Operative Approaches to Renal Artery Aneurysms

An overview of the surgical and endovascular options for this rare but treatable condition.

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Renal artery aneurysms (RAAs) are rare, and even large, single-institution, surgical series only amount to 10 to 35 patients treated over 12 to 20 years.[1-3] The most common etiologies are atherosclerosis, fibromuscular dysplasia or other forms of medial degeneration, and Ehlers-Danlos syndrome. True aneurysms of the renal artery occur as often in men as in women, with the exception of fibrodysplastic disease. Most (90%) of these aneurysms involve the extraparenchymal renal artery; 75% are saccular, and approximately 10% are bilateral. Typically, saccular RAAs occur near bifurcations of the main renal artery, often making repair technically difficult.

Figure 1. Selective renal arteriogram of right RAA subsequently treated with open exclusion and bypass.

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Most RAAs are asymptomatic and therefore are discovered incidentally on radiologic studies. Sometimes affected patients present with pain, hematuria, hypertension (from distal embolization to the renal parenchyma), or hydronephrosis. Rupture occurs uncommonly, although its risk seems greatly increased during pregnancy. Traditionally, repair is indicated in pregnant women with any size RAA (given very high mortality to both mother and fetus with rupture) and in other aneurysms > 2 cm in diameter.

Ruptured RAAs most often require open repair or nephrectomy. Elective repair can be accomplished by any one of a number of open or endovascular approaches.

ANEURYSMORRHAPHY WITH PRIMARY REPAIR OR PATCHING

Often, saccular RAAs can be repaired using an open approach with simple excision of the aneurysm and primary closure

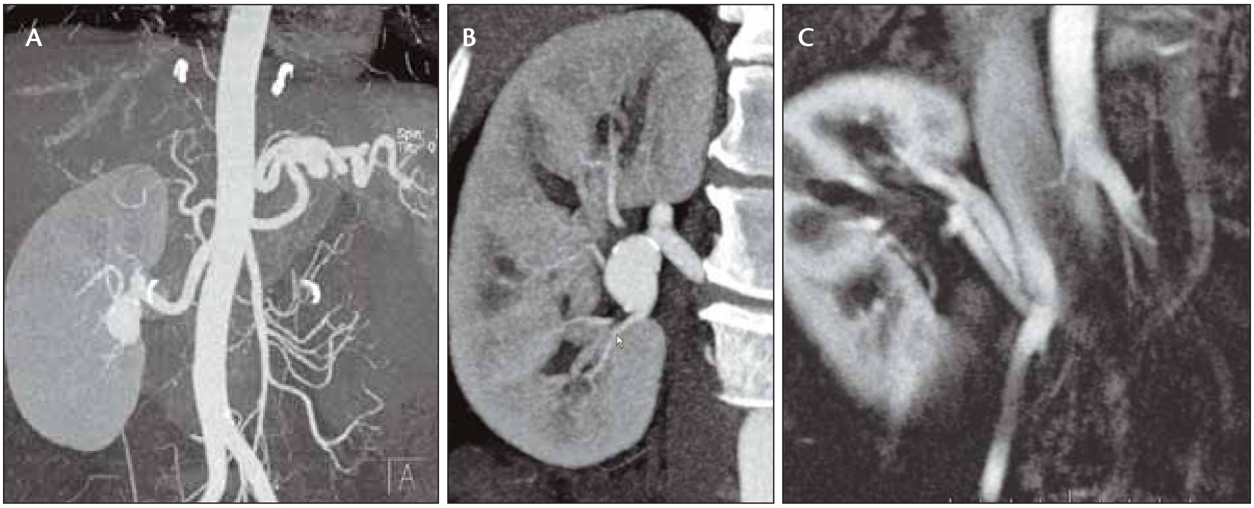

Figure 2. Computed tomographic angiogram of a right RAA in a patient who underwent ex vivo repair with reimplantation of multiple arterial branches and then autotransplantation (A, B). Magnetic resonance angiogram of the kidney autotransplanted into the right iliac fossa and anastamosed to the right common iliac vessels (C).

or patching of the renal artery. Commonly, saphenous vein is harvested to provide material for patch repair; we always prep the groins into the surgical field to allow saphenous vein harvest for patching or bypass during open repair of RAAs. Occasionally, the aneurysm can be excluded, and the involved artery can be reimplanted into an adjacent branch of the renal artery.

BYPASS

If primary repair, patch closure, or reimplantation of the renal artery is not possible, many surgeons prefer to perform bypass using autologous tissue, such as saphenous vein. This may be relatively straightforward in the case of involvement of the main renal artery; however, it may require complex repair and multiple distal anastamoses if the aneurysm involves a branch of the renal artery. A bifurcated internal iliac artery autograft has been described as a conduit (as an alternative to reversed saphenous vein) in cases of branch point lesions.[4] The proximal anastamosis can be performed to the uninvolved renal artery, the infrarenal aorta, or the splenic artery (for left RAAs) or hepatic artery (for right RAAs). Figure 1 shows an RAA that was subsequently repaired with exclusion and saphenous vein bypass.

EX VIVO REPAIR

In the case that multiple renal artery branches are involved in the aneurysm or extended periods of renal ischemia are anticipated to accomplish repair, extracorporeal aneurysm repair is sometimes required. This is accomplished by nephrectomy, hypothermic perfusion of the kidney with heparinized renal preservation solution,

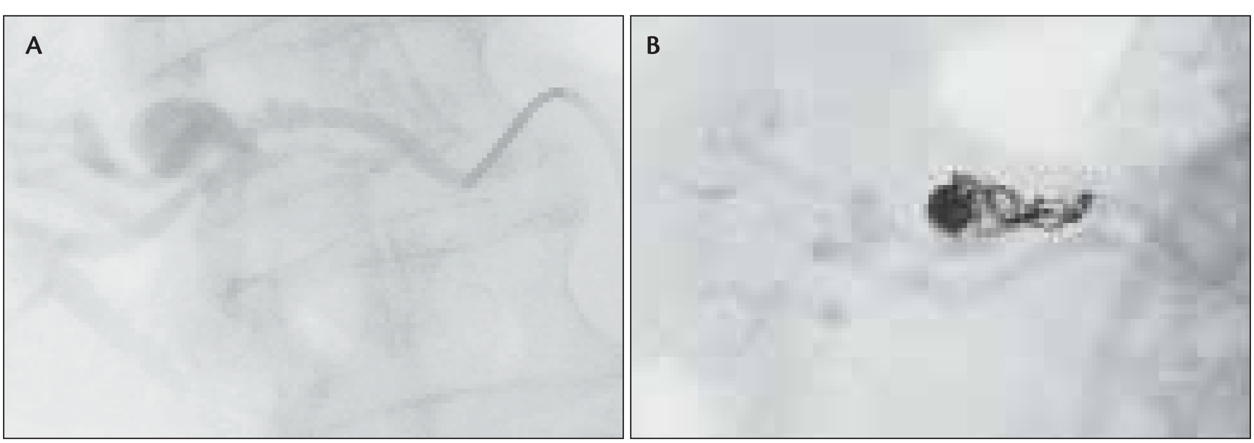

Figure 3. Selective right renal arteriogram demonstrating a saccular right RAA (A). Arteriogram after coil embolization of aneurysm demonstrating preservation of renal perfusion (B).

repair, and autotransplantation back to the native location or to the iliac fossa. Figure 2 shows an RAA involving multiple branch vessels located peripherally, almost intraparenchymal in location, which was repaired ex vivo.

TRANSCATHETER EMBOLIZATION

Endovascular approaches to RAA repair have gained popularity in recent years. Embolization using coils, glue, or alcohol is commonly employed. Coil embolization of saccular aneurysms can be accomplished without interruption of renal perfusion in the appropriate anatomic situation.

> " . . . stent graft repair is technically difficult and may necessitate occlusion of one or more renal artery branches . . . "

Figure 3 demonstrates such a case. This was an 80-year-old man with coronary artery disease who underwent a computed tomography scan to evaluate right-sided back pain, which revealed a 2-cm RAA. He was taken to the operating room for angiography and possible coil embolization. Retrograde femoral percutaneous access was accomplished, and a pigtail arteriography confirmed the right RAA. A 6-F left internal mammary artery guide catheter was used to access the right renal ostium, and then a 0.035-inch Glidewire and angled Glide catheter (Terumo Interventional Systems, Somerset, NJ) were used to cannulate the saccular aneurysm, which was subsequently embolized with multiple Tornado coils (Cook Medical, Bloomington, IN).

Stent-assisted coil embolization, in which coil embolization is achieved through the stent mesh using a microcatheter after an uncovered nitinol stent is deployed across the neck of the aneurysm, has also been described.[5] Intraparenchymal lesions may also be treated with embolization of involved distal arterial branches with preservation of uninvolved arteries.

STENT GRAFTING

Endografting is appealing for exclusion of RAAs with preservation of distal flow. Main renal artery lesions are most amenable to this therapy. Since Bui et al[6] first reported stent graft treatment of an RAA, multiple similar case reports of endovascular stent graft coverage of RAAs have appeared in the literature.

Rundback et al[7] proposed an anatomic classification system for RAAs with relevance for the surgeon's or interventionist's ability to place a stent graft in any particular aneurysm. Type 1 RAAs are saccular aneurysms arising from the main renal artery or a large segmental branch and are particularly amenable to stent graft treatment. Type 2 RAAs are fusiform aneurysms frequently involving branch points of the renal artery and therefore usually requiring open repair. Finally, type 3 RAAs are distal aneurysms that can be treated with coil embolization without danger of sacrifice of significant parenchyma.

However, that anatomic classification is less relevant to the common situation of branch-point saccular aneurysms similar to that demonstrated in Figure 3. Clearly, stent graft repair is technically difficult and may necessitate occlusion of one or more renal artery branches; in such cases, embolization or open repair may be required.

CONCLUSION

RAAs, although uncommon, can pose significant challenges to therapy. Anatomic constraints typically dictate therapeutic options. Minimally invasive endovascular approaches are available but not always possible given the frequency of branch point lesions. ■

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