Coil Knotting during Endovascular Coil Embolization for Ruptured MCA Aneurysm

A Case Report

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Summary

Complications during coil embolization of cerebral aneurysms include thromboembolic events, hemorrhagic complications related to procedural aneurysmal rupture and parent vessel perforation, and coil-related complications. The present report describes a rare coil-related complication involving spontaneous coil knotting.

Introduction

The procedure of endovascular embolization of an intracranial aneurysm using detachable coils has rapidly evolved. The International Subarachnoid Aneurysm Trial (ISAT) study firmly established this procedure as an alternative management strategy in terms of effectiveness and safety¹. However, the procedure has associated morbidity and mortality risks²⁻⁴.

The present report describes a rare complication of coil knotting during endovascular coil embolization of a ruptured middle cerebral artery (MCA) aneurysm.

Case Report

A 47-year-old man was admitted with no detectable blood pressure and respiration. Urgent resuscitation was implemented, resulting in vital signs returning to a relatively stable state. However, the patient remained comatose. Brain CT

and CTA indicated diffuse subarachnoid hemorrhage (SAH) with brain swelling, and a left MCA aneurysm (Figure 1). Due to his poor condition, an early coil embolization for a ruptured aneurysm was performed. A 6F guiding catheter (Envoy; Cordis, Miami, FL) was placed in the left proximal internal carotid artery, after which a microcatheter (pre-shaped 90, Excelsior SL-10, Boston Scientific) was positioned on the aneurysmal sac. During repeated advance and retrieval of the first tentative frame coil (Nexus Morpheus 3D, 6 mm-20 cm coil), the coil became stuck and would not move under moderate force (Figure 2). We concluded that the coil was locked. The coil bundle was withdrawn using a microcatheter. A knot was observed in the removed coil (Figure 3).

A second coil embolization procedure was successfully undertaken. However, the patient subsequently died from brain swelling related to hypoxic brain damage.

Discussion

Theoretically, most intravascular interventional devices can become knotted or kinked. Johansson et Al first reported knotting of an intravascular device in 1954⁵. Other intravascular devices reported to have knotted include cardiac catheters, central venous infusion catheters, pulmonary artery flow-directed (Swan-Ganz) catheters, arteriography cath-

Figure 1 Initial brain CT (A-C) and CTA (D) scans showing diffuse SAH with brain swelling, and left a MCA saccular aneurysm.

ters, guidewires and pacemaker electrodes^{6,7}. Pulmonary artery catheters were responsible for more than two thirds of all reported intravascular device knots^{6,7}. Knotting is generally associated with thin-walled long and soft intravascular devices, which were placed without fluoroscopic guidance. In contrast, there do not appear to be any reports describing knotting of a detachable coil during coil embolization for

cerebral aneurysms under fluoroscopic guidance.

In the present case, resistance was noted during the advance of the first frame coil. Although the reason for coil knotting could not be determined, we suspect that spontaneous knotting occurred due to intra-aneurysmal coil friction and looping related to improper coil selection. The present patient was treated using a

Figure 2 Frontal (A) and lateral (B) road map views showing the undetached initial frame coil. At this stage, the coil was locked and could not be advanced or retracted.

bioactive coil (Nexus 3D coil, Micro Therapeutics, Irvine, CA), which is a platinum alloy coil laced with absorbable polymer fibers recently been introduced to improve aneurysm obliteration⁸. These bioactive coils are usually associated with increased coil-on-coil friction compared to bare coils. The relation between coil knotting and such increased coil friction has yet to be established.

Conclusions

Neuro-interventionists should be aware that coil knotting can occur during the coil embolization of cerebral aneurysms. Knotting may be avoided by ensuring the appropriate coil type is used depending upon the aneurysmal configuration, and by not continuing to push the coil when resistance is felt.

Figure 3 Gross (A) and microscopic (B) pictures showing the knotted coil bundle after removal.

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