## 101. Renal Artery MRA

CE-MRA is also commonly utilized for the noninvasive evaluation of renal artery stenosis—the most common cause of secondary hypertension. Figure 101.1 demonstrates focal high-grade stenosis of the right renal artery on (A) coronal MIP CE-MRA images. Focal, less severe narrowing at the left renal artery origin is also present. Many stenoses occur without associated parenchymal dysfunction. Of note, clinical trials have shown no benefit for surgical revascularization in renal artery stenosis, as compared to medical therapy alone. Atherosclerotic causes of renal artery stenosis predominate, preferentially involving the proximal third of the renal artery and the ostium. Measurements of renal artery stenoses are often performed on coronal source images but suffer intra-observer variability and assess the stenosis in only one dimension. Image acquisition with isometric voxels allows reconstruction in any desired plane, as illustrated by the (B) sagittal, showing the origins of the celiac and superior mesenteric arteries, and (C) axial MIP reconstructions, both obtained from the same coronal source image data set as was the coronal MIP in Fig. 101.1A. A more reproducible approach to stenosis measurement thus involves initial identification of potential stenoses on coronal MIP images with subsequent measurements performed on reconstructions perpendicular to the region of suspected stenosis and also in the sagittal plane.

Fibromuscular dysplasia (FMD) is the second most common cause of renal artery stenosis, responsible for 30% or less of cases. CE-MRA reliably detects the characteristic string of beads appearance (Fig. 101.2A-B, white arrow) in medial dysplasia (80% of FMD), but is less sensitive than catheter angiography to subtle morphologic changes. CE-MRA is also relatively poor for the evaluation of renal artery branches more peripherally, whether in atherosclerotic disease or FMD. Pitfalls in MR technique include utilization of lower spatial resolution (greater than a 1 $mm^3$) or lower field strengths (i.e. 1.5 T), diminishing the sensitivity of CE-MRA for the diagnosis of the above pathologies.

CE-MRA is also utilized, along with MRI, to evaluate the suitability of living kidney donors. An important assessment is whether an accessory renal artery is present, with accessory arteries commonly derived from the abdominal aorta, common iliac, and superior mesenteric arteries. A large field-of-view is thus important for this evaluation, as well as high spatial resolution.

In post-transplant patients, CE-MRA may be used to detect vascular abnormalities such as renal artery kinking or stenosis. Susceptibility artifacts from surgical clips in the renal fossa can be present, degrading scans. Renal MR perfusion studies may be utilized for functional assessment. Renal MR venography is utilized to assess not only the renal veins in

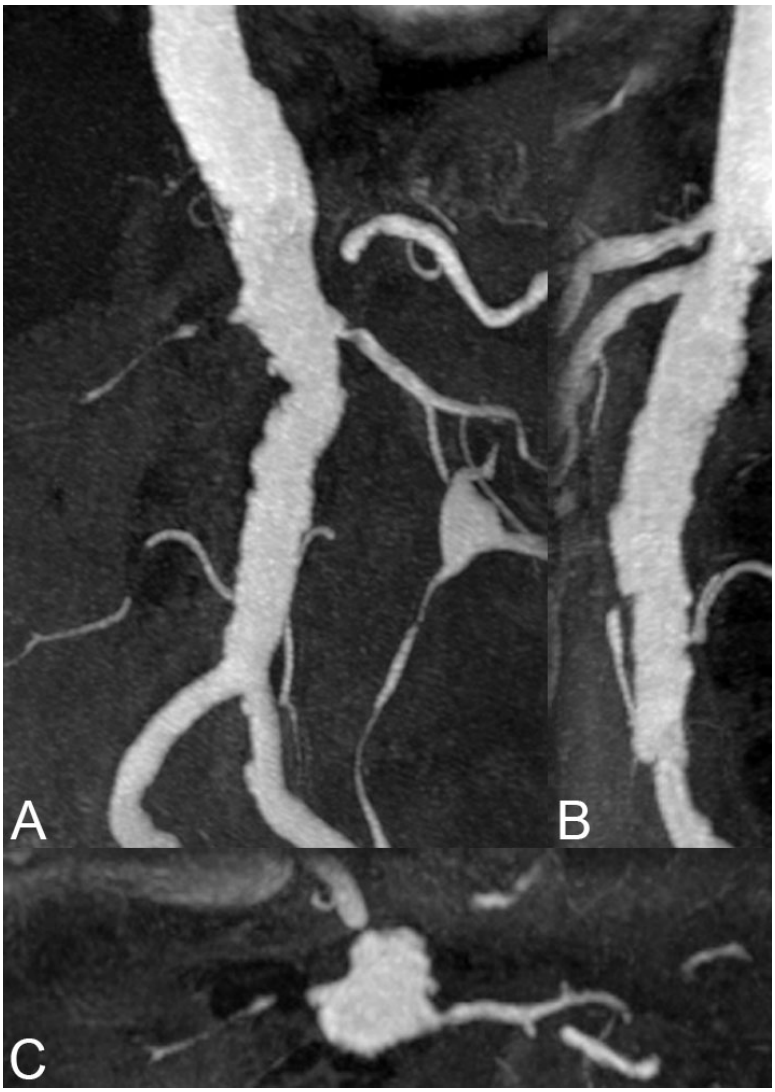


Fig. 101.1

perioperative transplant patients, but also (in a completely different setting) to evaluate possible venous invasion by renal cell carcinoma.

As alluded to above, the versatility of MR can be harnessed to evaluate a stenosis for hemodynamic significance and to detect nonvascular parenchymal disease through use of techniques assessing parenchymal perfusion, the latter also proving useful in the evaluation of transplanted kidneys. Techniques exist both based on gadolinium chelate administration and without IV contrast injection, such as blood oxygen level-dependent MRI (BOLD). Integration of perfusion assessments with traditional CE-MRA offers a more comprehensive evaluation of renal disease.

A discussion of renal CE-MRA would be remiss without mention of the association of NSF with gadolinium chelate contrast administration (primarily with the linear agents Omniscan, Optimark and Magnevist) in patients with GFRs less than 30 mL/min/1.73m$^2$. This topic

was further addressed in Chapters 97-98. TOF MRA is not commonly utilized for renal artery MRA due to generally poor results. Other newer non-contrast MRA techniques do however exist, and can be used in renal failure patients for renal artery evaluation.

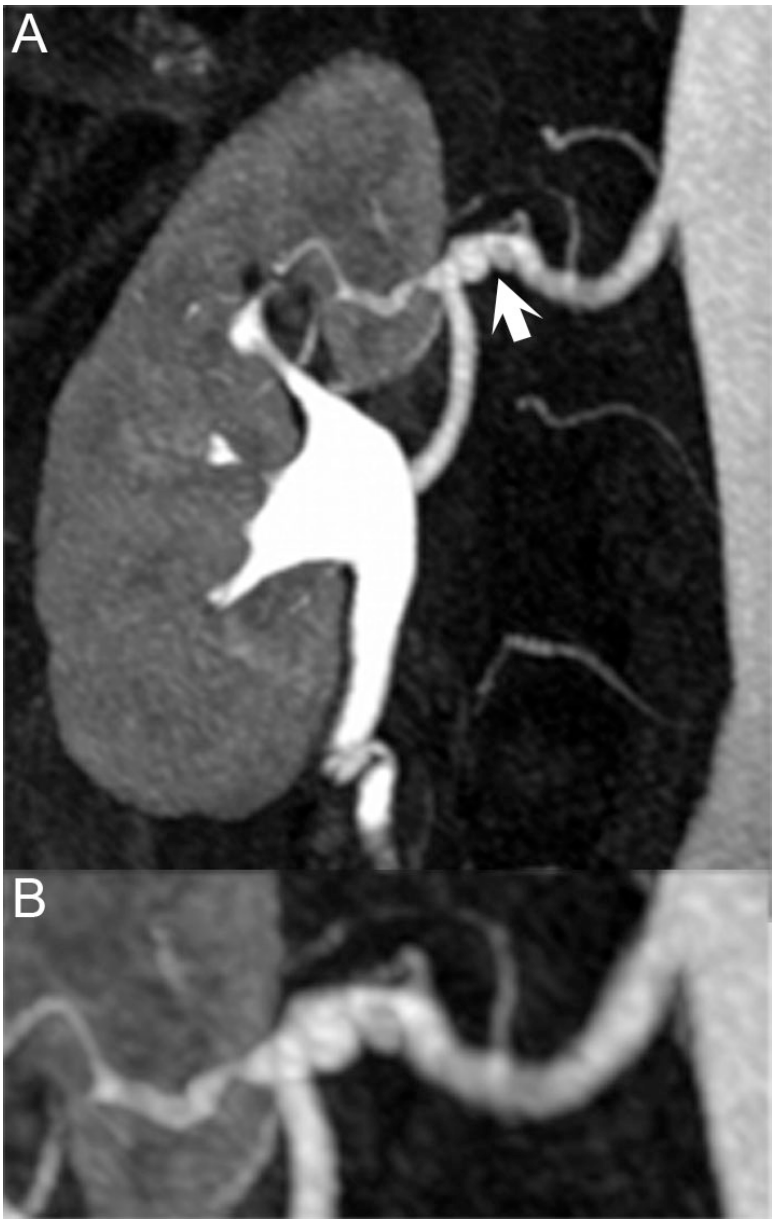


Fig. 101.2