Clip Blade Scissoring With Titanium Bayonet Clip in Aneurysm Surgery
—Two Case Reports—

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Abstract

Scissoring of the cerebral aneurysm clip blades is a rare but potentially devastating complication of clipping surgery and results in aneurysm neck injury inducing rupture and/or cerebral infarction. Scissoring has been reported using titanium straight clips. Here we present two unusual cases of crossing of the blades of titanium bayonet clips by a scissors-like mechanism during surgery. The present cases suggest the following points. Bayonet clips in addition to straight clips may display the scissoring phenomenon during clipping surgery. The slipped clip should be removed immediately because the scissor-like deformed aneurysm clip may slip further and result in parent artery stenosis. Scissoring tends to happen in the presence of partial arteriosclerosis of the aneurysm neck. Before a titanium clip is used to treat an aneurysm with partially arteriosclerotic neck, reducing the amount of aneurysm filling by temporary clipping of the main vessel is useful to avoid slippage phenomena.

Key words: aneurysm clip, titanium, blade crossing, scissoring, slippage

Introduction

Modern aneurysm clips are made of titanium or titanium alloy, because titanium has a better weight-to-strength ratio than other materials, causes little or no artifact on computed tomography and magnetic resonance (MR) imaging, and exhibits bactericidal and non-allergenic properties.[1,3,4,5] However, the risk of intraoperative scissoring of aneurysm clips made of titanium was reported in patients with internal carotid artery (ICA)[6] and middle cerebral artery aneurysms.[2] Scissoring was also developed after sustained opening in experiments.[7] All aneurysm clips showing scissor-like deformation have been straight and relatively long.[2,6,7] Scissoring occurs due to twisting of the clip blades during clipping surgery
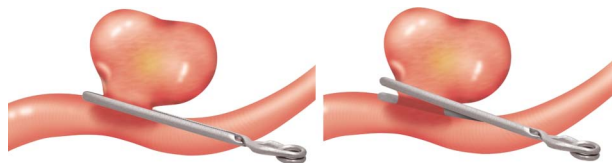

Fig. 1 Illustrations showing normal clip blades (*left*) and scissored clip blades (*right*) of a long straight clip.

(Fig. 1), and is an uncommon but potentially devastating complication. Here we describe two cases of aneurysm clip scissoring with a titanium bayonet clip.

Case Reports

Case 1: A 73-year-old woman presented with an unruptured aneurysm found incidentally on the left ICA. Cerebral angiography showed a 10-mm posterior communicating artery (PCoA) aneurysm (Fig. 2A). Intraoperatively, atherosclerosis was observed at the proximal neck of the aneurysm and the ICA. A Yasargil titanium bayonet clip (No. FT758T; Aesculap, Inc., Center Valley, Pennsylvania, USA) was applied to the aneurysm. After application of the clip, crossing of the clip blades occurred by a scissors-like mechanism (Fig. 3A, B). Another Yasargil titanium clip was applied nearby (No. FT750T; Aesculap, Inc.) for reinforcement, but the slipped clip was not removed because of the risk of aneurysm neck tearing. The patency of the PCoA was confirmed with Doppler flowmeter and endoscope examination.

Postoperatively, the patient suffered right upper extremity palsy. MR imaging at 3 hours after the surgery disclosed cerebral infarction in the right anterior thalamus and internal capsule supplied by perforating arteries of the PCoA (Fig. 2B). Immediate reoperation was performed. Intraoperatively, the slipped Yasargil bayonet clip was found to be further displaced, resulting in narrowing
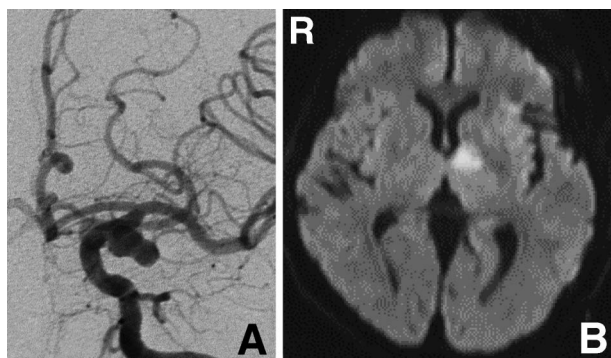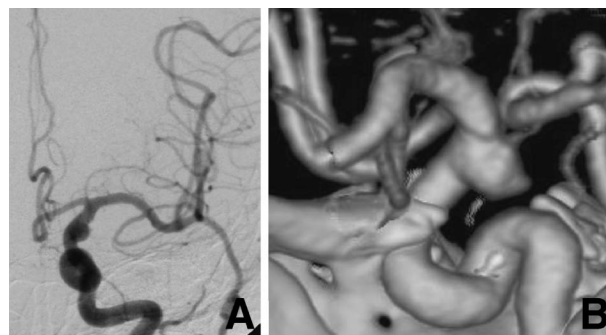
Fig. 2 Case 1. A: Left internal carotid angiogram, anteroposterior view, demonstrating a posterior communicating artery aneurysm. B: Postoperative diffusion-weighted image showing infarction in the left anterior thalamus and internal capsule.
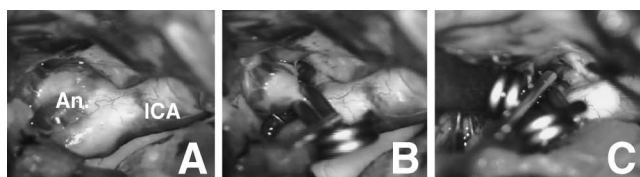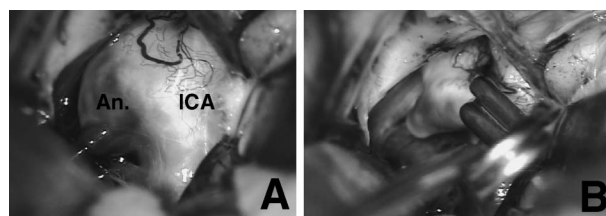

Fig. 3 Case 1. Intraoperative photographs at the first (A, B) and second surgery (C) revealing the posterior communicating artery (PCoA) aneurysm before (A) and after (B) clipping using a bayonet clip and stenosis of the PCoA (C). Note that the aneurysm (An.) has arteriosclerosis, especially in the proximal neck, and the clip blades are crossed by a scissors-like mechanism. ICA: internal carotid artery.

Fig. 4 Case 2. Left internal carotid angiogram, anteroposterior view (A), and three-dimensional computed tomography angiogram (B) showing a posterior communicating artery aneurysm (4 mm in size).

Fig. 5 Case 2. Intraoperative photographs showing the posterior communicating artery aneurysm before (A) and after (B) clip application. Note severe arteriosclerosis at the proximal, but not the distal neck, of the aneurysm (An.), and the clip blades are crossed. ICA: internal carotid artery.
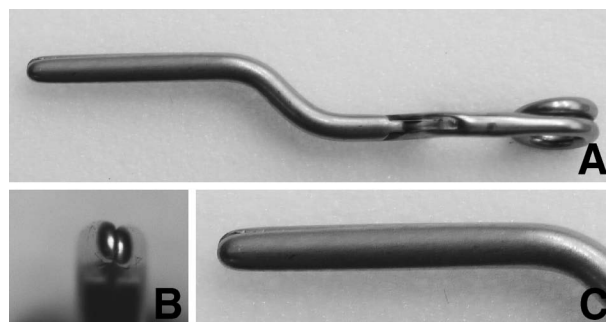
Fig. 6 Case 2. Photographs of the removed bayonet clip at lower (A) and high magnification (B, C) demonstrating slight dislocation of the clip blade tips after the crossing.

of the right PCoA (Fig. 3C). The slipped clip was removed carefully, and a mini clip (FT278D; Aesculap, Inc.) was applied at the neck of the aneurysm. The postoperative course was uneventful. Her right upper extremity palsy disappeared.

Case 2: A 78-year-old woman was incidentally discovered to have a left PCoA aneurysm (Fig. 4). Neck clipping of the aneurysm was performed through a left frontotemporal craniotomy. A wide neck aneurysm was exposed and atherosclerosis was found at the proximal neck of the aneurysm and the left ICA. A Yasargil titanium bayonet clip (No. FT758T) was used for obliteration of the aneurysm. Crossing of the clip blades occurred by a scissors-like mechanism (Fig. 5). The clip was removed because of the risk of aneurysm tearing or cerebral infarction. In an attempt to reduce the filling pressure of the aneurysm, the proximal ICA was temporarily occluded. Then the aneurysm was clipped completely using a Sugita bayonet clip (No. 07–934–14; Mizuho Co., Ltd., Tokyo). The removed clip blade tips were slightly dislocated (Fig. 6) and the closing force reduced to 1.75N (normal range from 1.81 to 2.11N). The postoperative course was uneventful. Complete obliteration of the left ICA aneurysm was confirmed. The patient recovered well and was discharged.

Discussion

Scissoring is a rare complication of clipping surgery and can injure the aneurysm neck, resulting in rupture and parent artery stenosis or occlusion. Scissoring may result from both inappropriate clip selection and application. Additionally, the aneurysm characteristics may be important, such as mural thrombus, calcification, broad neck, and large or giant aneurysm. In the present patients, atherosclerotic change was observed at the proximal, but

not distal, neck of the aneurysms in both cases, which might have caused increased blade gap, resulting in incremental slippage risk. Since scissoring tends to occur in the presence of partial arteriosclerosis of the aneurysm neck, severe arteriosclerotic neck should be preserved intentionally. ICA temporary occlusion was not applied during application of the Yasargil bayonet clips, so the force required for occlusion was probably large, and may also be responsible for clips that display translational movement.

In our first patient, the slipped clip was not removed immediately after application because of the risk of aneurysm tearing. However, the slipped clip caused cerebral infarction due to further dislocation, suggesting that the slipped clip should be removed as soon as possible, because the clip may slip further. In our second patient, the slipped clip was removed immediately because of the risk of aneurysm tearing or cerebral infarction. The proximal ICA was temporarily occluded before application of another clip, to reduce the filling pressure of the aneurysm. This procedure reduced the force required for occlusion, possibly avoiding slippage of the aneurysm clip.

The present cases suggest the following points. Bayonet clips in addition to straight clips may display the scissoring phenomenon during clipping surgery. The slipped clip should be removed immediately because the scissor-like deformed aneurysm clip may slip further and result in parent artery stenosis. Scissoring tends to happen in the presence of partial arteriosclerosis of the aneurysm neck. Before a titanium clip is used to treat an aneurysm with partially arteriosclerotic neck, reducing the amount of aneurysm filling by temporary clipping of the main vessel is useful to avoid slippage phenomena.

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