Falxuplication, a Novel Method for Wrap-Clipping a Fusiform Aneurysm: Technical Note

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BACKGROUND: **Various techniques have been used for wrap-clipping a ruptured, fusiform intracranial aneurysm; however, there is no available literature on use of the falx cerebri for wrap-clipping. We present a review of the literature, with an illustrative case, of a ruptured fusiform pericallosal artery aneurysm firmly attached to the lower edge of the falx cerebri and not amenable to endovascular intervention.**

METHODS: **Although the firm attachment between the inferior falx and the fusiform aneurysm was maintained, a section of the lower thinner part of the falx cerebri firmly attached to the aneurysm was dissected and wrapped around the fusiform aneurysm, and then stabilized with a fenestrated clip. We chose a segment slightly longer than the length of the fusiform aneurysm to avoid pre— and post—wrap-clipping stenosis.**

RESULTS: **Postprocedure, except for a small area of numbness on the left distal anterolateral left leg, the patient was neurologically intact and remained neurologically intact at a 12-month follow-up.**

CONCLUSIONS: **An inferior thin segment of the falx cerebri can be used for wrap-clipping of ruptured fusiform anterior cerebral artery aneurysms. Furthermore, the inferior falx can be wrapped around the attached fusiform anterior cerebral artery aneurysm without compromising flow, offering a safe solution in these unusually complex cases.**

INTRODUCTION

The overall prevalence of intracranial aneurysms is approximately 2%—3%,[1-3] with peak incidence during the sixth decade of life.[1] Different reports estimate the overall risk of aneurysmal rupture at 2—30/100,000 individuals per year.[2,4-6] As classified by morphology, intracranial aneurysms can be saccular, fusiform, or dissecting. Saccular aneurysms are the most common, accounting for 90% of cases and for most of the morbidity and mortality associated with aneurysmal subarachnoid hemorrhage (SAH).[7]

Fusiform aneurysms, the focus of this article, are the second most common type. They can be defined as a circumferential dilation of a segment of an intracranial artery lacking a defined orifice of flow, unlike saccular aneurysms.[7] Because the inflow and outflow are longitudinally separate in fusiform aneurysms, resulting in no clearly defined anatomic neck, surgical and endovascular interventions are challenging.[7] Without an anatomic neck akin to saccular aneurysms, fusiform aneurysms are not easily amenable to clipping or coiling. The reported prevalence is between 3% and 13% of all intracranial aneurysms and has increased in recent years.[8,9] Atherosclerotic fusiform aneurysms have a 5.2% annual mortality risk owing to rupture or ischemic stroke, compared with 0.51% for nonatherosclerotic fusiform aneurysms.[10] Fusiform aneurysm risk progression is also greater in atherosclerotic patients; the annual risk is 12% for atherosclerotic fusiform aneurysms versus 1.6% for nonatherosclerotic ones.[10] The same study demonstrated that atherosclerotic fusiform aneurysms are more likely to be located in the posterior circulation and of larger diameter, with a mean size of 11.6 mm versus 7.5 mm for nonatherosclerotic ones.[10] It has also been suggested that arterial dissection can lead to the formation of fusiform aneurysms.[11]

Key words
- Falx cerebri
- Falxuplication
- Fusiform aneurysm
- Wrap-clipping

Abbreviations and Acronyms
ACA: Anterior cerebral artery
CT: Computed tomography
SAH: Subarachnoid hemorrhage

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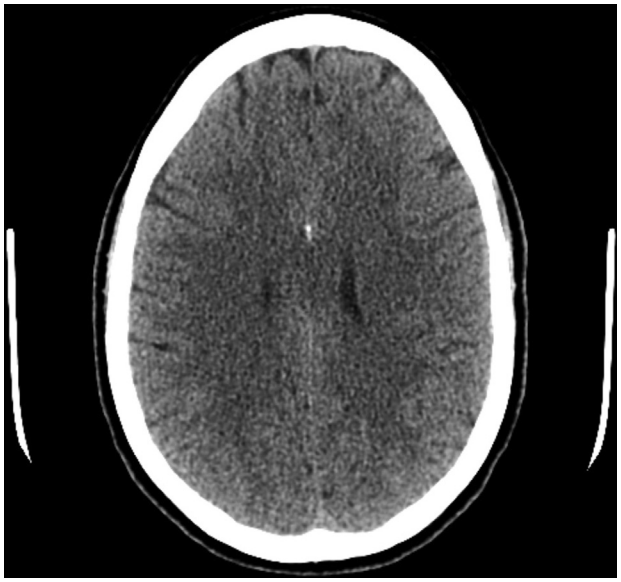

Figure 1. Preoperative noncontrast computed tomography scan of the head, axial view, showing suspicious subarachnoid hemorrhage.

Wrap-clipping for fusiform aneurysms has not been widely studied, but some cases have been reported in the literature. Reported materials for wrap-clipping have historically been non-autologous. In a case series of 22 patients with fusiform aneurysms, 7 were treated with wrap-clipping using either Bemsheet or periosteum.[9] There was 1 reported mortality and 1 case of contralateral intracranial hemorrhage. The remaining patients had fair outcomes or no follow-up. Another series of 48 patients with dolichoectatic or fusiform aneurysms reported wrap-clipping with Gore-Tex in 18 patients (45%).[12] There were no strokes or parent vessel stenoses in the patients who received wrap-clipping, but 2 patients (11%) experienced recurrent aneurysms, for which they underwent repeat wrap-clipping without recurrence for 2 subsequent years.[12] Another series of 40 patients with dolichoectatic and fusiform aneurysms in the anterior circulation reported wrap-clipping of 3 cases with muslin gauze.[13] Although the outcomes of these individual patients were not specified, patients with anterior circulation aneurysms appeared to have better outcomes than those with aneurysms in the posterior circulation.

Several cases of nontraumatic, distal anterior cerebral artery (ACA) intracranial aneurysms adherent to the falx cerebri have been reported in the literature. One such case involved a saccular aneurysm in which the dome was adherent to the falx but amenable to clipping.[14] Another larger case series of 117 patients with distal ACA aneurysms also described surgical clipping via an interhemispheric approach, with consequent sectioning of the falx; however, the specific number of adherent aneurysms, or any cases of wrap-clipping, were not reported.[15] Although dura mater has been used as an autologous wrap material for wrap-clipping of cerebral aneurysms, there are no reports in the literature of using the falx cerebri as a wrapping material to specifically wrap a distal fusiform ACA aneurysm attached to the falx, or any cases of wrap-clipping using the falx cerebri as an autologous wrap material for aneurysms at other locations. Here we report a novel method for treating a pericallosal artery aneurysm.

CLINICAL PRESENTATION

The patient, GCS 15 and Hunt & Hess 1, presented with severe headache classical for subarachnoid hemorrhage. She had a small area of light numbness for light touch in the anteromedial distal third of her left leg. A preoperative computed tomography (CT) scan showed hyperdensity suspicious for SAH in the interhemispheric fissue (**Figure 1**). CT angiography and cerebral

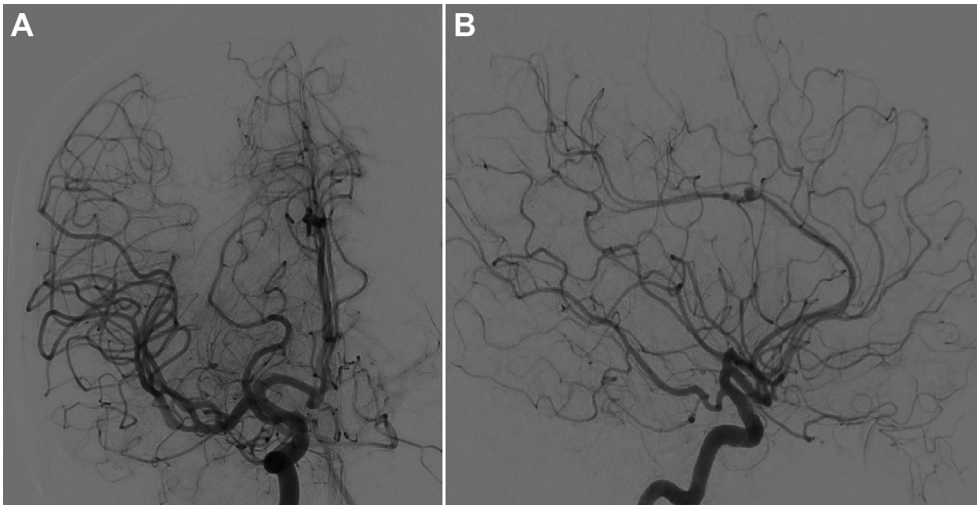

Figure 2. Preoperative digital subtraction angiography image showing a saccular aneurysm at the right pericallosal and callosomarginal artery bifurcation and a fusiform aneurysm at the pericallosal artery distal to the callosomarginal takeoff. (**A**) Anterioposterior (AP) view. (**B**) Lateral view.