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Selective stent placement versus balloon angioplasty for renovascular hypertension caused by Takayasu arteritis: Two-year results☆

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ABSTRACT

Objectives
We aimed to investigate the long-term clinical outcomes of selective stenting versus percutaneous balloon angioplasty (PTA) in hypertensive patients with renal artery stenosis caused by Takayasu arteritis (RASTA).
Methods
We retrospectively analyzed the data of consecutive 152 RASTA patients from Fuwai Hospital between 2005 and 2012. All target lesions of renal arteries were firstly treated by plain PTA. After angioplasty, if flow-limited dissection and/or residual stenosis >50% of diameter on angiogram existed, a selective stenting was then followed to further morphological improvement.
Results
The baseline characteristics between PTA (n = 93) and stenting groups (n = 59) were indistinguishable. At two-year follow-up, the rates of normalized, improved, and unaltered hypertension were 27.4%, 63.4% and 12.3% in PTA group (n = 93) versus 22.4%, 62.1% and 15.5% respectively in stenting group (p = 0.79). Primary patency rate was 90.1% in renal arteries (125 lesions) treated with PTA versus 75.6% in renal arteries (64 lesions) treated with stent placement (p = 0.008). Female, active stage of the disease requiring glucocorticoid and/or immunosuppressant agents, residual stenosis rate and stenting were significantly associated with the restenosis. In patients with restenosis, renal artery occlusion occurred more in stenting group (8/15), compared with that in PTA group (1/12) (p = 0.019). The stenting group underwent more reintervention procedures than PTA group (13/63 versus 8/125, p = 0.003).
Conclusions
If PTA alone failed in treating RASTA, selective stenting resulted in similarly effective blood pressure reduction. Stenting also resulted in lower 2-year primary patency rate, higher occlusion rate and higher reintervention rate than those who did not need stenting.

1. Introduction

Takayasu arteritis (TA) is a nonspecific vasculitis affecting mainly the aorta and its major branches. It is a rare disease with a relatively high prevalence in Asia, including China [1–3]. We previously reported that renal artery stenosis caused by Takayasu arteritis (RASTA) is the second major cause of all renal artery stenosis in our center [4]. RASTA can lead to renovascular hypertension, renal dysfunction, cardiac decompensation, stroke and premature death [2,3]. Revascularization, including surgical and endovascular procedures, has been applied in the management of symptomatic RASTA [5–7]. Percutaneous transluminal angioplasty (PTA) was most widely used in patients with RASTA, however angiographic outcomes are discontented in considerable cases because of accompanying recoil or dissection after plain balloon angioplasty [8,9]. If PTA fails, then stent placement is another candidate therapeutic procedure [8,9]. In literature, most of the reports regarding stent placement in RASTA have relatively small number of patients and short-term follow-up period [8,9], making it difficult to evaluate its long-term benefits and limitations. Therefore, a comprehensive evaluation of selective stent placement versus PTA alone in patients with RASTA is warranted.

In this retrospective analysis, we describe our experience of endovascular treatment specifically for RASTA. The study compares selective stent placement with PTA alone in a larger number of patients with emphasis on the long-term effects on blood pressure, renal function, and arterial patency rate.

☆ All authors take responsibility for all aspects of the reliability and freedom from bias of the data presented and their discussed interpretation.

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2. Methods

2.1. Study population

We retrospectively analyzed the data of the patients with RASTA undergoing endovascular treatment for stenotic lesions of renal arteries at Fuwai Hospital, Beijing between January 2005 and December 2012. The diagnosis of TA was based on the criteria reported by Sharma et al. in 1995 [1]. Patients undergoing endovascular treatment of renal artery met all of the following indications: (a) systolic blood pressure ≥ 160 mm Hg, and/or diastolic blood pressure ≥ 100 mm Hg in those without receiving drug therapy or systolic blood pressure ≥ 140 mm Hg, and/or diastolic blood pressure ≥ 90 mm Hg in those taking standard triple-drug combination treatment (calcium channel blockers + angiotensin converting enzyme inhibitors / angiotensin receptor blockers + diuretics); (b) angiographic evidence of ≥70% renal artery stenosis; and (c) disease was in inactive phase/stage or controlled with immunosuppressive drugs for at least 2 months. "Active phase/stage of the disease" was defined as new onset or worsening of two or more of the US National Institutes of Health criteria features of TA according to a modified Kerr's criteria [10]. Exclusion criteria included: (a) erythrocyte sedimentation rate (ESR) > 20 mm/h or C-reactive protein (CRP) > 10 mg/L after full dose usage of glucocorticoid and/or immunosuppressive agents (23 patients were excluded); (b) serum creatinine (SCr) level ≥ 176.8 μmol/L (2.0 mg/dl) (6 patients were excluded); (c) allergy to contrast medium (1 patient was excluded); (d) longitudinal kidney length < 7 cm supplied by target artery (4 patients were excluded); (e) severe stenosis of ascending aorta or proximal abdominal aorta, which caused ankle-brachial index <0.9 (11 patients were excluded); and (f) patients with potentially confounding diseases such as Cogan syndrome, syphilis, tuberculosis aortitis, Marfan syndrome and neurofibromatosis (5 patients were excluded). A total of 152 patients were enrolled finally in the study.

2.2. Baseline data collection

At baseline the information on social and demographic factors (sex, age, smoking status etc.); medical history (the use of glucocorticoid or immunosuppressant agents, the exact antihypertensive medications and doses, the history of hyperlipidemia, diabetes, stroke etc.) were collected. Clinical physical examination (including height, weight and blood pressure), echocardiography and angiographic and computed tomography findings were also recorded. ESR, CRP and SCr concentration were measured. Ankle-brachial index was measured using a dedicated device (Omron Colin VP-1000). Blood pressure was measured using mercury sphygmomanometer in the uninvolved limbs. Estimated glomerular filtration rate was calculated with the formula: eGFR (mL/min/1.73 m^2) = $186.3 * SCr\ (\text{in mg/dl})^{-1.154} * age^{-0.203} * 0.742$ (if female).

2.3. Revascularization technique

The renal artery was revascularized via a retrograde femoral approach (139 cases) or a brachial artery approach (13 cases) depending on the orientation of the renal artery to be catheterized. Heparin was used as the procedural anticoagulant agent. Baseline angiography was performed and a guide wire was interested across the lesion. To avoid the risk of arterial rupture or dissection, the diameter of balloon was 20%–30% smaller than the reference diameter at the first attempt. The balloons were positioned at the site of the stenosis and inflated within its rated burst pressure until the balloon was fully dilated. A larger-diameter balloon (up to the reference diameter) could be used if obvious recoil occurred after balloon dilatation. There were changes in devices used with angioplasty during the study period 2005–2012. Before January 2010, a 7F or 8F guiding catheter, a 0.035 in. 260 cm curved tip wire and then a 5F OTW balloon catheter was sequentially used in most of the patients. After January 2010, a 6F guiding catheter, a 0.014 in. coronary guiding wire and then a 3F–4F monorail balloon catheter were used in most of the patients. Besides, scoreflex balloon (Orbus Neich Medical) or cutting balloon (Boston Scientific) was attempted before selective stenting. The procedural success of PTA was defined as <50% residual stenosis in diameter. When there was flow-limiting intimal dissection and/or residual stenosis more than 50% of diameter on angiogram after angioplasty, a high-radial strength stent was implanted, from one of the following: Palmaz (Cordis), Hippocampus (Invitec), Palmaz Genesis (Cordis), and Express SD (Boston Scientific). The percentage of patients received stent implantation was 37.6% (46/123) before January 2010 and 27.3% (18/66) thereafter ($p = 0.16$). The procedural success of stent placement that was defined as the residual stenosis was less than 30% in diameter.

When the clinical results (blood pressure, renal function and clinical events) were analyzed, the patients were divided into two groups (the PTA group and the stenting group). Patients who underwent only angioplasty unilaterally ($n = 71$) or bilaterally ($n = 22$) were classified as the PTA group. Patients who received stent placement in at least one renal artery, regardless of whether or not angioplasty had been performed in the other renal artery were classified as the stenting group. In the PTA group, angioplasty was performed in 115 renal arteries of 93 patients. In the stenting group, renal stent placement was performed in 64 renal arteries of 59 patients. Ten patients had stent placement on one side, and angioplasty only on the other. They were included in the stenting group when the clinical results were analyzed. In 64 arteries of 59 patients who had stent placement, there were 29 arteries with residual stenosis more than 50% in diameter, 25 arteries with significant dissection after angioplasty, 10 arteries with both of them.

2.4. Medication therapy

All patients undergoing the interventional procedure should be treated with glucocorticoid and/or immunosuppressive agents after the procedure to prevent restenosis based on the experience in our center. Glucocorticoid (prednisone) was commenced at a daily dose of 0.5 mg/kg per day for 1 month, and then tapered gradually to keep ESR and CRP normal. It was gradually reduced to a maintenance dosage of 5–10 mg per day for at least 6 months. In order to minimize steroid exposure because of the extended adverse effect profile of the long-term corticosteroid therapy, additional agents, such as azathioprine and cyclophosphamide, can be used for patients who could not reach remission(i.e. normal ESR and normal CRP) of disease [11]. At baseline, there was no significant difference in the use of glucocorticoid/immunosuppressive agents [53 patients (57%) in the PTA group, 32 patients (54.3%) in the stenting group ($p = 0.74$)]. Immunosuppressive agents were given to 5 patients (5.4%) in the PTA group, and 3 patients (5.1%) in the stenting group ($p = 0.94$). At final follow-up, there was no significant difference in the use of glucocorticoid/immunosuppressive agents [48 patients (56.5%) in the stenting group, 30 patients (54.5%) in the PTA group ($p = 0.82$)]. Immunosuppressive agents were given to 4 patients (4.7%) in the PTA group, 3 patients (5.5%) in the stenting group ($p = 0.84$).

Aspirin (100 mg) daily was taken for 3 days before the intervention and for 6 months after the procedure.

2.5. Follow-up

Patients were followed up at 1, 6, 12, 18 and 24 months after the procedure. The median follow-up time was 22.9 ± 4.2 months; 12 patients (7.9%) had been lost to follow-up (8 in the PTA group and 4 in the stenting group, $p = 0.77$). ESR, CRP, SCr, renal artery color duplex scanning and blood pressures (using mercury sphygmomanometer in the uninvolved limbs) were measured at every visit. Confirmatory angiogram or computed tomography angiogram was performed when