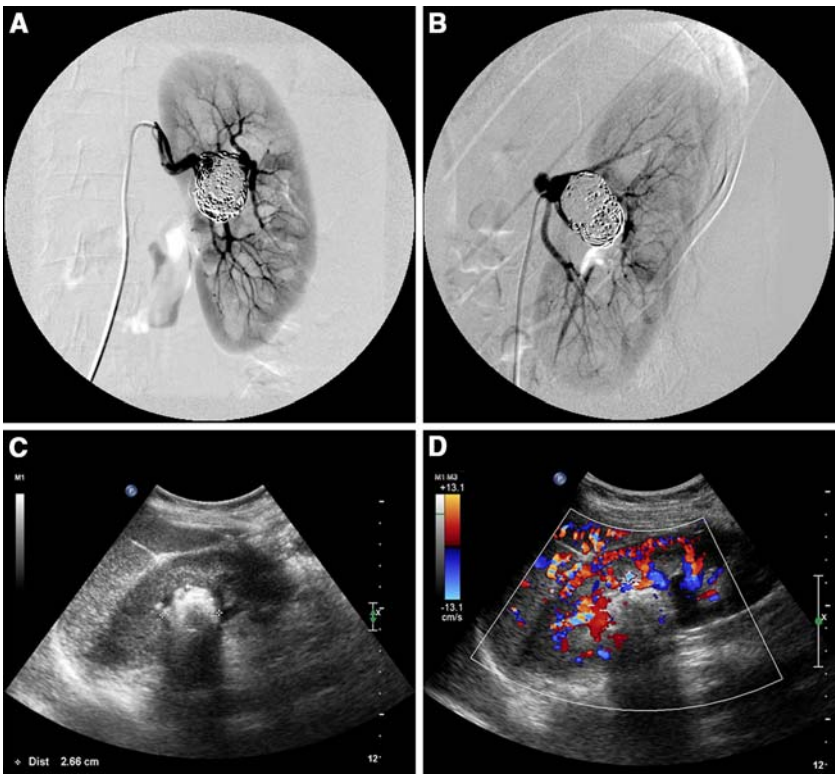

Fig. 2 Follow-up at 3 and 4 years after closure of the left renal artery aneurysm. **A**, **B** Renal angiography at 3 years shows no passage of contrast agent into the aneurysmal cavity and normal vascular architecture of the kidney. **C**, **D** Color Doppler ultrasound at 4 years shows complete obliteration of the aneurysm by the shadow generated by the coils and no vascular signal in the cavity

recent years from numerous studies [7]. In the last 20 years, the prevailing view about the treatment of choice has gradually changed, with a progressive shift from the surgical approach, which must in any case be considered [8–10], to endovascular transcatheter procedures [11]. Increased experience and advances in interventional materials and techniques have made endovascular treatment of RAA a feasible and effective alternative to traditional, open methods of repair in many cases. Indeed, surgical management of this type of vascular pathology requires considerable operator skill, procedures such as partial or total nephrectomy, ex vivo repair, and autotransplantation into the iliac fossa [12], and may be associated with higher morbidity and mortality. These aspects of the treatment choice are even more critical in the case of RAA rupture or when this vascular pathology is located in a solitary kidney [13].

The endovascular approach offers several treatment modalities, depending on the RAA location, the size of the neck, and the operator's familiarity with the various devices and techniques available for exclusion [14–16]. There is no doubt that precise information on the anatomical characteristics of the RAA plays a critical role in choosing the appropriate endovascular therapy. In this regard, the absence of branch involvement and a proximal location, close to the renal artery ostium, favor the option of covered-stent implantation, which also allows any associated arterial stenosis to be corrected. With covered-stent placement, the RAA is excluded without the risk of endotension, which is a potential cause of rupture. However, no long-term follow-up is reported as regards possible late complications affecting the renal circulation [17–19]. In the presence of a complex vascular anatomy, which often cannot be interpreted even with multiple angiographic projections, covered-stent placement is problematical and the alternative of RAA embolization with *N*-butyl cyanoacrylate or ethylene vinyl alcohol glue must be considered. The use of glues, however, is complex. Polymerization can occur inside the catheter, and the glue can overflow from the aneurysm, causing distal embolization. In addition, the level of procedural control of this technique is lower than that of covered-stent placement.

Free coils and controlled-detachment coils remain to be considered [20]. Considerable experience has been acquired with these devices, especially in the treatment of intracranial aneurysms. For this application, however, the reported incidence of recanalization and rupture is not negligible, particularly when the aneurysm lies in the direction of blood flow [21]. Controlled-detachment coils, mostly platinum, have recently been improved by two important features. Current coils adapt even to an irregular aneurysm, taking on a complex three-dimensional shape during release. The possibility that these coils might protrude or migrate is therefore very small, even if the aneurysm neck is wide. At the same time, a lower rate of compartmentalization, i.e., the persistence of empty spaces,

which may explain recanalization since blood can continue to flow between the coils, has been observed with their use. Recently, coils have been coated with a polymer consisting of a polyglycolic-polylactic acid (PGLA) film [21]. This material promotes endothelial proliferation that induces thrombus conversion to fibrocellular tissue. The new controlled-detachment coils allow controlled delivery since their detachment is decided only when fluoroscopy shows that they have taken their complex-shape design, effectively adapting to the anatomical shape of the aneurysm. The more efficient the aneurysm packing obtained, avoiding empty spaces as much as possible, the easier it is to create stasis and thrombus formation inside the aneurysm. This result is more difficult to be achieved in large aneurysms, which often require a considerable number of coils to be obliterated. In our case, 17 coils were needed, for a total length of 485 cm. Thus, procedural cost is an issue that should be considered. Another feature of this type of coils is their very modest radial force, which may explain the absence of aneurysm rupture in the previous clinical experience in extracranial vascular sites with these devices. Of note, Klein et al. reported no procedural complications or late recanalization in the largest series of RAAs available [20]. In our case, the results at follow-up, which is the longest reported to date, seem to confirm these positive findings concerning the long-term safety and efficacy of embolization with controlled-detachment coils in the treatment of single or multiple saccular RAAs.

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