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Endovascular Revascularization for Carotid Artery Occlusion in Patients with Takayasu Arteritis

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WHAT THIS PAPER ADDS

Type I Takayasu arteritis (TA) is a progressive inflammatory disease involving the aortic arch and its main branches. If untreated, patients may develop hemiplegia or die at a young age. However, few reports have focused on endovascular recanalization of the carotid artery in patients with TA. This study reports results of a series of endovascular revascularizations for complete occlusion of the carotid artery in high risk TA patients.

Objectives: Type I Takayasu arteritis is a progressive inflammatory disease involving the aortic arch and its main branches. If untreated, patients may develop a variety of serious conditions ranging from hemiplegia to death. Whilst there is a relatively strong evidence base for the outcome of surgical techniques, few reports have focused on revascularization using an endovascular technique in patients with Takayasu arteritis.

Methods: From May 2007 to March 2013, 11 consecutive patients with Takayasu arteritis presenting with severe cerebral ischemia symptoms caused by occlusive lesion in carotid artery underwent elective revascularization, 10 on the left carotid artery and 1 on the right. All patients received immunosuppressive treatment pre-and post-operation. Contraindications to open surgery included: ESR $>$40 mm/h; ipsilateral cerebral infarction of $<$2 weeks duration and sufficient poor health whereby the patient cannot tolerate general anesthesia. Quality of life was analyzed using the EQ-5D questionnaire before and after surgery.

Results: Patients were followed for a mean of 31.6±27.4 months. Seven cases of total occlusion and 2 cases of severe stenosis were recanalized successfully and experienced clinical remission. Recanalization failed in 2 patients, both of whom had occlusion of a long segment of the artery. Initial endovascularization comprised small diameter, low pressure dilatation only to allow time for the reopened arteries to respond. If clinically indicated, repeat angioplasty with a larger diameter balloon was performed 1-3 months later. Major complications occurred in 2 patients. Eight of the recanalized carotid arteries were patent at the end of follow-up and patients had satisfactory quality of life

Conclusions: In patients with Takayasu arteritis, carotid artery recanalization via endovascular surgery combined with immunosuppressive therapy is effective and can be performed safely and repeatedly. The improvement in carotid artery blood flow supplying the central nervous system relieves symptoms of cerebral ischemia and is associated with an improved quality of life.

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INTRODUCTION

Takayasu arteritis (TA) is a disease of unknown etiology that may result in significant morbidity and premature mortality in young patients.[1] The progressive stenosis or, especially, the occlusive pathological changes in the supra-aortic vessels that occur with TA can cause cerebral ischemia or infarction, visual disturbance, pulseless syndrome, and hypertension.[2] A delay in the diagnosis and treatment of TA, or failure of vascular intervention is likely to lead to poor patient outcomes.[3] Currently there is no appropriate standard therapy, although immunosuppressive drugs are the treatment of choice,[4,5] and previous reports have shown that surgical bypass can be performed safely and effectively to treat tissue ischemia. However, percutaneous transluminal angioplasty (PTA) offers a less invasive, more cost-

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effective, and safer method for the treatment of stenotic lesions in patients with TA.[3,6,7]

Steno-occlusive disease is the primary pathologic state of TA, especially in the left subclavian and carotid arteries, which if untreated may result in hemiplegia or death.[1–3] Traditional open surgical revascularization treatments have demonstrated excellent long-term durability for supra-aortic bypass procedures. But the techniques are more complex and associated with significant operative morbidity.[8–10] As PTA offers a minimally invasive option, techniques for stenotic lesions have undergone rapid development in recent years. However, PTA is rare in situations of total occlusion because of inability to cross the lesion with a wire. The risk of a range of serious complications including cerebral hemorrhage, embolism, hyperperfusion, and vascular trauma during revascularization of multiple arch vessels impairs adoption of the technique. There are only a few case reports of endovascular revascularization of carotid, brachiocephalic, and subclavian artery lesions in TA. The purpose of this study was to report the results of a series aiming to achieve palliation of cerebral symptoms by endovascular revascularization for complete occlusion of the carotid artery in high risk TA patients.

MATERIALS AND METHODS

The clinical records of 11 patients with TA who received endovascular revascularization by angioplasty between May 1, 2007 and March 30, 2013 were studied. Records included details of disease presentation, medical history, physical observations, diagnostic and laboratory test results, operative records, post-operative complications, and mortality. Complete follow up was defined as data obtained up to March 30, 2013.

TA was diagnosed according to criteria of the American College of Rheumatology.[11] All patients underwent cerebral, thoracic, and abdominal angiography to define the location and extent of the disease. Patients were divided into clinical types according to the Lupi-Herrera classification.

Endovascular revascularization was provided for all cerebral ischemia patients who were reluctant to undergo traditional open surgery or who were in a critical condition and could not meet the standard for open surgery. Contraindications for carotid artery revascularization were: ESR $>$40 mm/h; ipsilateral cerebral infarction $<$2 weeks duration; and a patient too acutely ill to tolerate general anesthesia. The revascularization procedure was considered successful if angiography showed patency in the carotid artery irrespective of the vessel caliber. Success was defined by improvement of the manifestations of cerebral ischemia, such as reduction of headache, improvement of vision, and disappearance of dizziness.

The major target vessel for revascularization was the carotid artery, which could be occluded in segments or throughout its length. Carotid artery patency was determined by the results of the last imaging study, including ultrasonic duplex imaging, computed tomography, or angiography. All patients were treated with glucocorticoid and antiplatelet drugs for at least 2 weeks before and after revascularization.[12] In addition, four patients received immunosuppressive therapy with cyclophosphamide or methotrexate.

Femoral artery access was obtained using standard catheterization techniques. During the procedure, 80 U/kg of heparin was administered with an additional 15U/kg of heparin per 1.5 hours. Angioplasty of the aortic arch was performed with multiple angiographic projections to determine the vestigial structure of the carotid artery. A 0.035-inch hydrophilic guide wire (Terumo, Japan) was slowly advanced over the ostium of the carotid artery assisted by a 4F VER catheter (Cordis Corporation, USA). Once adequate backup had been achieved, a 0.018 inch control wire (Boston Scientific, USA) was substituted to cross the occlusions. If the true lumen was recanalized, or the wire arrived at the carotid bifurcation, a 0.014 inch PILOT/150 floppy wire (Abbott Laboratories, USA) was used and fixed in the internal or external carotid artery. A 2–3.5 mm/120 mm Amphirion DEEP balloon (Invatec, Italy) was inflated to a nominal pressure for 3 minutes. Continued vessel stenosis was regarded as an indication for further balloon dilatation.

All patients were managed in the intensive care unit for overnight hemodynamic and neurological monitoring, and control of systolic blood pressure. Methylprednisolone and heparin were administered continuously by intravenous pump or through an indwelling carotid artery catheter for 48–72 hours. Activated coagulation time of whole blood was maintained between 50 and 60 seconds. The dose of corticosteroid was at first doubled, then returned to the pre-surgical level. If the fibrinogen level and platelet count were both higher than normal, low dose warfarin (INR 1.5–1.8) was given. Aspirin and clopidogrel were continued after successful intervention.

The study endpoints were death linked to TA, acute cerebral ischemia or life threatening cerebral hemorrhage, and recurrence of symptoms or clinical deterioration after surgery. Follow up clinical examinations were performed at 6 month intervals and life table analysis was used to assess the safety of the revascularization procedure. The EQ-5D questionnaire was used as an index for the analysis of health related quality of life. Scores before and 3–6 months after the procedure were recorded and analyzed by paired *t* test. The study received approval from the research ethics board of Xuanwu Hospital.

RESULTS

Patient characteristics

All patients were diagnosed with TA based on American College of Rheumatology criteria and included 10 females and one male with a median age of 28.9 $\pm$ 13.8 years (mean 23.5 years; range 12–58 years) (Table 1). Seven patients (64%) were admitted with hemiplegia, six cases on the right side and one on the left, and four (36%) were becoming comatose because of acute cerebral ischemia. All patients had suffered from symptoms such as headache,