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Crush Technique of A Complex Bifurcational Left Renal Artery Stenosis

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We report a case of bilateral renal artery stenosis treated via a femoral approach performed in two stages. In the first setting direct stenting of the right renal artery was performed. Four weeks later a complex left renal artery bifurcational stenosis was treated with a crush stenting technique to avoid side branch compromise. The crush technique provides excellent patency of the branch artery after stenting the main vessel. The immediate outcome of this technique is excellent; however, its long term consequences are not known and need further investigation.

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Progress in endovascular techniques made stent implantation the procedure of choice for treating renal artery stenosis. Clinical results have documented superior hemodynamic and angiographic results when compared to balloon angioplasty alone[1, 2.] The reported technical success is high with low incidence of major morbidity and mortality 5-8% [3,4]. Furthermore, the long-term prognosis is excellent with restenosis rates less than 25% [5,6].

However, the treatment of complex bifurcational renal artery stenosis poses a special challenge because of the need to preserve the patency of side branches especially when renal function is impaired or is liable to deteriorate as in our case.

We report a case of bilateral renal artery stenosis treated via a femoral approach performed in two stages. To our knowledge, this is the second case reported in the literature about the use of this technique in the renal circulation.

THE CASE

Sixty-five year old male patient with an ischemic cardiomyopathy and left ventricular ejection fraction of 30%. He underwent cardiac angiography in January 2005, which revealed total right coronary artery (RCA) occlusion. Routine non-selective renal angiography at the time of catheterization revealed 80% right renal artery stenosis and 95% complex bifurcational left renal artery stenosis (Figure 1).

The patient serum creatinine was 246 µm/l. It was determined that a major part of his renal impairment was due to his bilateral renal artery stenosis. Subsequently, it was decided to use endovascular therapy in two stages to minimize the risk of renal deterioration.

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A bolus of 5000 IU of unfractionated heparin was administered. An eight Fr renal guide catheter (55cm length RDC, Cordis®) was used to engage the right renal artery, 0.014" BMW™ wire (Guidant®, Santa Clara) was passed through the stenosis and direct stenting of the right renal artery was done using a 7x12mm Radix Carbostent (Sorin®/Biomedica) deployed at 14 atm pressure up to a diameter of 7.6 mm.

Four weeks later, the patient was brought back for left renal artery stenting. His admission creatinine was normalized at 125 μm/l. Again the artery was engaged with an eight Fr guide catheter (55cm length RDC, Cordis®), 0.014" BMW wire was passed through the upper lobe branch artery (BA) then another BMW wire was passed through the main left renal arterial branch (MA).

The MA was predilated with 4x20 mm JOMED® coronary balloon (JOCATH Maestro) at 18 atm (Figure 2).

After angioplasty, we advanced a 4x13mm MULTILINK Penta coronary stent (Guidant®, Belgium) into the BA. The stent was positioned to cover its ostium and protruding into the MA by around 2-3 mm. As we failed to advance the MA stent and the BA stent simultaneously through the 8 Fr guide, we deployed first the BA stent at 14 atm (Figure 3).

After that, angiography demonstrated full expansion of the BA stent without complication. The stent balloon and the corresponding wire were subsequently removed. Then we advanced the MA 7x17mm Radix carbostent (with some difficulty due to the expanded BA stent into the main artery). The stent was deployed at 14 atm, crushing the protruding BA stent against the vessel wall. The final angiography demonstrated a widely patent bifurcational BA-MA stents with restoration of normal flow distally (Figure 4).

The result was felt to be optimal and additional rewiring of the BA to perform kissing balloon angioplasty was felt to be unnecessary.

The post procedural hospital course was smooth .The next day; the creatinine serum level was120 μm/l. He was discharged on dual antiplatelet therapy with aspirin for life and ticlopidine for 1 month.

We were unable to withdraw medications in our patient due to the concomitant presence of ischemic heart disease that required anti-anginal and anti-failure therapy.

DISCUSSION

Atherosclerotic renal artery stenosis is the most common cause of secondary hypertension, being present to some degree in less than 5% of the general population of hypertensive patient[7.] However, in several clinical subsets of patients this percentage of association increases to affect 18% of patients undergoing angiography for suspected coronary artey disease**,** 24% of patients with renal insufficiency and up to 28% in patients with occlusive peripheral vascular disease[8,9,10].

Although this strong association between RAS and CAD does not necessarily imply causation, it has been shown that RAS correlates to mortality in long term follow up of a cardiac cathterization population[11].

Although still a debatable issue worldwide, in our cardiology practice, screening renal angiography is routinely performed in patients undergoing cardiac catheterization for atherosclerotic heart disease. We see virtually no assignable risk to non-selective renal angiography.

Traditional teaching requires that both renal arteries be compromised to cause renal impairment. In our case correction of the right renal artery in the first stage was able to normalize the patient creatinine value. And as it was shown that the natural history of atherosclerotic renal artery stenosis is to progress over time, correction of the second renal artery was felt necessary[12].

The potential benefit of renal artery intervention may be limited by iatrogenic damage related to the procedure such as side branch occlusion, distal embolization, contrast nephropathy or by recurrent stenosis during follow up.

Prevention of post procedural renal damage secondary to distal embolizaion can be achieved using protection devices. Contrast nephropathy can be avoided by staging the procedure in bilateral renal artery cases. Side branch occlusion necessitates special techniques to avoid or treat BA compromise and possibly by the use of drug eluted stents [13,14].

Percutaneous treatment of bifurcational lesions has been done using several techniques[15,16,17,18,19]. Whereas high procedural success can be achieved, restenosis remains the major problem especially at the ostiae of the side branches that are usually incompletely covered by the stent struts.

Antonio Colombo had proposed crush stenting technique for bifurcational coronary artery stenosis stating that it ensures complete ostial coverage of the side branches with stent struts[15]. The crush technique consists of double wiring of the BA and the MA with subsequent kissing balloon angioplasty if necessary and sequential placement of two stents positioned simultaneously at the bifurcation. The BA is stented using an appropriately sized stent with its proximal end protruding into the MA to ensure adequate coverage of the BA ostium .To avoid inability of advancing MA stent with an expanded.

BA stent protruding into the main artery, every effort should be made to try to advance the MA stent to its intended position before deploying the BA stent.

After angiography demonstrates adequate BA stent expansion without complications such as distal dissection, the MA stent is then deployed, crushing the protruding segment of BA stent against the vessel wall. Additional rewiring of BA and kissing balloon angioplasty can be performed to optimize results.

In our case the RDC renal guide internal diameter (ID) was 0.088 inch (2.2mm). The 4mm Penta maximum-labeled shaft diameter was 3.1 F (1.02mm) while the maximal labeled shaft diameter for the Radix stent was 3.4 F (1.11mm). Although the sum of shaft diameters of both stents was less than the ID of the guide catheter, we were unable to advance both stents sequentially inside the guide except for the first 20 centimeters. Therefore we had to advance both stents and deploy them separately.

The crush technique provides excellent patency of the BA after stenting the main vessel, therefore avoiding consequences of the BA occlusion mainly caused by plaque shifting.

Whereas the immediate outcome of this technique is thought to be better than the other techniques used in treating bifurcations, still the restenosis of crush stenting is expected to be higher than that reported for uncomplicated renal stents. The higher restenosis rates may be related to the creation of more metal at the crush site.

Antonio Colombo proved in the Bifurcations Study that the use of sirolimus–eluting stents greatly reduced the incidence of restsnosis[13].

Granillo was the first to report this technique in the renal circulation using Paclitaxel eluting stents and an EPI filter EX wire. Renal angiography at three months follow up showed that the initial angiographic result was maintained perfectly at the bifurcation[14].

CONCLUSION

Although the long term consequences of this technique are not known and needs further investigation. The availability in the future of the appropriate size drug-eluting stents for use in the renal arteries holds great promise for decreasing the potential impact risk of restenosis associated with this technique on either the long term clinical or angiographic outcomes.

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