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Nondissecting Vertebral Fusiform Aneurysm: Embolization Using Wire-Directed Detachable Balloons

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Summary: The authors report the embolization of an unruptured nondissecting vertebral fusiform aneurysm using a new silicone detachable balloon that they have developed, which is advanced without inflation over a guide wire.

Index terms: Arteries, vertebral; Aneurysm, therapeutic blockade; Catheters and catheterization, balloon

We developed a new silicone detechable balloon which is advanced over a guide wire (1). The balloon has two self-sealing valves: the proximal valve grips the catheter tip, and the distal valve allows a guide wire to pass smoothly through it, allowing accurate placement of the balloon independent of blood flow. The balloon is filled with isoosmotic contrast medium; we do not use any special filling materials.

We herein report a case of an unruptured nondissecting vertebral fusiform aneurysm that we directly and completely embolized by placing two balloons.

Case Report

A 56-year-old male bus driver complained of diplopia and dizziness. Selective angiography confirmed a fusiform and segmental dilatation and tortuosity of the left vertebral artery, measuring 10 × 12 × 26 mm distal to the posterior inferior cerebellar artery (PICA) (Fig. 1A). The origin of the anterior spinal artery was not visible on angiography. Computed tomography and magnetic resonance did not disclose intracranial hemorrhage or infarction, and there was no evidence of a dissecting aneurysm on computed tomography, magnetic resonance, or angiography.

A compression tolerance study using a nondetachable balloon catheter was performed prior to intravascular balloon embolization therapy. The balloon was inflated near the aneurysm distal to the PICA. Auditory brain stem response was normal. No neurologic changes occurred.

A wire-directed detachable balloon (Hanako Medical Co Ltd, Tokyo, Japan) with an inflated size of 0.3 mL (6.5 mm × 14 mm) was attached to a Tracker-18 catheter with 2.2-F outer diameter extended tip (Tracker-18 Vascular Access System; Target Therapeutics, San Jose, CA). We used a 0.016-inch Radifocus guide wire (Terumo Co Ltd, Tokyo, Japan), which was passed through the distal valve of the balloon. The system was passed through a 9-F outer diameter introducing a catheter that had been previously positioned in the proximal portion of the left vertebral artery.

The balloon was advanced to the distal portion to the PICA over the guide wire using essentially the same technique as standard catheter-guide wire manipulation, care being taken not withdraw the guide wire from the balloon. The guide wire was withdrawn and then the balloon was inflated and detached by traction on the catheter. However, immediately after detachment, the balloon migrated into the aneurysm by blood pressure (Fig. 1B).

Subsequently, we placed the second 0.3-mL balloon which was easily advanced over the guide wire into the remnant lumen of the aneurysm. The first balloon was pushed to the distal end of the aneurysm by inflating the second balloon, which occluded the remnant lumen of the aneurysm. The proximal part of the second detached balloon was sited below the aneurysm distal to the PICA. Postembolization digital subtraction angiography (DSA) confirmed successful obliteration of the aneurysm (Fig. 1C). The wire-directed method was very useful in placement of the second balloon as the first balloon had reduced the flow into the aneurysm, as shown on DSA (Fig. 1B).

The patient complained of occasional mild headaches for a week after treatment. Five months later, follow-up angiography confirmed the success of our treatment (Figs. 1D–1F), and his complaints had disappeared. No neurologic deficits have occurred. He has returned to his job of driving a bus and uses no medication.

Discussion

Nondissecting (atherosclerotic) fusiform aneurysms have been associated with compression and/or ischemia and, rarely, with rupture (2–7). Unclippable vertebral fusiform aneurysms have

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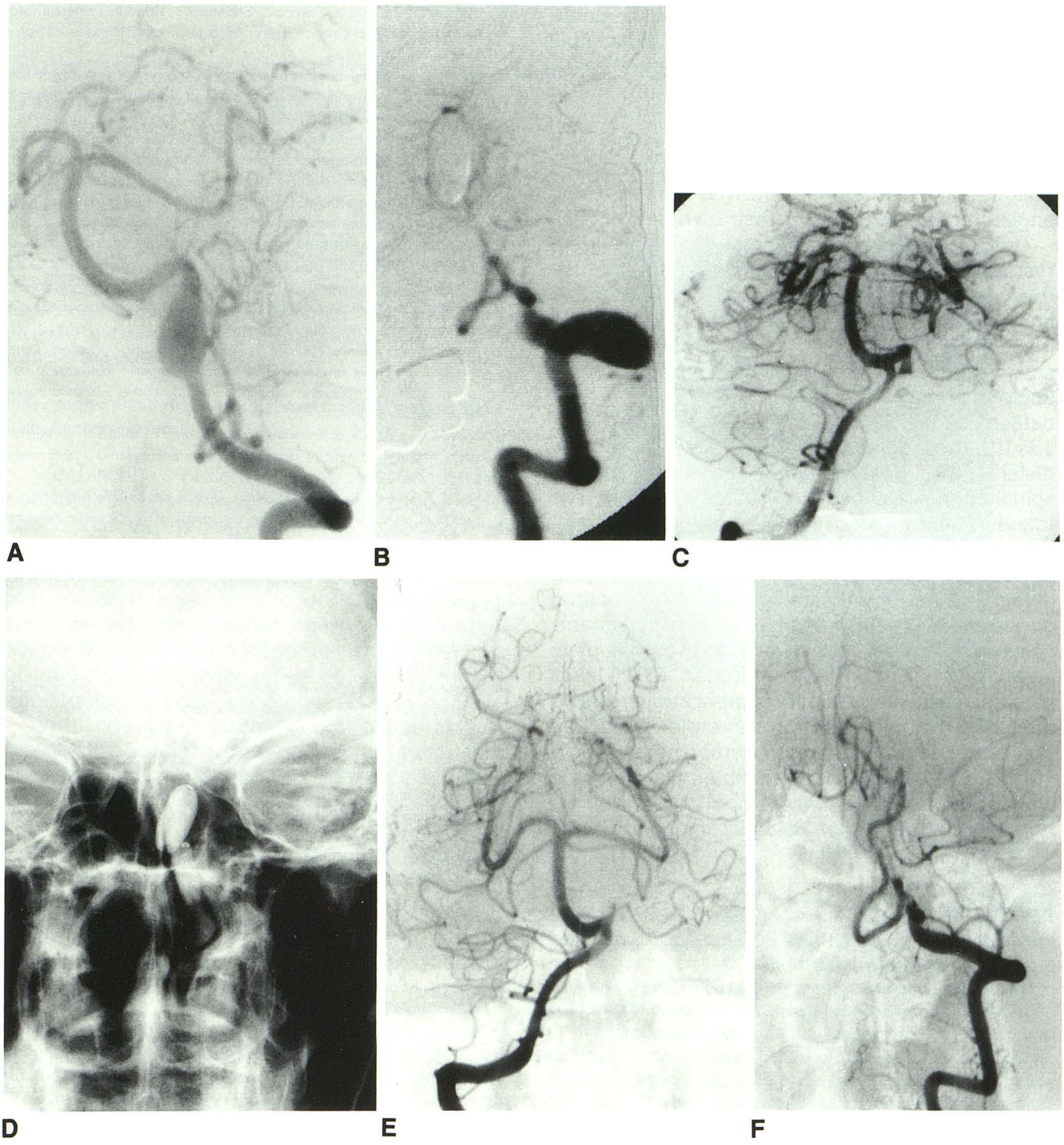

Fig. 1. *A*, Left vertebral arteriogram shows a vertebral fusiform aneurysm distal to the posterior inferior cerebellar artery.
B, DSA after the first balloon placement. Enhancement around the balloon within the aneurysm is observed.
C, Postembolization right vertebral arteriogram (DSA).
D, Five-month follow-up plain film.
E, Five-month follow-up right vertebral arteriogram.
F, Five-month follow-up left vertebral arteriogram.

been primarily treated by wrapping of the aneurysms, and by proximal clipping or detachable balloon occlusion of the vertebral artery (7–11). Echiverri et al reported a favorable outcome in the management of nondissecting fusiform aneurysms of the vertebrobasilar arterial system with anticoagulation therapy (2). Sugita et al reported obliteration of vertebral fusiform aneurysm using angled fenestrated clips of their own design (12).

Unlike saccular aneurysms or dissecting aneurysms, the risk of rupture of nondissecting fusiform aneurysm is low due to the diffusely thickened and stiff wall (2). It seems to allow balloon placement in the fusiform aneurysm. Needless to say, anatomical and pathologic exploration by angiography and a tolerance study using a nondetachable balloon catheter are important (8, 11, 13–15). In this case, the aneurysm was located distal to the PICA and the origin of the anterior spinal artery was not visible on angiography. The tolerance study was negative. Balloon embolotherapy of major cerebral vessels was first reported by Serbinenko (16). Our newly designed detachable balloon is advanced without inflation over a guide wire (1). We placed two detachable balloons in the fusiform aneurysm for complete embolization with no remnant lumen, which leads to recurrence of ischemic complications due to the turbulent flow and/or compression by dilatation of the aneurysm and/or hemorrhage (9, 17–19). The wire-directed detachable balloon would also seem to be useful for embolization with no remnant lumen of giant saccular aneurysm.

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