Endovascular Stent-Graft Repair of Renal Dissection with Expanding Intramural Hematoma Following Renal Artery Stenting

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Case report. A 75-year-old male presented with recurrent episodes of flash pulmonary edema, angina, renal insufficiency (creatinine 2.1 mg/dl) and recurrent transient ischemic attacks. Diagnostic renal and coronary angiography revealed severe bilateral ostial calcific renal artery stenosis with mild disease in his left coronary system and a 60% ostial right coronary artery stenosis followed by an 80% lesion in the mid vessel. The left ventricular function by echocardiography was normal with an ejection fraction of 60%. Carotid ultrasound revealed a critical area of disease in the proximal left internal carotid artery and mild disease in his right internal carotid artery.

He underwent percutaneous revascularization of the 90% ostial left renal artery stenosis (Figure 1a). An 8Fr renal guide RDC catheter (Medtronic, Minneapolis, Minnesota) was utilized. Peri-procedural anticoagulation was achieved with bivalirudin 0.75 mg/kg IV bolus, followed by 1.75 mg/kg/hr infusion and clopidogrel 300 mg. After crossing the lesion with an 0.035” Wholey wire (Mallinckrodt, Hazelwood, Missouri), angioplasty was carried out with a 5.0 x 20 mm PowerFlex balloon (Cordis/J&J, Warren, New Jersey). Stenting was then performed with a 6.0 x 18 mm Genesis stent (Cordis/J&J) deployed at 10 atmospheres. A distal edge dissection area was noted (Figure 1), thus a second 6.0 x 18 mm Genesis stent was then deployed at 10 atmospheres in a tandem fashion distal to the first stent. A subintimal dye leak persisted at the site of the stent overlap. The subintimal hematoma dissected distally (Figure 2) and compromised the lumen of the artery just prior to the main bifurcation. A 4.5 x 26 mm Jostent stent-graft (JoMed, Abbott Park, Illinois) was then deployed at the site of the leak and post dilated with a 5.0 x 18 mm High Sail balloon (Guidant, Indianapolis, Indiana). The intramural leak was successfully sealed, but the renal vessel was left with an angiographic 90% distal lumen compromise (Figure 3). Intravascular ultrasound (IVUS) (Atlantis SR Pro catheter, Boston Scientific, Natick, Massachusetts) interrogation (Figure 4) confirmed the presence of the intramural hematoma without expansion distal into the bifurcation. The decision became whether or not to perform further angioplasty and/or stenting to the distal vessel. The IVUS images did not demonstrate a critical lumen compromise, and further treatment with angioplasty and/or stenting could possibly jail the major branches, push the hematoma distally or rupture the artery. We elected to monitor the vessel conservatively and only intervene for clinical evidence of deterioration. Furthermore, the vessel would be reevaluated when the patient returned for staged treatment of his right renal and right coronary arteries in 72 hours. Bivalirudin was discontinued post-procedure, and the patient was maintained on clopidogrel 75 mg daily. Post-procedure, a duplex ultrasound was performed that revealed no significant flow compromise to the left kidney. A computed tomography scan was performed and revealed no perinephric hematoma.

The creatinine and blood pressure remained stable post-procedure. He returned to the cardiac catheterization...
laboratory, and his left renal artery was revisualized 72 hours post-intervention. There was complete regression of the intramural hematoma and normal flow in the left renal artery (Figure 5). Intravascular ultrasound also showed resolution of the subintimal hematoma with a widely patent lumen (Figure 6). He underwent uncomplicated percutaneous revascularization of his right renal artery and right coronary artery.

His renal function steadily improved while in the hospital, despite recurrent procedures, and he was discharged home with a creatinine of 1.4 mg/dl and a mean systolic blood pressure of 110 systolic off his antihypertensive drugs. At one month follow-up, the patient was doing well, with no recurrence of symptoms.

**Discussion**

This case illustrates a rare complication following renal artery stenting. To our knowledge, the development of an intramural hematoma in a renal artery following stenting with documented angiographic and IVUS resolution at 72 hours post-intervention has not been previously reported. Prolonged balloon inflation was not an effective therapy, and the use of an endovascular stent-graft was necessary to seal the entry site of the hematoma from the lumen.

In a series by Maehara et al., intramural hematomas were detected by IVUS in 6.7% of percutaneous coronary interventions and appear to be related to a dissection into the media without re-entry. The hematomas extended distal to the entry site in 63% of the cases. In 29% of the cases, the post-procedure angiogram was unremarkable, while in 60% of the cases the angiogram appeared to have a dissection, and in 11% there appeared to be a new stenosis. In the coronary arteries, lumen compromise could lead to myocardial infarction and possibly sudden death. Intramural hematomas have been reported in the aorta and can resolve spontaneously
or lead to pseudoaneurysm or aneurysmal changes.\textsuperscript{2,3}

Crucial to the management of an expanding intramural hematoma is sealing the dissection at the entry point. In our case, this was not possible with simple low-pressure; prolonged balloon inflation and placement of a stent-graft was required. Once we were assured the hematoma was no longer expanding, the discussion turned towards the distal lumen compromise. The angiogram suggested a critical stenosis just prior to the bifurcation; however, IVUS interrogation demonstrated a moderate stenosis that did not appear critical. Multi-modality imaging was extremely valuable in the decision process, as placement of another stent carried the risk of jailing the major renal branches, pushing the hematoma further distally, or rupturing the adventitial layer of the artery. Furthermore, the baseline angiographic and IVUS images allowed for documentation of progression or regression of the hematoma. Surprisingly, the angiographic and IVUS follow-up showed complete spontaneous resolution of the hematoma with no residual stenosis.

This case describes the natural history of a subintimal hematoma, and represents another application of stent-grafts in the periphery. It was a difficult decision to not stent the residual 90\% stenosis, as we frequently want to place “just one more” stent when the artery does not look quite right, but the absence of residual ischemia or hemodynamic compromise to the end organ allowed for a conservative management and subsequent excellent outcome.

\textbf{References}


\textbf{Commentary}

Richard Heuser, MD

\textit{Endovascular Stent-Graft Repair of Renal Dissection with Expanding Intramural Hematoma Following Renal Artery Stenting} is an excellent case report, describing a fairly common problem treated in a unique way. Instead of just treating a subintimal dye leak at the site of stent overlap, Shammas et al. wisely analyzed the vessel lumen with intravascular ultrasound, showing that there was an intramural hematoma. The conservative approach paid off with effective therapy, without placement of further stents that may have jeopardized one or two important renal branches supplying the renal parenchyma.

The authors describe an interesting example of a patient who had a dissection effectively treated with a covered stent. Finding an area distal to the stent with either a dissection or a significant obstruction lesion, they wisely used intravascular ultrasound (IVUS) to ascertain what was happening at tissue level. This conservative therapy potentially eliminated the risk of obstructing one of the important renal artery side branches. This case is an excellent example of, “if at first you don’t succeed, it is not always best to try, try again.” By using intraluminal diagnostics such as the IVUS, we learn that some things may just take care of themselves.