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"Sapi wire technique" — a novel technique for percutaneous transluminal renal angioplasty of aorto-ostial lesion

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Abstract

Renal artery stenosis (RAS) is the most common cause of secondary hypertension. Percutaneous transluminal renal angioplasty (PTRA) is associated with improved blood pressure control, preservation of renal function, and has a high technical success rate with an acceptable adverse event and restenosis rate. Aorto-ostial renal artery intervention remains a challenge, as precise positioning of stents using conventional angiographic landmarks is difficult. We describe a novel technique stent positioning for aorto-ostial lesion of renal artery that makes use of a simple additional workhorse wire curling back into the aorta like the sepal of a flower in a 61-year-old hypertensive male. PTRA using left transradial approach was performed by deploying 6x18 mm stent (Herculink, Boston, USA) by deploying at 8 atmospheres, and further flaring the ostium by little pulling up the balloon at
10 atmospheres obtaining adequate result. At 3-years follow-up by computed tomography, it was well opposed and patent.

**Key words**: aorto-ostial lesion; atheroembolism; percutaneous transluminal renal angioplasty; renal artery stenosis; sepal wire technique

**Introduction**

Renal artery stenosis (RAS) is the most common secondary cause of hypertension (HTN). Renovascular disease leads to malignant HTN in 10–45% of patients. In patients older than 50 years, it is responsible for 5–15% of the renal failure, and 10–20% of the end-stage renal disease. The prevalence of RAS, greater than 60%, has been reported to be 6.8% in patients older than 65 years of age [1, 2]. Percutaneous transluminal renal angioplasty (PTRA) has now become gold standard replacing surgery as reduction in blood pressure, improvement in renal function, and decreased numbers of complications have been demonstrated [3]. The procedure is associated with plaque disruption, spiral dissection, atheroembolism, and acute occlusion of the main renal artery which varies from 0.9–1.7% [4, 5]. These may be avoided by minimal contact and manipulation between the guide catheter and the atherosclerotic aorta, and the ostial lesion. These can be circumvented by catheter-in-catheter, no-touch technique, and Szabo technique. However aorto-ostial lesions are different subsets as one cannot afford either geographical miss as it may invite future restenosis, or excess overhang of stent in aorta.

**Case report**

A 61-year-old smoker and hypertensive male presented with flash pulmonary hypertension. He had difficult-to-control blood pressure and was receiving telmisartan, amlodipine, and
hydrochlorothiazide. His blood pressure was 188/100 mm Hg, and pulse rate was 86/min. His haemogram and renal function were normal. Electrocardiogram revealed mild concentric left ventricular hypertrophy, and normal systolic function. During work-up, left renal angiogram showed critical ostial lesion with 90% stenosis, and had a downward take-off. Left transradial approach was planned for PTRA after proper consent. The left radial artery was prepped and draped in a sterile fashion, and accessed with a 7F Glide Sheath (Terumo, Japan). Judkins right (JR)-3.5 guiding catheter (Medtronic, USA) was advanced over 0.035-inch terumo wire. Once reached descending aorta near the left renal ostium, terumo wire was exchanged with 0.014-inch runthrough wire (Terumo, Japan). An additional runthrough wire was chosen to give it a bigger curve at its proximal soft end which was passed through the guiding catheter, and curling back into the aorta like the sepal of a flower. The sepal wire was preventing the selective intubation of renal artery (Fig. 1A). Once the guiding catheter was short of the ostium, the first runthrough wire was advanced into the artery and parked into branch of renal artery (Fig. 1B). Lesion was predilated with 4 x 10 mm Traveller balloon (Abott Vascular, USA) and stented with 6 x 18 mm stent (Herculink, Boston, USA) by deploying at 8 atmospheres (Fig. 2, 3). The stent balloon was little pulled up and proximal end of the stent was flared at 12 atmospheres to completely cover the ostium (Fig. 4). His hospital course was uneventful and discharged in stable condition with dual antiplatelets, statin, and antihypertensive medication. He has done well at follow-up, although still requiring multiple medications, and his systolic blood pressures have consistently been in the 130s. Abdominal computed tomographic imaging at 6 months, 1, and 3-years later showed well apposed stents with excellent patency (Fig. 5).

Discussion
Although the renal vascular bed is considered more forgiving than other vascular beds, yet PTRA is not immune to complications [6]. Using sepal wire technique can avoid renal artery injury and subsequent atheroembolism as it nearly eliminates all the guiding manipulations. Transradial renal artery stenting is safe and feasible, though the small calibre and tortuous nature of the radial artery may prove challenging in some cases but in modern era with the availability of low profile hardwares, the devices can be tracked over 6-7F guide. In some patients, the length of the guide may fall short of the ostium of renal artery. These can be circumvented by the transbrachial approach, left radial approach which saves approximately 10 cm of distance, or lengthening the guiding catheter [7]. Aorto-ostial PTRA remains a challenge, as precise positioning of stents using conventional angiographic landmarks is difficult. A stent placed just distal to the true ostium leads to geographical miss and a high incidence of restenosis [8]. If a second stent is deployed to cover the geographical miss, this will make not the procedure costly, but also potentially increases the risk of stent thrombosis due to unnecessary stent overlapping. It is equally undesirable if a stent is placed too proximally with too much stent length protruding into the aorta [9, 10]. It also makes proper engagement of the guiding catheter difficult if not impossible in the future in cases of re-intervention if one encounters restenosis. Ideally, a stent should be placed right at the ostium or minimally protruding (1–2 mm) into the aorta in order to achieve sufficient lesion coverage and adequate expansion to prevent recoil of the more fibro-elastic aorto-ostial junction. However, it may be technically difficult because of anatomical complexities. The take-off of the renal artery from the aorta is either perpendicular, or downward in most of the cases. Stent placement should ensure that the stent adequately covers the superior aspect of the renal artery (RA), which would mean that some stent length will have to protrude into the aorta at the inferior aspect of the RA. The more acute the take-off angle, the more stent length will be needed to protrude back into the aorta.
to ensure adequate coverage of the true ostium. Furthermore, if case of acute take-off angle, it becomes difficult to find good angiographic views that clearly delineate this relationship. Using conventional fluoroscopic guidance alone, the true RA ostium is missed in many cases. Szabo et al [8] and Wong et al [10] have reported special techniques to help accurate positioning of the left main stent by threading another wire through one of the proximal stent struts. Similar technique can be utilized for PTRA but in order to achieve this, the stent delivery balloon has to be partially inflated to allow threading of the second wire and then properly re-crimped to ensure smooth delivery of the stent, which is technically cumbersome. Our novel technique is simple, easy, and quite feasible to implement for treatment of aorto-ostial lesion which requires another regular workhorse wire as an additional device. This wire enables the guiding catheter to park closely to the true ostium, yet it cannot be intubated fully into the RA. It allows good contrast filling which enables proper visualization of aorto-ostial lesion. Finally, precise adjustment of the stent’s position is made easy because the wire stops the guiding catheter from being “sucked” into the RA when one attempts to properly position the stent by pulling it out to ensure ostial coverage. The abdominal aorta contains more extensive atherosclerotic disease than the ascending aorta, especially in the segment proximal to the sinotubular ridge [11]. This technique potentially reduces the duration of procedure, decreases the amount of contrast usage, and minimizes the risk of atheroembolism.

Conflict of interest

None.

References


**Figure legend**

Figure 1. The sepal wire is floating in descending aorta, and preventing selective intubation of ostium of renal artery (A); Another wire was parked in branch of renal artery (B).

Figure 2. The ostium of renal artery is showing critical stenosis (A); Lesion was predilated with 4 x 10 mm Traveller balloon (B). (Abott Vascular, USA) and stented with 6 x 18 mm stent (Herculink, Boston, USA) by deploying at 8 atmospheres (Fig. 2, 3).

Figure 3. 6 x 18 mm bare metal stent (Herculink, Boston, USA) was parked across the lesion with proximal few struts protruding into aorta (A); The stented was deployed at 8 atmospheres (B).

Figure 4. Angiogram after selective intubation of ostium showing well apposed stent (A; B).

Figure 5. Abdominal computed tomographic imaging with contrast, and volume rendered reconstruction at 6 months (A), 1 (B), and 3- years (B) later showed well apposed stents with excellent patency.