
An unrecognised presentation of Takayasu arteritis: superficial femoral artery involvement

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Received on September 12, 2016; accepted

in revised form on October 17, 2016.

Clin Exp Rheumatol 2017; 35 (Suppl. 103):

S83-S87.

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EXPERIMENTAL RHEUMATOLOGY 2017.

Key words: femoral artery,
Takayasu arteritis, angioplasty.

ABSTRACT

Objective. Superficial femoral artery (SFA) involvement in Takayasu arteritis (TAK) has rarely been reported. The purpose of this study was to investigate the clinical characteristic and clinical outcomes of endovascular therapy in such patients.

Methods. We analysed the data collected from 105 consecutive patients with TAK, who were diagnosed from January 2011 to December 2013. All patients underwent ankle brachial index (ABI) measurements and angiography. Nine patients with an ABI <0.9 and SFA stenosis (≥50%) were detected. Of them, 5 patients underwent percutaneous transluminal angioplasty (PTA) in SFA lesions. The clinical features, angiographic findings, treatment, and follow-up outcomes were investigated retrospectively.

Results. Thirteen SFA stenosis in 8.6% patients (9/105) was found. The mean age was 44.3±15.7 years (all female) and mean Rutherford stage was 2.1±0.6. Compared with that at baseline, the ABI (0.98±0.03 vs. 0.66±0.09, $p=0.001$) and 6-min walking capacity (361±47 vs. 224±44 m, $p<0.001$) after PTA had improved significantly. During a mean follow-up of 27.4±10.6 months, the changes of ABI (0.29±0.06 vs. -0.04±0.04, $p<0.001$) differed significantly between SFA lesions that had undergone PTA and those without PTA. Restenosis was found in one SFA lesion 23 months after PTA. No severe adverse events occurred in 5 patients who underwent PTA during the perioperative period and follow-up.

Conclusion. SFA involvement in TAK is not rare. PTA is a safe and feasible way to improve SFA ischaemia.

Introduction

Takayasu arteritis (TAK) is a chronic, non-specific inflammatory disease of unknown aetiology, mainly affecting

the aorta and its major branches, as well as pulmonary arteries (1-5). The involvement of superficial femoral artery (SFA) in TAK has rarely been reported (6-10). So far, endovascular treatment for such lesions has been described only in one TAK patient (9). The aim of this study was to evaluate the clinical characteristics and clinical outcomes of endovascular therapy of SFA involvement in TAK patients.

Materials and methods

Patient population

Between January 2011 and December 2013, 105 consecutive patients with TAK underwent ankle brachial index (ABI) measurements and percutaneous angiography in our institution. TAK was diagnosed according to the American College of Rheumatology 1990 criteria (1). Nine patients with an ABI <0.9 and SFA stenosis (≥50%) were detected. Five patients with moderate to severe intermittent claudication (Rutherford class 2 or 3) who wanted to pursue endovascular management, underwent percutaneous transluminal angioplasty (PTA) in SFA lesions. This study was approved by the ethics committee of our Hospital. Written informed consent was provided by each patient before the procedure.

Interventional procedure and medical therapy

The interventional procedures were all performed under local anaesthesia through contralateral femoral artery access. Using the Seldinger technique, a 6F introducer sheath was positioned, and heparin (1 mg/kg) was administered. Non-selective ascending aorta, super-arch, abdominal aorta, and iliac arteries was first made by a diagnostic catheter 5F Omni flush (Cordis, USA) to detect stenotic/occlusive lesions. All patients with (ankle brachial index) ABI<0.9 underwent selective lower

Competing interests: none declared.

limb angiography. For patients scheduled for percutaneous intervention, a shuttle flexor introducer long sheath (COOK, USA) in three cases or a guiding catheter, including 6F MPA (Boston Scientific, USA) in one case and 6F RDC in one case, was inserted into the proximal of SFA lesions over a 0.035-inch HiWire angled hydrophilic guidewire (Cook, USA). Then, a guide wire (300 cm 0.01-in V-18 guidewire in three cases, 180 cm 0.014-in Fielder guidewire in two cases) was inserted across the lesion. The SFA lesion was dilated by graded undersized balloons with the maximal size $\leq 90\%$ of the original size of the vessel diameter (Fig. 1). The procedural success of PTA was defined as $\leq 30\%$ residual stenosis.

Aspirin (100 mg) daily was taken for 3 days before the procedure and for 6 months after PTA, and then tapered gradually to keep ESR and CRP normal to prevent restenosis. It was gradually reduced to a maintenance dosage of 5–10 mg per day for at least 6 months (11).

Follow-up

Telephone or clinic interviews were conducted 1, 6, and every 6 months after the procedure by a dedicated research coordinator. Rutherford stage, ABI, 6-min walking capacity, and inflammatory factors (ESR and CRP) of all 9 patients were examined. SFA Doppler ultrasound was performed if any patient who underwent PTA had an ABI < 0.9 during follow-up.

Statistical analysis

Continuous variables were the mean \pm SD, while categorical data were given as counts and percentages. Differences between variables (angiographic stenosis, ABI and 6-min walking capacity) measured before, after PTA and follow-up were tested by the paired *t*-test. The changes of Rutherford stage and 6-min walking capacity measured before PTA

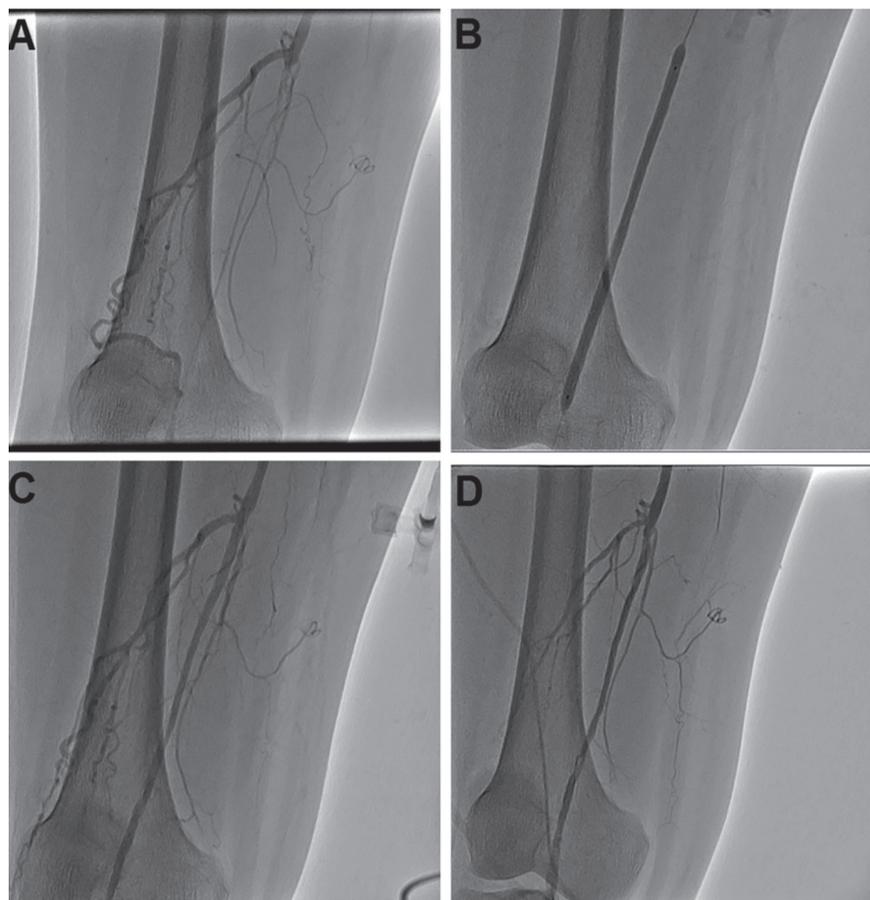


Fig. 1. Percutaneous transluminal angioplasty (PTA) in superficial femoral artery (SFA) lesion and follow-up. (A) Right SFA angiogram before PTA. (B) PTA in right SFA lesion (Lite Pac 4.0x120mm). (C) Right SFA angiogram after PTA. (D) Right SFA angiogram at 12 months follow-up.

and follow-up between patients who underwent PTA or without PTA in SFA lesions were tested by independent sample *t*-test. All analyses were performed using the SPSS 17.0 software (SPSS Inc.). All probability values were 2-sided, and a *p*-value < 0.05 was considered statistically significant.

Results

Baseline patient characteristics

The 9 patients were 19–58 (40.4 ± 12.6) years old; all were female. The duration of TAK was 1.0–30.3 (18.8 ± 10.2) years. No patients had diabetes and dyslipidaemia, nor were smokers. Five patients suffered from hypertension due to renal artery stenosis, renal and aortic stenosis in two patients and aortic stenosis in one patient, respectively. Mean Rutherford stage of 9 patients was 2.1 ± 0.6 . ABI at baseline of 13 SFA lesions was 0.56–0.83 (0.68 ± 0.85) and 6-min walking capacity at baseline of 9 patients was 176–322 (248 ± 48) m. Ac-

cording to the anatomic classification reported by Lupi-Herrera *et al.* (12), 7 (77.8%) patients were of type III, followed by type II (11.1%) and type IV (11.1%). Six patients had undergone previous percutaneous intervention of other arteries (Table I).

Procedural characteristics

According to angiographic classification of Trans-Atlantic Inter-Society Consensus (TASC) (13), nine (69.2%), two (15.4%), one (7.7%), one (7.7%) SFA lesions were of TASC type D, A, B and C, respectively. There were no stenotic lesions found in other lower extremity arteries (iliac arteries, deep femoral arteries, etc.). The length and stenosis of 13 SFA lesions were 28.0–362.0 (243.6 ± 109.6) mm and 80.0–100 (97.6 ± 6.0)%, respectively. PTA was performed in 5 SFA lesions in 5 patients. The maximal diameters of angioplasty balloons were 5 mm, 4 mm in 2, 3 SFA lesions, respectively (Table II). The

Table I. Baseline clinical and angiographic characteristics of all 9 patients.

Case	Sex	Age (years)	Duration of TA detected (years)	TAK Classification	Angiographic characteristics of vessel lesions Location/severity of stenosis				
					SFA/%	Aorta/%	Supra-arch arteries/%	RA/%	Othe Vessels/%
1	F	37	20.0	III	LSFA/100, RSFA/100	-	LSA/90*	RRA/100*	-
2	F	37	15.8	IV	LSFA/100, RSFA/100	AA/50	RSA/100, LCA/100, RCA/100	RRA/50	RPA/100*, LUPA/80*
3	F	26	6.0	III	RSFA/99	-	RCA/50, LCA/50,	LRA/90	-
4	F	39	16.0	III	LSFA/100, RSFA/100	AA/50	LECA/100	-	-
5	F	46	24.0	III	RSFA/80	-	RCA/50, LCA/50, LSA/80	-	-
6	F	69	30.2	III	RSFA/100	-	LCA/100, LSA/100, RSA/50	RRA/50	LCX/95*, LAD/50
7	F	58	27.3	III	LSFA/100, RSFA/100	AA/90*	LSA/90	-	-
8	F	53	29.0	III	LSFA/100	DA/75*, AA/80*	LSA/90 RSA/90	RRA/90*, LRA/90*	-
9	F	19	1.0	II	RSFA/70	DA/80*	-	-	-

*indicated the vessel lesions that underwent previous percutaneous intervention. F: female; SFA: superficial femoral artery; LSFA: left superficial femoral artery; RSFA: right superficial femoral artery; RA: renal artery; RRA: right renal artery; LRA: left renal artery; LSA: left subclavian artery; RSA: right subclavian artery; LCA: left common carotid artery; RCA: right common carotid artery; AA: abdominal aorta; DA: descending aorta; LECA: left external carotid artery; RPA: right pulmonary artery; LUPA: left upper pulmonary artery; LCX: left circumflex artery; LAD: left anterior descending artery.

Table II. Intervention and follow-up data of 13 SFA lesions in 9 patients.

Case	SFA lesions				ABI		6-min walk distance(m)		Rutherford stage		Follow-up (months)
	Side	TASC	PTA	Residual stenosis (%)	Baseline	Follow-up	Baseline	Follow-up	Baseline	Follow-up	
1	R	D	No	-	0.68	0.69	176	267	3	2	13.5
	L	D	Yes	30	0.57	0.88					
2	R	D	Yes	20	0.56	0.93	181	278	3	2	28.2
	L	D	No	-	0.68	0.66					
3	R	B	Yes	25	0.66	0.98	278	442	2	0	37.6
4	R	C	No	-	0.83	0.84	243	372	2	1	23.0
	L	D	Yes	10	0.72	0.93					
5	R	A	Yes	10	0.77	1.02	244	435	2	0	47.0
6	R	D	No	-	0.67	0.60	293	235	2	2	26.5
7	R	D	No	-	0.60	0.57	232	184	2	3	33.6
	L	D	No	-	0.64	0.61					
8	L	D	No	-	0.64	0.56	265	177	2	3	20.2
9	R	A	No	-	0.81	0.74	322	275	1	2	16.8

SFA: superficial femoral artery; ABI: ankle brachial index; TASC: Trans-Atlantic Inter-Society Consensus; TA: percutaneous transluminal angioplasty; R: right; L: left.

angiographic stenosis decreased from 97.8±4.4% to 19.0±8.9%. Compared with that at baseline, the ABI (0.98±0.03 vs. 0.66±0.09, $p=0.001$) and 6-min walking capacity (361±47 vs. 224±44 m, $p<0.001$) after PTA had improved significantly. Simultaneous percutaneous intervention of other arteries was performed in 6 patients, including right

subclavian artery in Case 2, Case 7 and Case 8, left renal artery in Case 3, left subclavian artery in Case 5, left common carotid artery in Case 6. No procedure-related adverse event occurred in all patients during the perioperative period.

Follow-up

After an average of 27.4±10.6 months

of follow-up (range 13.5–47.0 months), the ABI improvement was maintained (0.96±0.04 vs. 0.66±0.09, compared with baseline, $p=0.001$). The changes of ABI (0.29±0.06 vs. -0.04±0.04, $p<0.001$) differed significantly between SFA lesions that underwent PTA and those that did not. The improvements of ABI (0.29±0.06 vs. -0.04±

0.04, $p < 0.001$), 6-min walking capacity (134.4 ± 43.0 vs. -60.2 ± 19.2 , $p < 0.001$) and Rutherford stage (-1.4 ± 0.5 vs. 0.8 ± 0.5 , $p = 0.001$) differed significantly between patients who underwent PTA in SFA lesions and those who did not. The inflammatory factors of 8 patients were normal during follow-up. Other one patient stopped taking prednisone at 17 months, and a restenosis of 50% occurred at 23 months after PTA. The patient went back on prednisone once again, and the restenosis remained unchanged. There were no other adverse events occurring in any patient during follow-up.

Discussion

To the best of our knowledge, the present study represents the largest consecutive series of patients with SFA involvement. Our study showed that SFA involvement in TAK is not rare, with an incidence of 8.6%. Mean Rutherford stage of 9 patients was 2.1 and most SFA lesions were TASC type D. PTA was found to be a safe and feasible way to improve SFA ischaemia with no sequelae.

TAK, also known as "pulseless disease", is a non-specific inflammatory disease that commonly affects young females and causes stenosis, occlusion, or dilation of the aorta, its major branches and pulmonary arteries. It is prevalent in Asian and Middle Eastern countries. SFA involvement has been reported in few TAK cases (6-10). Lagneau *et al.* reported 3 cases with occluded vessels below the inguinal ligament in 39 TAK patients, one of whom had SFA involvement (2.6%) (6). Nakabayashi *et al.* described one TAK patient with partial occlusion in right SFA and complete occlusion in left SFA, and the patient underwent bypass operation between right femoral and popliteal artery due to severe intermittent claudication (7). Cakar *et al.* found one 14-year-old TA girl (5.2%) who suffered from the occlusion of bilateral SFA in a cohort of 19 TAK children (8). Beschorner *et al.* diagnosed a 24-year-old woman with only bilateral SFA occlusion (Rutherford stage 5) in TAK by percutaneous transluminal atherectomy. This patient underwent staged endovascular therapy in bilateral lower

limbs (9). So far, no studies have systematically evaluated SFA involvement in TAK. In our study, all patients with an ankle brachial index (ABI) < 0.9 underwent selective lower extremity angiography. Nine (8.6%) patients with 13 SFA lesions were diagnosed. The difference between the SFA lesions due to atherosclerosis (approximate 30%) (14-16), and the SFA lesions in TAK (69.2%) is that they were TASC type D. However, the mean ABI was higher and Rutherford stage was lower in TAK patients. Potential reasons for this included better collateral circulation derived from non-stenotic deep femoral arteries and no stenotic lesions in other limb arteries.

Surgical procedures including arterial reconstruction, bypass grafting and thromboendarterectomy have been reported to increase the long-term survival in TAK patients (17-18). However, due to the characteristics of multiple arterial involvement and serious complications (anastomotic site aneurysms, graft occlusion) (3, 17), widespread use of reconstructive surgery has been precluded. With recent advances in endovascular treatment, PTA has become an attractive treatment strategy for inactive stenotic/occlusive lesions of the aorta and its major branches due to TAK (11, 18). However, this treatment strategy has been only reported in one case with SFA involvement. In our series, 5 patients with moderate and severe intermittent claudication underwent PTA. The improvements of ABI, 6-min walking capacity and Rutherford stage differed significantly between patients who underwent PTA and those who did not in SFA lesions. More importantly, 6 patients underwent simultaneous intervention of other arteries in our study, the simultaneous surgical management of which may be difficult and may not even be feasible. According to our experience, the following two points were crucial to improve long-term SFA patency due to TAK. First, the difference with atherosclerotic SFA lesions, arterial dissection was less frequent in SFA lesions due to TAK by PTA with undersized balloon. Moreover, more SFA lesions were Type D, stent implantation had

high incidence of restenosis. Therefore, all SFA lesions underwent only PTA in our studies. Second, the mechanism of restenosis after PTA in TAK was vessel inflammation rather than the inflammatory reaction that was the leading cause of atherosclerosis (3, 11, 18, 19). Thus, we suggest that vigilant anti-inflammatory therapy is mandatory to prevent restenosis during follow-up.

The present study was mainly limited by its retrospective nature and small sample size. Additionally, lower limb angiography was not performed routinely in all the 105 TAK patients, therefore, the real incidence rate of SFA involvement in TAK may be underestimated.

Conclusions

In conclusion, the incidence of SFA involvement in TA was 8.6%. PTA is a safe and feasible way to improve SFA ischaemia. Further large-sample studies are needed to verify our results.

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