**CASE REPORT**

**Transradial Intravascular Ultrasound Guided Culotte Stenting with Zotarolimus Eluting Coronary Stents in Renal Artery Bifurcation Stenosis**

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**Introduction:** Invasive treatment of a renal artery bifurcation stenosis is technically challenging as the stent may occlude a renal artery side branch. Treatment of a patient by transradial intravascular ultrasound (IVUS) guided renal artery stenting is reported.

**Report:** Renal artery stenosis was confirmed by digital subtraction angiography. The renal artery bifurcation stenosis was stented with two balloon expandable zotarolimus eluting stents using the culotte technique and the result was optimized with the kissing balloon technique. Post-interventional IVUS confirmed good stent expansion and apposition after final high pressure balloon angioplasty.

**Conclusion:** Transradial IVUS guided renal artery stenting using the culotte stent technique is an effective procedure to treat complex renal artery bifurcation stenosis.

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**INTRODUCTION**

Percutaneous renal artery intervention (PRI) with bare metal stent (BMS) placement is an effective technique to treat atherosclerotic renal artery stenosis (RnAS). However, in branching RnAS, stent implantation can result in side branch occlusion. Additionally, BMS implantation is also associated with a high restenosis rate. Several techniques have been introduced to treat renal artery (RnA) bifurcation stenosis, such as kissing balloon angioplasty, T and simultaneous kissing stent technique using BMS, and drug eluting stents (DES). Nevertheless, the culotte stent technique (CST), widely used in coronary interventions (Fig. 1), has not yet been reported for RnAs. This report discusses the CST in bifurcation PRI performed from a radial artery (RA) approach using 6-F compatible devices.

**REPORT**

A 50 year old woman with hypertension, hyperlipidemia, and peripheral artery disease was referred for RnA digital subtraction angiography (DSA). DSA confirmed significant right bifurcation RnAS. The indication for the renal intervention was hypertension refractory to pharmacotherapy. The right RnA was engaged from the right RA with a 6-F Judkins right 5 guiding catheter (JR5, 100 cm; Medtronic Co., Minneapolis, MN, USA) (Fig. 2A). A balance middle weight (BMW) 0.014 coronary guide wire (GW) (Abbott Co., Abbott Park, IL, USA) was advanced in the upper RnA through the stenosis and an IVUS examination was performed with an Atlantis Plus 40 MHz IVUS catheter (Boston Scientific, Marlborough, MA, USA) to determine lesion size, length, and composition measurement (Fig. 2B–D).

The inferior RnA was then wired with another BMW GW. Balloon dilatation was performed, and an Endeavour Resolute (4 × 28 mm) stent was implanted (Fig. 3A). After stent implantation, the BMW GW was retrieved from the stent and the stent struts were crossed into the unstented branch. The jailed BMW was retrieved and then advanced in the lower RA (Fig. 3B). After balloon dilatation of the stent struts, the upper RnA was stented with a 4 × 32 mm Endeavour Resolute stent (Fig. 3C). The stent struts were dilated with an Apex balloon (3 × 20 mm) (Fig. 3D), and kissing dilatation was performed with two coronary balloons (Fig. 3E). The proximal stent was dilated with a non-compliant balloon at high pressure (Fig. 3F). The final DSA showed no residual stenosis (Fig. 2E). Good stent apposition and expansion was confirmed by IVUS at both the proximal and the bifurcation site (Fig. 2F–H), but
malapposition was found in the distal part of the upper stent, therefore, to prevent stent thrombosis, it was optimized by a final distal balloon angioplasty. The patient had an uneventful post-procedural course.

DISCUSSION

RA access during coronary interventions plays a pivotal role in reducing access site complications, achieving immediate mobilization and shortening hospitalization; however, its beneficial effect for peripheral interventions has not been investigated thoroughly. In a recent publication comparing the clinical impact of access site selection (femoral vs. radial) for coronary interventions in 439,947 patients in the UK, it was found that RA access was associated with fewer bleeding and access site complications in all clinical conditions. The main technical advantage of radial over femoral access is the easy and stable cannulation of the RnA, especially when it is of inferior origin. RnA bifurcation cases can be treated using the T stent technique; however, in complex cases when the side branch is stenosed and the angulation between the parent vessels is too small, the frequency of plaque shifting is high and may result in side branch occlusion. In comparison, in coronary bifurcations, several techniques were introduced such as T stenting, V stenting, crush stenting, simultaneous kissing stenting, and CST. Nonetheless, these procedures have rarely been investigated for RnAS. The present report was about a complex bifurcation case with flat angulation where the side branch had the same size as the main branch, reaching 2 mm in diameter. These lesions can technically be treated by culotte stenting. The main advantage of CST is the complete coverage of the side branch ostium, the spot responsible for acute side branch occlusion and late restenosis. More technical advantages over other techniques include the lowest recoil at the ostium site, the least residual stenosis, and the least stent distortion. From an interventionalist point of view, final rewiring of the side branch is easier after culotte than after other complex stenting approaches such as crush stenting. Small RAs (<4 mm) have a high restenosis rate; therefore, DESs have mainly been used for the treatment of small RAs. Zähringer et al. reported that sirolimus eluting stents led to a reduction of the restenosis rate at the 6 month follow up (BMS 14.3% vs. DES 6.7%; p = .30). The present case of bifurcating RnA was optimized with IVUS to select the proper stent size, to achieve good stent apposition and expansion, and to rule out acute complications. IVUS detected distal stent malapposition that was treated with balloon post-dilatation.
Figure 2. High grade right radial artery bifurcation stenosis on (A) digital subtraction angiography (DSA) and (B) cross sectional intravascular ultrasound (IVUS) image shows significant stenosis (Minimum lumen area (MLA) = 6.1 mm$^2$) and (C) mixed plaque with virtual histology (fibrotic: 68%; necrotic: 21%; lipid: 8%; calcified: 3%). (D) Longitudinal images show calcified plaque at the bifurcation site. (E) Final DSA, (F, G) cross sectional IVUS image (mid-stent MLA = 16.2 mm$^2$ and proximal stent MLA = 21.4 mm$^2$), and (H) longitudinal IVUS image after culotte stenting.
CONCLUSION

Transradial IVUS guided renal artery stenting using the CST is an effective procedure to treat complex renal artery bifurcation stenosis.

REFERENCES


Figure 3. (A) High grade right renal bifurcation stenosis cannulated with a Judkins Right 100 cm guiding catheter and stenting of the inferior renal artery (white arrow). (B) Guide wire (GW) exchange and balloon dilatation of the struts (white arrow). (C) Stenting of the superior RA (white arrow). (D) GW exchange and dilatation of the stent struts (white arrow). (E) Kissing balloon dilatation of the stent strut (white arrow). (F) Proximal optimization with a non-compliant balloon (white arrow).