Stent thrombosis is a major limitation of stent-assisted coiling, which is an effective method for treating wide-necked aneurysms. Although early in-stent thrombosis has been reported, very late stent thrombosis (VLST) (>1 year) has not been reported following implantation of a single self-expandable stent designed for coiling. Herein, the authors present a case of VLST that occurred 14 months after single stent implantation in a large paraclinoid aneurysm with an ultra-wide neck involving the parent artery circumferentially. This case indicates the need for establishing guidelines regarding the optimal duration of prophylactic antiplatelet therapy following stent-assisted coiling, which remains undefined in the neuroendovascular field.

Key Words: Aneurysm · Antiplatelet · Stent · Stent-assisted coiling · Very late stent thrombosis.

INTRODUCTION

Stent-assisted coiling is a safe and effective method for treating wide-necked aneurysms, but ischemic stroke related to stent thrombosis is a major potential drawback. All thromboses occur within one year after the initial procedure, very late stent thrombosis (VLST), which is defined as stent thrombosis occurring one year after implantation, following sole stent-assisted coiling has not been previously reported. Here, we report the first case of VLST, which occurred 14 months after a typical sole stent-assisted coiling procedure.

This case highlights the possible mechanism of VLST after single stent-assisted coiling and raises concerns about the duration of prophylactic antiplatelet therapy (APT).

CASE REPORT

History and procedure

A 56-year-old woman presented with subarachnoid hemorrhage from a ruptured aneurysm in the anterior communicating artery (AcoA) and an unruptured large aneurysm with a wide neck involving the parent artery circumferentially at the right paraclinoid internal carotid artery (ICA) (Fig. 1). The ruptured AcoA aneurysm was treated successfully by clipping. Endovascular coil embolization was performed for the paraclinoid
an aneurysm 4 weeks after clipping. Coiling was performed using a stent-assisted technique for wide neck remodeling. The patient received oral aspirin (300 mg/d) and clopidogrel (75 mg/d) for 7 days before the coiling procedure, which was performed using a transfemoral approach under full anticoagulation with intravenous heparin (activated clotting time >250 s). First, a closed-cell Enterprise stent (4.5×37 mm; Cordis, Miami Lakes, FL, USA) was navigated in the ICA and implanted across the wide neck of the aneurysm, and coiling then was performed using 19 bare platinum coils (Orbit; Cordis, Miami Lakes, FL, USA) via a SL-10 microcatheter (Boston Scientific, Natick, MA, USA), which was jailed outside the stent. The final angiogram showed near complete obliteration of the aneurysm with minimal neck remnant (Fig. 2A).

The patient had an uneventful postoperative course and was neurologically normal at the outpatient department follow-up. Furthermore, follow-up angiography performed at 12 months after the coiling procedure depicted no change in the small amount of residual filling of the aneurysmal neck and a well-preserved parent artery without any thrombosis or stenosis (Fig. 2B).

**Antiplatelet therapy**

The patient was maintained on dual antiplatelet therapy (APT) for 12 months after the initial treatment. We used 300 mg aspirin and 75 mg clopidogrel as the dual antiplatelet regimen for 4 weeks followed by 200 mg aspirin and 75 mg clopidogrel for 5 months and 100 mg aspirin and 75 mg clopidogrel for the remaining 6 months. After the 1-year follow-up angiographic evaluation, dual APT was switched to aspirin monotherapy.

**Very late thrombosis**

Two months after switching to aspirin monotherapy, the patient experienced transient ischemic attack symptoms. Computed tomography angiography revealed occlusion of the right ICA at the level of stent implantation. Diffusion weighted imaging taken for evaluating ischemic symptoms demonstrated multiple embolic infarctions in the right hemisphere (Fig. 3A). Digital subtraction angiography (DSA) revealed in-stent thrombosis extending from the cavernous ICA to the distal ICA (Fig. 3B). The patient admitted stopping her aspirin medication prior to a dental procedure conducted 3 days before the ischemic event.

**Management of thrombosis**

The patient was managed conservatively, because the potential risk of thrombus distal migration was considered to be high for interventional therapy. Clopidogrel 75 mg was added to aspirin 200 mg and low molecular heparin was administered for 10 days. A follow-up angiography showed completely resolution of the thrombosis with good flow through the parent artery (Fig. 3C). The patient was discharged neurologically intact on 200 mg aspirin and 75 mg clopidogrel.

**DISCUSSION**

Stent-assisted coiling is increasingly being used to treat aneurysms, but, although this is an effective and relatively safe technique, it has inherent problems such as thromboembolic complications and in-stent stenosis. The timing of stent thrombosis can be classified as acute (<24 h post procedure), early or subacute (24 h to 30 days post procedure), late (31 days to 1 year post procedure), or very late (>1 year post procedure). In-stent thrombosis within 1 year after stenting has been reported to occur at a rate of around 3% after stent-assisted coiling. However, no report has previously described VLST following implantation of a sole stent, which is self-expanding intracranial stent designed for coiling assistance. The mechanisms of VLST previously proposed are: progressive in-stent stenosis, premature discontinuation of dual APT, delayed atypical response to adjacent polyglycolic acid-loaded “bioactive” coils, spontaneous occlusion of the parent artery, stenting across major arterial side branches, stent mal-apposition, stent fracture, stent strut penetration of the necrotic core, disruption of vulnerable plaque near the stent, radiation therapy, and hypersensitiv-
A study is required to determine optimal APT regimens according to stent type, number, and aneurysm size, shape after stent-assisted coiling. Although VLST is extremely rare, it is a serious event with potentially devastating consequences. This case demonstrates that long-term APT and patient strict adherence are required to possibly prevent this complication when a large portion of the stent is anticipated to be unopposed to the vessel wall.

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