Complications Associated with Stenting for Cerebral Arteries

T. TERADA, M. TSUURA, H. MATSUMOTO, O. MASUO, H. YAMAGA,
T. TSUMOTO, T. ITAKURA

Department of Neurological Surgery, Wakayama Medical University

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Summary

We have experienced total 116 stenting for 102 of cranio-cephalic arteries and 14 of intracranial arteries including occlusive cerebrovascular diseases, aneurysms, and fistulas. Ten complications were encountered. Three were ischemic complication, four stent migration, two restenosis, and one aneurysmal perforation during coiling across the stent strut. The mechanism and preventive method of these complications were discussed in this paper.

Introduction

The chance to use stents as a primary or adjuvant treatment for ischemic cerebrovascular diseases or cerebral aneurysms is rapidly increasing^{1,4,5}. Stents are thought to be very effective to treat these diseases and brought new aspects for treating difficult aneurysms⁵ but there exist several complications related to stent deployment. We reviewed our complications related to stent deployment in our series and discussed about the treatment of these complications.

Material and Methods

Various types of stents were used for 102 cases of brachio-cephalic arteries and 14 cases of intracranial arteries. Except for stenotic lesions,

two cases of cervical internal carotid aneurysms, one case of carotid cavernous fistula, and three cases of cerebral aneurysms were included. We encountered total ten complications related to stent deployment. The mechanism and preventive method of these complications were discussed.

Results

Complications were classified into four groups as follows:

- 1) ischemic complication,
- 2) stent migration or slipping off,
- 3) restenosis,
- 4) other complications related to stents.

1) Ischemic complication: Three ischemic complications appeared after stenting. One was embolic complication during carotid stenting without cerebral protection. Major neurological deficit remained in this case. Two were acute stent thrombosis after stenting for intracranial stenotic or occlusive cerebral arteries. These two arteries were recanalized with thrombolytic therapy or repeated PTA. In one case minor neurological deficit remained in spite of recanalization.

2) Stent migration or slipping off: Two stents slipped off from the mounted balloon catheter. One was the coronary stent (AVE-GFX) and

Figure 1 A) Symptomatic left cavernous ICA 60% stenosis (arrow) was demonstrated in left carotid angiography (lateral view). B) A coronary stent (AVE-GFX) slipped off from the balloon catheter and migrated into the cavernous portion (arrows). C) The migrated stent was snared and retrieved from the sheath.

the other was Palmaz stent. These two stents were snared and retrieved via the transfemoral route (figure 1). Two stents migrated after deployment. One was the coronary stent which was used to cover the neck of the cerebral aneurysm. After the stent was deployed, it migrated to the distal part of the intracranial internal carotid artery. This stent was retrieved using a balloon catheter and a guide wire and repositioned and secured with further dilatation of the stent (figure 2). Another stent migrated due to the tangled protection catheter around the stent for the cervical internal carotid artery. In this case, the cervical internal carotid artery was surgically exposed and the stent was retrieved and endarterectomy was performed simultaneously.

3) *Restenosis*: Two restenosis were demonstrated. One appeared in the basilar artery and the other in the cervical ICA after stenting. Repeated PTA was performed and successful dilatation was obtained in both cases.

4) *Other complication*: An aneurysmal rupture occurred during coiling after stenting for the wide-necked MCA aneurysm. The microcatheter was fixed between the stent strut and the wall of the MCA. The introduced coil perforated the aneurysmal wall resulted in SAH. Additional coil embolization prevented from further bleeding.

Finally, permanent neurological deficit remained in two of ten cases. One resulted in major and the other was in minor neurological deficit.

Figure 2 A) Symptomatic left cavernous ICA aneurysm was demonstrated in left carotid angiography. B) A coronary stent (S-670, 3 x 12 mm) was deployed in the cavernous ICA across the neck of the aneurysm. C) The stent migrated distally, when balloon catheter was gently pushed. D) The migrated stent was demonstrated in the left carotid angiography.

Figure 2 E) The stent was retrieved and repositioned by gently pulling back the stent with the balloon inflated in the stent. F) The aneurysm was embolized using GDC coils via the stent strut.

Discussion

The mechanism and preventive method of these complications were discussed in each category.

1) *Ischemic complications:* Protection device must be used to prevent from embolic complication related to stenting for cervical internal carotid arterial stenosis^{1,4}. In fact, ischemic neurological deficit remarkably reduced after introduction of our original protective system for the cervical carotid stenting. There exists the higher chance of stent thrombosis² in intracranial artery (less than 3 mm) with severe stenosis or occlusion. Special care should be taken for the postprocedural anticoagulation therapy to prevent from stent thrombosis. A stent should be deployed to cover the entire lesion. Insufficient covering have a chance to cause stent thrombosis.

2) *Stent migration or slipping off:* We encountered two cases of stent migration. One was a Palmaz stent and the other was a coronary stent. It was very difficult to retrieve Palmaz stent, once it was extruded from the guiding catheter. If Palmaz stent was not deployed in the target lesion, it should be deployed in the

other appropriate artery. To prevent from this complication, a guiding catheter should be introduced distal portion of the stenosis and the guiding catheter was retrieved gradually after the stent was positioned in the appropriate position. However, this technique is used only for the subclavian artery or common carotid artery. For the internal carotid artery, this technique is not appropriate. In case of coronary stent migration, stent retrieval is possible by a snare wire (figure 1). The most important thing is the mounted stent should be monitored under the fluoroscopy when it was retrieved. Even a coronary stent, it sometimes slipped off from the balloon catheter, if the vessels were tortuous³. In case of cerebral aneurysms, it is necessary to cover the orifice of aneurysm and normal arteries. The deployed stent should be tightly secured to the parent artery, because the contact surface between the stent and the vessel wall is small and there is no stenosis in aneurysm cases (figure 2). Finally, special care should be taken during stent deployment not to pinch other catheters between the stent and the vascular wall.

3) *Restenosis:* Restenosis is inevitable if a stent is deployed in the vessels. Repeated PT A

is usually effective but not always. Recently, a special stent coated with drug to prevent restenosis is developed and demonstrates excellent results in coronary arteries⁷.

4) *Other complications:* In case of coil embolization after stent deployment across the neck of the aneurysm, coil introduction should be performed carefully to prevent from coil perforation, because the microcatheter is fixed between the stent strut and the vessel wall. Fur-

thermore, we must remember the hyperperfusion haemorrhage after PTA or stenting⁶. Fortunately, we did not have any case of hyperperfusion syndrome in stent group, although we have two cases of hyperperfusion in our PTA-treated group.

It is important to know the possible complications related to stenting for cerebral arteries to improve the outcome of the endovascular treatment.

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Tomoaki Terada, M.D.
Department of Neurological Surgery
Wakayama Medical University
811-1 Kimiidera, Wakayama city
Wakayama 641-0012, Japan
E-mail: teradato@wakayama-med.ac.jp