Hepatorenal bypass resulting in dialysis independence in case of acute renal failure

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ABSTRACT

In the present case report, we have described a patient with bilateral renal artery occlusion resulting in the acute onset of refractory hypertension and renal failure requiring hemodialysis. Endovascular stenting of the renal arteries was not feasible owing to extensive aortic and renal orifice calcification. After consultation with nephrology and medical optimization, the patient underwent unilateral hepatorenal bypass, with subsequent improvement in renal function and sustained freedom from dialysis. Although percutaneous revascularization has become the preferred option for surgical management of renal artery occlusion, the findings from the present case have demonstrated that hepatorenal bypass remains a viable alternative for more complex cases. (J Vasc Surg Cases and Innovative Techniques 2021;7:113-6.)

Keywords: Aortic calcification; Dialysis; Hepatorenal bypass; Renal artery stenosis; Renal vascular hypertension

Renal artery stenosis (RAS) is defined by the narrowing of one or both of the renal arteries and is often due to systemic atherosclerosis. However, other etiologies include fibromuscular dysplasia and dissection.[1] Although consensus exists that RAS due to fibromuscular dysplasia can be effectively treated with balloon angioplasty, the optimal management of atherosclerotic etiologies has remained controversial.

The presence of low perfusion pressure to the kidneys in the setting of chronic RAS can cause ischemic nephropathy, in addition to multidrug resistant hypertension through activation of the renin-angiotensin-aldosterone system.[2,3] RAS has been estimated to be present in 11% to 22% of patients requiring dialysis,[4] and the natural history of RAS has suggested that 2.9% of patients with RAS will progress to end-stage renal disease annually.[5]

Renal artery occlusion (RAO) is rare and can result from in situ thrombosis in the setting of chronic RAS, embolus, dissection, or iatrogenic thrombosis after endovascular intervention. Patients with acute occlusion superimposed on chronic RAS can present with acute renal failure and uncontrolled hypertension. Management of renal artery occlusion includes conservative management with anticoagulation, stenting, open revascularization, and catheter-directed thrombolysis.[6]

For patients with acute RAO in the setting of chronic RAS who are poor endovascular candidates, the performance of extra-anatomic bypass is an alternative option. The use of hepatorenal bypass, first discussed in 1976, has resulted in significant improvement in renal function and was used for the present patient.[7-9] The patient provided written inform consent to the report of her case details.

CASE REPORT

The patient was a 53-year-old woman who had been referred to a tertiary medical center for refractory hypertension with acute kidney injury secondary to occlusion of the bilateral renal arteries. Two weeks earlier, she had presented to an outside hospital with an hypertensive emergency (blood pressure, 249/99 mm Hg) and altered mental status consistent with posterior reversible encephalopathy syndrome. At presentation, her creatinine was 5.4 mg/dL (baseline, 0.9 mg/dL). Her blood pressure was controlled with intravenous nicardipine, and hemodialysis was urgently started.

Before transfer, the patient underwent computed tomography angiography (CTA), which revealed a large segment of calcific plaque from the inferior to the superior mesenteric artery and extending to the renal and inferior mesenteric arteries. Also noted were bilateral renal occlusions with distal reconstitution via collateralization (right more than left), with subacute thrombus present in the right renal artery orifice (Fig 1). On transfer, the patient underwent aortography to assess for potential collateral renal flow and potential intervention, which again revealed calcific plaque and bilateral occlusion of the renal arteries (Fig 2). Stenting was deemed unfeasible owing to the extensive calcification. Thus, aortic endarterectomy was considered a highly morbid intervention because of the presence of calcification above the celiac artery. We decided to proceed with right renal artery bypass owing to the larger pole—pole length (92 mm vs 86 mm) and less cortical thinning, indicating a better renal prognosis.

Fig 1. Extensive calcification of visceral aorta and reconstitution of right renal artery. **A,** Computed tomography angiogram showing an ~8.2-cm-long calcified thrombus in the abdominal aorta, beginning just distal from the takeoff of the superior mesenteric artery extending down to the level of the inferior mesenteric artery. Both renal arteries were occluded at this level. **B,** Computed tomography angiography showing reconstitution of the right renal artery (*white arrow*) distally via collateralization.

Operative procedure. The right great saphenous vein (GSV) was isolated and mobilized. The vein was left in situ until just before the reconstruction to ensure an adequate length and minimize conduit trauma. A right subcostal incision was performed. The common hepatic artery, gastroduodenal artery (GDA), and proper hepatic artery were controlled. Cholecystectomy was performed, and the right renal artery was identified.

After systemic heparinization, the right renal artery was ligated at the orifice, and the distal right renal artery underwent thrombectomy using a 3F Fogarty catheter, with strong back-bleeding noted. The GDA was ligated 1 cm distal from its takeoff from the hepatic artery. The proximal anastomosis to the GDA stump was performed with the reversed GSV. The distal anastomosis was performed in an end-to-end fashion to the right renal artery. The bypass had a strong palpable pulse.

Postoperative course. Postoperatively, the patient received clonidine (0.3 mg every 8 hours), nifedipine (30 mg), hydralazine (10 mg as necessary), intravenous nicardipine, and labetalol as needed. The patient remained oliguric after the procedure and required three additional dialysis sessions for volume and electrolyte management. A nuclear medicine study revealed that perfusion to the kidneys was intact and symmetrical, with the left kidney likely filling from collaterals seen on CTA, although with worse differential function compared with that of the right (44% vs 56%). Arterial duplex ultrasound examination demonstrated a patent bypass with normal flow velocities. Her course was complicated by upper gastrointestinal bleeding secondary to duodenal ulcers, which was treated with epinephrine injection, with no further bleeding. The patient no longer required dialysis by postoperative day 19, with a creatinine of 1.94 mg/dL. She was discharged with a prescription of oral antihypertensive agents. At 6 months postoperatively, the patient had continued to not require dialysis, with a creatinine of 1.11 mg/dL and an estimated glomerular filtration rate of

56 mL/min and with a patent bypass and excellent flow seen on duplex ultrasonography.

DISCUSSION

Prompt treatment of RAO is critical, especially for patients with disease severe enough to require dialysis. Studies have demonstrated that the kidney can tolerate ~1 hour of ischemia,[10] although patients with chronic RAS have a greater likelihood of renal recovery after prolonged ischemia in the setting of collateral formation from their chronic disease.[11] As indicated by the patient's bilateral disease, she had developed a thrombotic occlusion that occurred in the setting of severe bilateral renal artery stenosis. Often, these patients with thrombotic occlusions will be able to regain renal function just as our patient did, despite the interval from presentation to revascularization. Although not evident by CTA or aortography, these patients will have peripelvic, periureteric, and capsular collateralization that develop as the occlusions become more hemodynamically significant. This collateral flow will maintain subfiltration renal blood flow when the occlusion finally occurs. Thus, although the kidneys will often be anuric, renal viability can still be maintained.[11] Thus, the performance of revascularization to prevent the requirement for dialysis and to correct renovascular hypertension becomes possible.

The optimal revascularization of RAO has remained controversial. Open revascularization options include thromboendarterectomy and bypass, with aortorenal bypass the most common bypass option.[12] A single-center study of 16 patients reported that those with thrombotic RAO treated with open revascularization had experienced significantly improved hypertension and renal function compared with patients treated nonoperatively.[13] Other studies reported that a significant
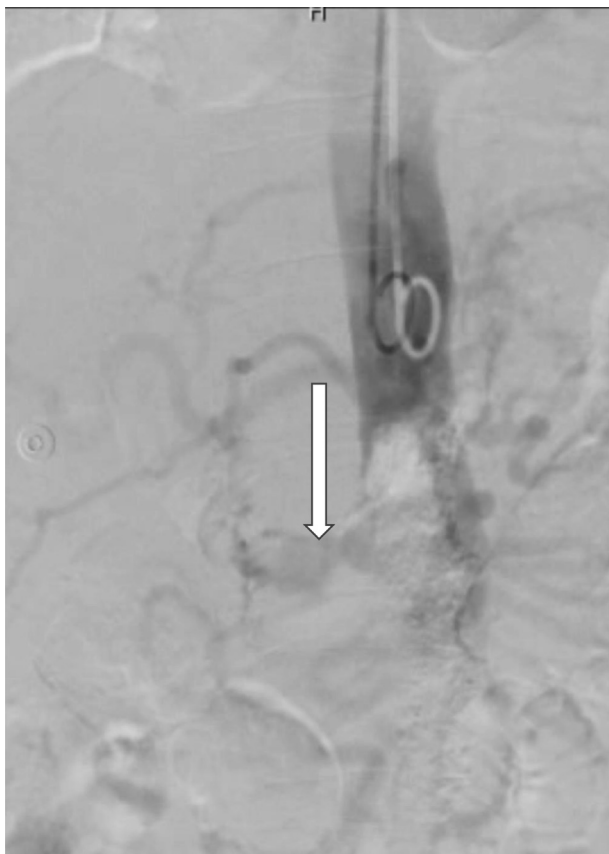
Fig 2. Aortogram demonstrating disruption of flow of both renal arteries. The right renal artery was occluded (*white arrow*). However, as revealed by the aortogram, the amount of calcific plaque was less compared with that of left renal artery orifice, suggesting a more acute occlusion. Note the extensive plaque in the visceral aorta. Because of the amount of calcification, stenting did not appear viable.

proportion of patients requiring dialysis preoperatively no longer did so after open revascularization (range, 62.5%-80%).[14,15] Although major trials have shown that renal artery stenting is not beneficial for RAS,[16,17] case reports have demonstrated that angioplasty and stenting can successfully treat patients with RAO.[18-20] Catheter-directed thrombolysis is another alternative that has been shown to produce good angiographic results, although with decreased kidney function over time.[6]

In our experience, the decision to operate should be determined on an individual basis. Our patient was young with few comorbidities and a normal baseline creatinine level, indicating greater potential for renal recovery. Although she had had occlusion of both renal arteries, her subacute right renal thrombus and acute hemodynamic instability increased the likelihood that revascularization would result in symptomatic improvement. The right renal artery was ultimately treated because of its larger pole-to-pole length and the appearance of subacute thrombus on the imaging studies,

suggesting relatively recent inflow, and because the left renal artery appeared more calcific on the imaging studies.

Cholecystectomy was performed to eliminate the risk of a future gallbladder operation interfering with the patient's hepatorenal bypass. Additionally, a theoretical risk exists of gallbladder ischemia, given the diversion of the blood supply to the kidney. Because cholecystectomy is considered a clean-contaminated case, the GSV was used, instead of a prosthetic, given the lower risk of infection.

CONCLUSION

In properly selected patients who have required dialysis for a short period and are unsuitable for endovascular repair, open revascularization of a unilateral kidney via a hepatorenal approach can result in hemodynamic improvement and salvage from the requirement for dialysis.

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