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Modified No-touch technique using floating wire — a novel technique of Unprotected Carotid Artery Stenting for aorto-ostial lesion

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Abstract

Takayasu arteritis (TA) is chronic inflammatory large vessel vasculitis where aorta and its main branches bear the maximum burden. Here, we report a case of 23-yr-old hypertensive male that had an episode of transient ischemic attack (TIA) three months back. He was diagnosed with type I Takayasu's arteritis (TA) showing long segment osteo-proximal lesion of right common carotid artery (RCC) with near total occlusion, along with lesion involving bifurcation and proximal part of internal carotid artery having similar degree of severity on computed tomographic angiography of aorta. It was successfully stented with two overlapping 6 x 19, and 6 x 18 mm Herculink stent (Abott Vascular, USA) distally at 12 atm pressure while aorto-ostial lesion was stented using 7 x 19, and 7 x 18 mm overlapping Herculink stents at 14 atm pressure achieving excellent results with no residual stenosis. Carotid artery stenting (CAS) was unprotected as no embolic protection device was used, and aorto-ostial lesion was stented keeping a floating wire in subclavian artery as a modification of no touch technique. At 4-year follow up, computed tomographic imaging revealed well apposed stents with excellent patency.

Key words — Carotid Artery Stenting, Carotid Endarterectomy, Takayasu Arteritis, Transient Ischemic Attack.

Introduction

Takayasu arteritis (TA) is chronic inflammatory arteritis that affects the large vessels, predominantly the aorta and its main branches, pulmonary arteries, and rarely coronary artery as well. Clinical symptoms are attributed to systemic inflammatory response as well as local vascular complications with mortality rate up to of 30% at 5-years [1]. Congestive heart failure, acute coronary syndrome, stroke, and renal failure are usual causes of death. Neurological manifestation of the disease includes headache, dizziness, visual disturbance, transient ischemic attack (TIA) and stroke [2]. It can lead to stenosis/occlusion of the vessel as a result of adventitial thickening, lymphocytic infiltration of the tunica media, and intimal hyperplasia while aneurysmal dilatation, though uncommon are the result of medial degeneration. More recently, carotid artery stenting (CAS) has emerged as an alternative to carotid endarterectomy (CEA). However, the procedure is associated with plaque disruption, spiral dissection, atheroembolism, and acute stroke. These may be avoided by minimal contact and manipulation between the guide catheter and the atherosclerotic aorta, and the ostial lesion. These can be circumvented by use of embolic protection device (EPD), catheter-in-catheter, no-touch technique, and minimal manipulation. However aorto-ostial lesions of common carotid artery are different subsets as one cannot afford either geographical miss as it may invite future restenosis, or excess overhang of stent in aorta.

Case report

A 23-yr-old male attended our outdoor department for evaluation of hypertension. It was incidentally detected as he had suffered an episode of transient ischemic attack (TIA) three months back. His blood pressure was 160/92 mmHg. He was receiving amlodipine — 10mg, losartan-50 mg, and hydrochlorthiazide — 12.5 mg. Pulse rate was 68/min, regular in rhythm, normal in volume and character with no radio-radial or radio-femoral delay with all pulses palpable. Other physical examinations were normal. Electrocardiogram showed normal sinus

rhythm along with mild ST-T changes in precordial leads. Echocardiography revealed mild concentric left ventricular hypertrophy, grade-II diastolic dysfunction with normal ejection fraction. There was a bruit audible over the right submandibular area along with a palpable thrill. On admission, his haematological, biochemical, and urinalysis were normal. Computed tomographic (CT) angiography of aorta revealed long segment osteo-proximal lesion of right common carotid artery (RCC) with near total occlusion along with similar severity of lesion involving bifurcation and proximal part of internal carotid artery (Fig. 1A). Also shown was total occlusion of right renal artery while left was patent. Ultrasonography of abdomen showed atrophic right kidney. Based on above parameters, it was diagnosed as type IIb Takayasu's arteritis as per new angiographic classification of Takayasu's arteritis [3]. Angiographically, it was labelled as type I [4]. Erythrocyte sedimentation rate (ESR), and C-reactive protein (CRP) values were within their normal ranges which ruled out active phase of the disease. Percutaneous carotid intervention was planned after taking informed consent. Right femoral artery was accessed with 7F sheath. He was subsequently heparinised to keep an activated clotting time of 250 to 350 seconds. Selective angiography of right innominate artery with 5F multipurpose catheter revealed osteo-proximal lesion with 50% stenosis of right subclavian artery (RSC), long segment osteo-proximal disease with 95% stenosis of right CCA, along with another critical stenotic segment before the bifurcation extending to internal carotid artery (ICA) as well (Fig. 1B). The diagnostic catheter was then exchanged with a 7F Judkins right (JR) guiding catheter (Medtronic, USA). 0.014 inch runthrough wire (Terumo, Japan) was parked into RSC artery. The floating wire was preventing the selective intubation of RCC artery. Once the guiding catheter was short of the ostium, the second runthrough wire was advanced into the RCC and parked into internal carotid artery (Fig. 2A). The lesions were sequentially predilated with 3.5 × 10, and 4 x 10 mm quantum Meverik non-compliant balloon (Boston Scientific, USA) at 20 atm pressure (Fig. 2B). There was

significant residual stenosis despite high pressure predilatation (Fig. 2C). The distal lesion was stented with two overlapping 6x19, and 6x18 mm Herculink stent (Abott Vascular, USA) which were deployed at 12 atm pressure (Fig. 3A, B, C, and D). The proximal lesion was stented with 7 x 18 mm Herculink stent at 13 atm pressure (Fig. 4A, B). Another 7 x 19 mm Herculink stent overlapping with the previous stent was deployed at 13 atm pressure making sure that few struts were hanging into aorta (Fig. 4C). The stent balloon was little pulled up and proximal end of the stent was flared at 14 atmospheres to completely cover the ostium (Fig. 4D). During inflation of the stent, the patient complained of right-side neck pain which resolved once balloon was deflated. A transient episode of bradycardia was also noted which reverted to sinus rhythm. Digital subtraction angiogram revealed well apposed stents with no dissection, or residual stenosis (Fig. 5A, B). The bruit over the right submandibular area disappeared. His hospital stay was uneventful, and was subsequently discharged on fifth day on aspirin 75 mg/daily permanently and clopidogrel 75 mg/daily for 6 months. He has done well at follow-up, although still requiring multiple medications, and his systolic blood pressures have consistently been in the 130s. At 4-year follow up, digital computed tomographic imaging revealed well apposed stents with excellent patency (Fig. 6**)**.

Discussion

Stroke is the third most common cause of death worldwide. With refinements in technology, better understanding of the patho-physiology of carotid plaque, and advancement in hardwares design, CAS has seen a significant fall in the complications including stroke. Embolization occurs during all transcatheter manipulation with atherosclerotic plaque, and the brain is unforgiving. There is no end for protection as embolic filter devices (EPD) may cause paradoxical embolism, may have micro emboli, and sometimes entanglement [5]. Therefore, there is unending quest for the ideal device. Tallarita et al in their review have

concluded that no significant difference exist in the primary end points of perioperative stroke, myocardial infarction between unprotected vs. protected CAS [6].

Lesion morphology in patients with Takayasu arteritis differs from that of typical atherosclerotic plaque. In the early, active phase of the disease, stenotic lesions are uncommon, and often yields at low pressure but one should refrain from stenting except in bail out situations like flow-limiting dissection or vessel wall recoil as they carry higher rate of future restenosis [7–9]. As patients requiring intervention commonly present in late phase of the disease when lesions becomes tough, and fibrotic, and therefore results of plain balloon angioplasty alone may be suboptimal. Therefore, angioplasty balloons used should be non-compliant and capable of withstanding high pressures. Also, suboptimal lesion expansion appears to invite future restenosis. Even non-compliant balloon possess certain degree of compliance at very high pressure, resulting into over dilatation of segments adjacent to resistant site in long lesion. Stents are used to improve the results of angioplasty in TA. Therefore, elective use of stents permits more optimal dilatation of stenotic lesions with larger balloons and/or higher pressures as any induced dissections are tackled down by the stent; this along with limitation of vessel wall recoil achieves a greater luminal gain in diameter which may negate short-term restenotic tendencies. Effective immunosuppressive therapy may also retard stenotic process [10]. In cases of Takayasu arteritis, however, stenting for these supra-aortic vessels, especially for the carotid arteries, has rarely been documented despite more frequent use of this technique in the abdominal/thoracic aorta and its major branches [7–9]. Carotid stenting in patients with TA have been reported by very few authors, with excellent results over long term period [11]. In our case, stents were patent at the end of 4-years. Another remarkable point demonstrated by this case was aorto-ostial lesion of unprotected carotid artery can be done with aid of embolic protection device (EPD). Besides being minimally invasive and therefore less risky than open surgery, the

percutaneous approach has advantages such as the ability to treat multiple lesions and long segment disease.

Conflict of interests

None.

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Figure legends

Figure 1 — Angiography of aorta and its vessel revealing long segment osteo-proximal lesion of right common carotid artery (RCC) with near total occlusion along with similar severity of lesion involving bifurcation and proximal part of internal carotid artery (white arrow — stenotic part, arrowhead — mild lesion of right subclavian artery; A — Computed tomographic angiography; B — catheter based diagnostic angiogram)

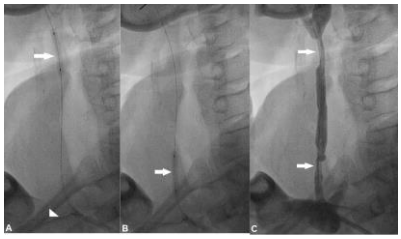

Figure 2 — Workhorse wire was parked into right internal carotid artery along with a floating wire in right subclavian artery (A); Lesions were sequentially predilated with non-compliant balloon at high pressure (A, B); Significant residual stenosis was noted despite high pressure predilatation (C).

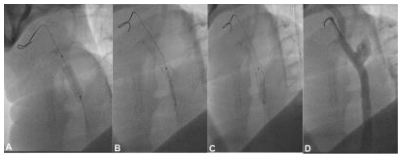

Figure 3 — The distal lesion was stented with two overlapping 6 x 19 (A), and 6 x 18 mm Herculink stent (B,C) at 12 atm pressure achieving excellent flow with no residual stenosis (D).

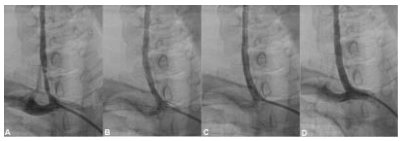

Figure 4 — The proximal lesion was stented with 7 x 18 mm Herculink stent (A, B); Another 7 x 19 mm Herculink stent overlapping with the previous stent was deployed at 13 atm pressure making sure that few struts were hanging into aorta (B, C). Excellent flow with no residual stenosis after ostial flaring (D).

Figure 5 — Digital subtraction angiogram revealed well apposed stents with no dissection, or residual stenosis.

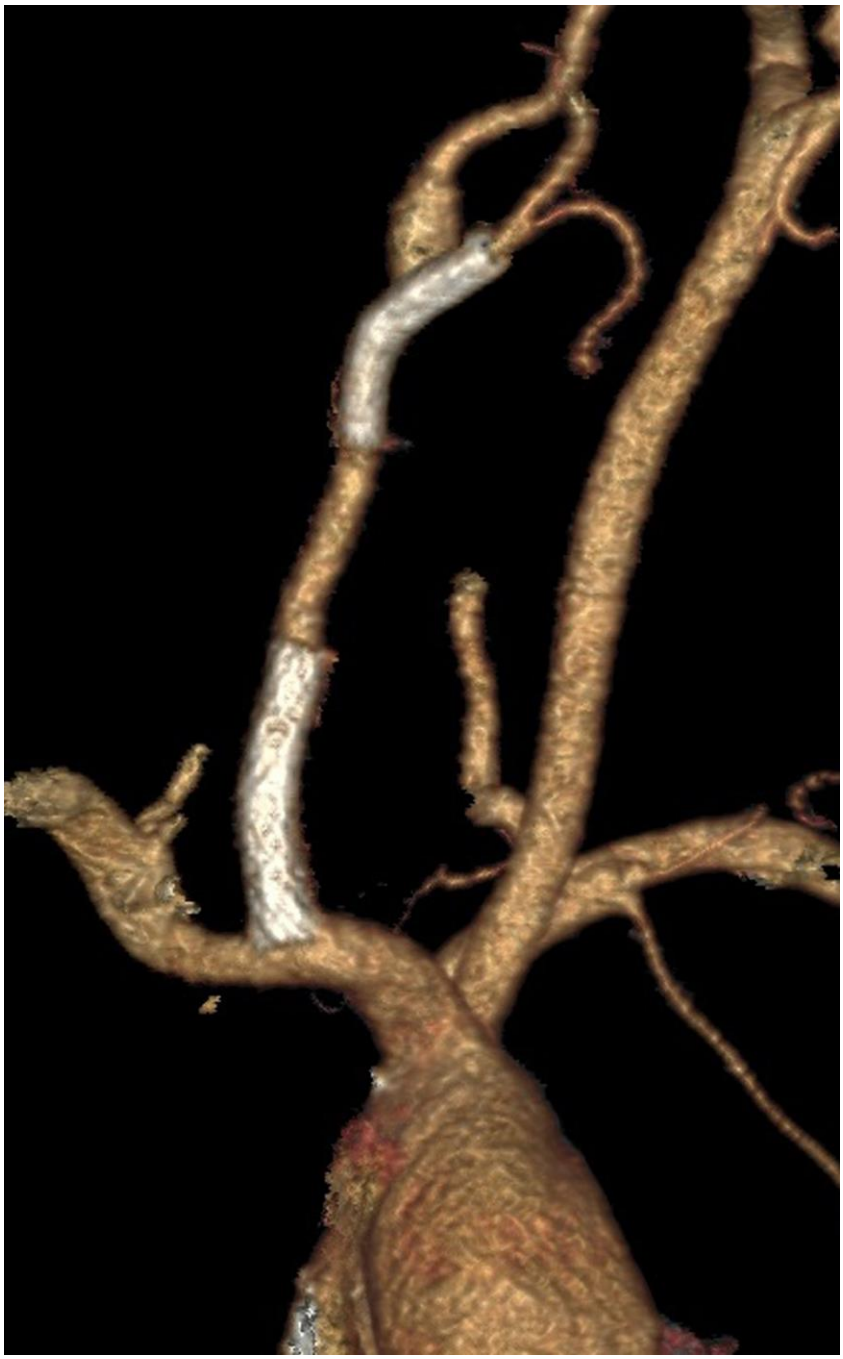

Figure 6 — At 4-year follow up, computed tomographic imaging revealed well apposed stents with excellent patency (A-distal stents; B- proximal stents).