Utility of Percutaneous Treatment in Spontaneous Renal Artery Dissection: Case Report and Review of the Literature

Steven R. Ullrick, M.D.,¹ and Myron Wojtowycz, M.D.¹

ABSTRACT

Spontaneous renal artery dissection (SRAD) is a relatively rare entity that has been described in several case reports and small series in the medical literature. The condition is best diagnosed with angiography, with renal ischemia or infarction a common complication. Conservative medical management, surgical intervention, and percutaneous intervention are all discussed in the current literature. However, there is no consensus on which treatment option provides the best clinical outcome. Percutaneous stent placement has only recently been considered as an option for treatment of SRAD. This case report reviews the course of an otherwise healthy patient with a solitary right kidney who had SRAD complicated by renal infarction and was treated by percutaneous renal artery stent placement. Subsequently, we discuss and review the literature on SRAD treatment.

KEYWORDS: Spontaneous renal artery dissection, percutaneous treatment, stent, renal ischemia

Objectives: Upon completion of this article, the reader should have an understanding of (1) the common signs and symptoms of spontaneous renal artery dissection (SRAD), and (2) the current treatment options, including percutaneous intervention, for SRAD.

Accreditation: Tufts University School of Medicine (TUSM) is accredited by the Accreditation Council for Continuing Medical Education to provide continuing medical education for physicians.

Credit: TUSM designates this educational activity for a maximum of 1 *AMA PRA Category 1 Credit*[™]. Physicians should only claim credit commensurate with the extent of their participation in the activity.

Spontaneous renal artery dissection (SRAD) is a relatively rare entity that typically presents with lumbar or flank pain and hypertension. Although the diagnosis can be suggested on contrast-enhanced computed tomography (CT), the condition is best diagnosed with angiography. Renal ischemia or infarction is a common complication. Treatment options for this entity include conservative medical management, surgical intervention,

or percutaneous intervention. However, there is no consensus on the parameters that should dictate which treatment method is employed. Percutaneous stent placement has only recently been considered as an option for treatment of SRAD. This case report reviews the course of an otherwise healthy patient who had SRAD complicated by renal infarction and was treated by percutaneous renal artery stent placement.

¹Department of Radiology, University of Wisconsin Hospital and Clinics, Madison, Wisconsin.

Address for correspondence and reprint requests: Myron Wojtowycz, M.D., Professor, Angiointerventional Section, Department of Radiology, University of Wisconsin Hospital and Clinics, 600 Highland Avenue, Madison, WI 53792.

Case-Based Interventional Radiology; Guest Editors, Ron C.

Gaba, M.D., Derek L. West, M.D., James T. Bui, M.D., Charles A. Owens, M.D.

Semin Intervent Radiol 2007;24:63–67. Copyright © 2007 by Thieme Medical Publishers, Inc., 333 Seventh Avenue, New York, NY 10001, USA. Tel: +1(212) 584-4662. DOI 10.1055/s-2007-971188. ISSN 0739-9529.

Figure 1 Axial noncontrast computed tomography image shows absence of left kidney. Lack of contrast does not allow assessment of perfusion of solitary right kidney.

CASE REPORT

A previously healthy 42-year-old man experienced the sudden onset of severe right flank pain associated with nausea and vomiting. He was seen within 1 hour of onset at an urgent care center, where he received parenteral morphine for pain control. Despite almost 3 L of intravenous fluids, he could not produce a urine sample. A presumptive diagnosis of obstructing renal calculus was made, and he was transferred to the emergency department.

Initial vital signs included blood pressure of 136/86, pulse rate of 75, respiratory rate of 20, and temperature of 97.7°F. Physical examination was completely benign with the exception of minimal right costovertebral angle tenderness on palpation. Laboratory evaluation revealed all blood tests to be within normal limits, with the exception of a serum creatinine of 2.0 mg/mL and a blood urea nitrogen level of 14. Urinalysis was normal.

A noncontrast abdominal and pelvic CT study was performed to assess for the presence of nephrolithiasis. There was a tiny 0.2-cm lower pole right renal calcification seen. The right kidney was otherwise normal, with no hydronephrosis identified. Importantly, no left kidney was seen in the abdomen or pelvis, consistent with congenital absence (Fig. 1). A renal ultrasound was performed immediately following the CT. There was particular difficulty obtaining intrarenal arterial waveforms in the superior aspect of the solitary kidney, although those that were obtained revealed normal systolic rise times. The main renal artery and vein appeared patent. Although these findings were somewhat equivocal, the possibility of renal artery dissection was of sufficient concern to proceed with aortography and selective renal angiography.

Renal arteriography revealed a right main renal artery dissection (Fig. 2). There was parenchymal enhancement of only the inferior pole of the kidney, with little to no parenchymal enhancement of the upper two thirds of the kidney. The dissection did not extend into the branches of the main renal artery.

At this point, it was decided that stent placement was warranted to preserve remaining flow to the inferior pole of the patient's kidney and to maintain perfusion of any remaining viable parenchyma in the rest of the organ. Via a right femoral approach, an 8 × 39 mm Palmaz Genesis (Cordis, Miami, FL) balloon expandable stent was deployed within the right main renal artery proximal to its bifurcation. A poststent arteriogram was then performed (Fig. 3). This showed obliteration of the false lumen and increased flow through the central vessels. However, there was no significant immediate increase in parenchymal enhancement. The estimated time from onset

Figure 2 (A) Renal angiogram taken during early phase of selective contrast infusion demonstrates false lumen at superior aspect of right main renal artery and minimal contrast in upper arterial branches. Arrowheads delineate dissection flap. (B) Angiogram taken later during same selective contrast infusion shows near complete lack of perfusion of upper two thirds of right kidney.

Figure 3 Subtracted early angiographic image taken after stent placement in main renal artery. The false lumen has been obliterated, with significant increase in contrast reaching upper arterial branches. (B) Subtracted late angiographic image taken after stent placement in main renal artery. There is only minimal immediate improvement in perfusion of upper two thirds of kidney. (C) Unsubtracted angiographic image taken following stent placement again shows significant improvement in contrast reaching upper right renal arterial branches.

of symptoms to stent placement was approximately 10 hours.

The patient's creatinine continued to rise, peaking in 36 hours at 5.0. His creatinine levels then tapered off, to a stable level of 2.9 on days 8 through 10. The patient was on a heparin drip for 48 hours following stent placement. His hospital course was complicated by pneumonia, which was successfully treated during his stay. The patient was finally discharged on clopidogrel bisulfate and an angiotensin-converting enzyme inhibitor.

DISCUSSION

Our case report describes a patient with spontaneous renal artery dissection that was suspected after both abdominal CT and ultrasound was performed. This diagnosis was confirmed by renal angiography. An aggressive approach to treatment with percutaneous angioplasty and stenting was selected. Salvaging any viable renal parenchyma was imperative in this patient with a solitary right kidney.

In previous literature, renal artery dissection has been separated into four categories: spontaneous,

angiographic (iatrogenic), agonal, and chronic.¹ The focus of this discussion is spontaneous renal artery dissection, the diagnosis for the case at hand.

Spontaneous renal artery dissection is a rare diagnosis. As discussed by Lacombe in a 2001 article,² fewer than 200 cases are described in the medical literature. Many of these are isolated cases or small series. SRAD has been noted to be associated with other clinical entities, predominantly atherosclerosis, fibromuscular dysplasia, and Ehlers-Danlos syndrome.^{1,3} However, many cases present in otherwise healthy individuals. There is a strong male predominance. The largest published series of spontaneous renal artery dissections to date showed a 10:1 male-to-female ratio.⁴

The most typical symptoms present in SRAD are hypertension and lumbar or flank pain.² Other less common symptoms are hematuria and fever. In the case discussed, significantly elevated blood pressure was never identified throughout the patient's hospital course. Renal ischemia or infarction is a common finding in the acute setting, identified in ~40% of patients.^{2,5} Due to the relative rarity and nonspecific presentation of SRAD, there is often a diagnostic delay, in one series from 12 to 72 hours.⁶ In our case, the time between onset of symptoms to stent placement was 10 hours.

The most controversial aspect regarding SRAD lies in determining appropriate treatment. Treatment options discussed in the literature include observation, anticoagulation, surgical revascularization, and percutaneous revascularization. In an article in 2002, Ramamoorthy et al found no clear benefit of one treatment over another.⁶ In the previously mentioned largest series of SRAD to date, Edwards et al found no greater long-term improvement in blood pressure control after surgery versus medical management alone.⁴ However, surgical management has been employed in several cases of SRAD, with overall improvement in blood pressure and renal function.^{1,5,7} Anticoagulation and thrombolysis have been discussed as potential supplemental therapies. However, Blum et al found that any such treatment outside of the warm ischemia time of the kidney (3 hours) had no long-term effect on renal function.⁸ Selective infusion of thrombolytic drugs was considered for the patient reported here, but it was felt infusion was highly unlikely to produce any benefit after 10 hours of profound ischemia and would expose the patient to undue risk.

Percutaneous revascularization, as employed in our case, is the newest and certainly least reported treatment option for SRAD. Only one other case report could be identified in the literature in which percutaneous stent placement was used to treat SRAD.⁹ Percutaneous angioplasty or stent placement has long been an option for treatment of renal artery stenosis from atherosclerotic disease or fibromuscular dysplasia. This option has also been proposed for treatment of thrombotic

or embolic renal artery occlusions. Since the initial such case described in 1981,¹⁰ in which the patient coincidentally had a solitary kidney as in this case study, there have been several case reports and small series in the literature involving patients with purely thrombotic or embolic disease. In one of the larger series reviewing 10 patients, Boyer et al found a significant and durable improvement in serum creatinine in the six technically successful percutaneous cases.¹¹

As already noted, only one similar case of vascular stent placement for SRAD has been reported in the literature.⁹ That patient was a 48-year-old healthy man who did have both kidneys present. He had a right renal artery stent placed after a dissection of a right renal artery branch was identified. The patient was discharged at 5 days and left the hospital with normal blood pressure and kidney function.

Percutaneous stent placement appears to have been a viable option for effective treatment of spontaneous renal artery dissection in both our case and the case previously reported by Lee et al.⁹ In the case we report, prompt diagnosis and early mobilization of an angiographic team might have preserved more of the patient's renal function. In retrospect, the patient's failure to produce a urine sample despite a large fluid bolus signaled his unusual situation, although an obstructing ureteral stone in a solitary kidney would still have been more likely than SRAD. We emphasize the need to proceed with angiography as soon as SRAD is seriously suspected. More study is necessary to identify the place of percutaneous intervention within the still controversial treatment algorithm of SRAD.

REFERENCES

1. Smith BM, Holcomb GW, Richie RE, Dean RH. Renal artery dissection. *Ann Surg* 1984;200:134-146
2. Lacombe M. Isolated spontaneous dissection of the renal artery. *J Vasc Surg* 2001;33:385-391
3. Alamir A, Middendorf DF, Baker P, Nahman NS Jr, Fontaine AB, Hebert LA. Renal artery dissection causing renal artery infarction in otherwise healthy men. *Am J Kidney Dis* 1997;30:851-855
4. Edwards BS, Stanson AW, Holley KE, Sheps SG. Isolated renal artery dissection: presentation, evaluation, management, and pathology. *Mayo Clin Proc* 1982;57:564-571
5. Slavis SA, Hodge EE, Novick AC, Maatman T. Surgical treatment for isolated dissection of the renal artery. *J Urol* 1990;144:233-237
6. Ramamoorthy SL, Vasquez JC, Taft PM, McGinn RF, Hye RJ. Nonoperative management of acute spontaneous renal artery dissection. *Ann Vasc Surg* 2002;16:157-162
7. Reilly LM, Cunningham CG, Maggisano R, Ehrenfeld WK, Stoney RJ. The role of arterial reconstruction in spontaneous renal artery dissection. *J Vasc Surg* 1991;14:468-479
8. Blum U, Billmann P, Krause T, et al. Effect of local low-dose thrombolysis on clinical outcome in acute embolic renal artery occlusion. *Radiology* 1993;189:549-554

9. Lee SH, Lee HC, Oh SJ, et al. Percutaneous intervention of spontaneous renal artery dissection complicated with renal infarction: a case report and literature review. *Catheter Cardiovasc Interv* 2003;60:335–338
10. Gutierrez OH, Izzo JL Jr, Burgener FA. Transluminal recanalization of an occluded renal artery: reversal of anuria in a patient with a solitary kidney. *AJR Am J Roentgenol* 1981;137:1254–1256
11. Boyer L, Ravel A, Boissier A, et al. Percutaneous recanalization of recent renal artery occlusions: report of 10 cases. *Cardiovasc Intervent Radiol* 1994;17:258–263