Renal artery stent placement in hypertensive patients with atheromatous renal artery stenosis: our experience

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Authors: C. Cecchelli, D. Attinì, M. Di Carlo, A. Casadei, M. Zompatori; Bologna/IT  
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Purpose

Atherosclerotic stenosis of renal artery (ASRA) represents a common condition related to hypertension, progressive renal failure and cardiovascular morbidity [1,2].

The clinical efficacy of endovascular therapy of renal artery stenosis is still controversial [3].

According to the results of two important randomized and controlled trials (ASTRAL and STAR) there were not a significant advantage of endovascular procedures compared to medical therapy alone, in improving renal function and blood pressure values [4,5,6]. These two studies should be anyway considered not conclusive, because of their intrinsic bias. First of all patients without hemodynamic significative stenosis and patients with uncertain indications for renal artery stent placement (RASP) were included in these trials. Several studies confronting RASP to medical therapy alone are still in course. In detail one of these, the CORAL trial (Cardiovascular outcomes in renal atherosclerotic lesions), should be mentioned. Primary endpoint of CORAL study is to evaluate if a significative difference in terms of renal function improvement and cardiovascular morbidity/mortality incidence between two groups of patients (treated with RASP and medical therapy vs medical therapy alone) is present [7].

Waiting for the results of CORAL and other trials, we retrospectively assessed our five year experience of RASP in patients affected by ASRA. Immediate technical success and long term impact on renal function and blood pressure values (up to two years) were evaluated.

Only patients with defined indications for the endovascular treatment were included in our study.
Methods and Materials

135 patients (86 men, 49 women, mean age: 64) treated with RASP between January 2007 and December 2011, were retrospectively evaluated.

Diagnosis of ASRA was suggested by colour Doppler ultrasound (ECD) findings (Fig. 1 on page 5 Fig. 2 on page 5) and confirmed by CT or MRI (Fig. 3 on page 6).

All patients had indications for RASP according to our inclusion criteria:

- renal artery stenosis > 70%
- resistant hypertension to a 3 drug regimen
- altered renal function
- stenosis < 70% in solitary functioning kidney patients with reduction of renal bipolar diameter

The exclusion criteria were:

- longitudinal diameter of the involved kidney < than 8 cm
- patients affected by stenosis > 70% without hypertension or altered renal function
- alterations at preliminary coagulation test

Before each procedure we evaluated the risk of iodate contrast nephropathy (CIN) based on the values of renal glomerular filtration and creatinaemia; in patients with risk of CIN we applied the guide lines of our Hospital's protocol which provides:

- the suspension, the day before the procedure, of these drugs categories: Non Steroidal Anti-Inflammatory Drugs, ACE inhibitors, Angiotensin Receptor Blockers (ARBs), nephrotoxic antibiotics, metformin.
- the suspension of anticoagulant/antiaggregant therapies
- hydration with isotonic sodium chloride solution (0,9%), sodium bicarbonate (1,4 %) and acetylcysteine.

All the RASPs were performed in the angiography suite by an experienced interventional radiologist. Ballon-expandable stents (Palmaz Blue peripheral 0,14 stent system) were used and recanalisation was usually performed after a percutaneous puncture of the femoral artery (trans-brachial approach was performed only in particular conditions: tortuosity of the abdominal aorta, severe angle at the origin of renal artery from the aorta, stenosis of the iliac arteries).

Aortography was performed through a pig tail catheter in order to evaluate the anatomy of the renal arteries and the stenotic lesions (Fig. 4 on page 7). The occlusion were usually crossed using a 0,035-in hydrophilic guidewire supported by a 6F guiding catheter positioned at the renal ostium. At this point the stent was introduced and an angiographic
control was performed (Fig. 5 on page 8) in order to evaluate its correct position (the markers of the stent have to cover completely the stenosis; furthermore at least 2 mm of the stent surface have to protrude into the aortic lumen). The stent was finally implanted and the last angiogram was performed to evaluate the result (Fig. 6 on page 9). At the end of the procedure the artery puncture was sealed through a vascular closure device.

All patients received 3,000 to 5,000 (according to the patient’s weight) UI heparin intra-arterially during the procedure.

Immediate technical success of the procedure (residual stenosis <30%) and procedure-related complications were evaluated in all 135 patients.

94/135 (69.6%) patients were studied by ECD after 12 months from RASP to define restenosis incidence (significant hemodynamic restenosis was defined as more than 50% diameter stenosis).

Blood pressure and serum creatinine levels were measured before the procedures. The same parameters were evaluated after 1 month, 12 months and 24 months in 74 patients (RASP performed between January 2007 and December 2010) and after 1 month and 12 months in 20 patients (RASP performed during 2011).

41 patients were not evaluated in long term follow up after RASP because they were not followed by the Nephrology Department of our Hospital anymore.

Data analysis was based on the two following statistical tests: ANOVA (for repeated measurements and variance analysis) and Bonferroni’s (for the analysis of multiple confrontations).
Fig. 1: "Parvus and tardus" waveform of an intrarenal artery in a patient affected by stenosis of the renal artery (picture on the left) in comparison to a normal waveform of an intrarenal artery (picture on the right).

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Fig. 2: Color Doppler Sonography shows an elevated Peak Systolic Velocity at the left renal artery ostium. Angiography confirms the presence of the stenosis.

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Fig. 3: Volume rendering CT reconstruction shows a severe stenosis of the right renal artery (white arrow) associated to an extensive infarction involving the upper pole of the right kidney (black arrows).

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Fig. 4: Preliminary aortography shows a severe stenosis of the left renal artery

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Fig. 5: Stent placement

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**Fig. 6:** Angiographic control after stent opening

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Results

Immediate technical success was obtained in all patients.

Three minor complications (1 mononeuropahty of the median nerve for local trauma, 1 arteriovenous fistula and 1 pseudoaneurysm of the femoral artery) were reported (Fig. 7 on page 12)

Significant hemodynamic restenosis after 1 year occurred in 9/94 patients (plus 3 cases of not hemodynamic significant restenosis) (Fig. 8 on page 12). All these 9 cases were treated again through angioplasty (only in 2/9 cases a new stent was placed).

Considering the 74 patients who were followed for two years (group 1), we revealed a statistically significant reduction (p<0.05) of serum creatinine levels; in detail the mean serum creatinine levels were 1.97 mg/dl before the procedure, 1.76mg/dl at 1 month , 1.74 mg/dl at 1 year and 1.74 mg/dl at 24 months (Fig. 9 on page 13).

Considering the 20 patients who were followed for one year (group 2), we revealed a statistically significant reduction (p<0.05) of serum creatinine levels; in detail the mean serum creatinine levels were 2.04 mg/dl before the procedure, 1.56 mg/dl at 1 month and 1.52 mg/dl at 12 months (Fig. 10 on page 14).

In group 1 we revealed a statistically significant improvement (p<0.05) of systolic blood pressure values; in detail the mean systolic blood pressure values were: 162,67 mmHg before the procedure, 133,51 mmHg at 1 month , 132,43 mmHg at 1 year and 130,87 mmHg at 24 months (Fig. 11 on page 14).

Also in group 2 we revealed a statistically significant improvement (p<0.05) of systolic blood pressure values; in detail the mean systolic blood pressure values were: 160,25 mmHg before the procedure, 128,5 mmHg at 1 month and 129,75 mmHg at 12 months (Fig. 12 on page 15).

For diastolic blood pressure values we revealed a statistically significant improvement (p<0.05) in both two groups of patients. In detail the mean diastolic blood pressure values were : 83,39 mmHG before the procedure, 74,83 mmHg at 1 month, 73,48 mmHg at 12 months, 73,89 mmHg at 24 months (Group 1) and 83,75 mmHg before the procedure, 72,5 mmHg at 1 month and 72,25 mmHg at 12 months (Group 2) (Fig. 13 on page 16, Fig. 14 on page 16)
Fig. 7

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Fig. 8

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**Fig. 9:** Serum creatinine levels before and after RASP in Group 1

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**Fig. 10:** Serum creatinine levels before and after RASP in group 2

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Fig. 11: Systolic blood pressure values before and after RASP in Group 1

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Fig. 12: Systolic blood pressure values before and after RASP in Group 2

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![Graph](image)

Fig. 13: Diastolic blood pressure values before and after RASP in Group 1

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Fig. 14: Diastolic blood pressure values before and after RASP in Group 2

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Conclusion

The differences between the pre- and postprocedural systolic blood pressure, diastolic blood pressure and serum creatinin average values were statistically significant ($p<0.05$).

Immediate technical success was obtained in all patients.

Only minor complications occurred and the incidence of significant hemodynamic restenosis at 12 months was 9.6 %.

According to our experience RASP represents a safe procedure characterized by a low risk of complications.

In patients with defined indications this endovascular procedure is effective in improving renal function and blood pressure control.
References


