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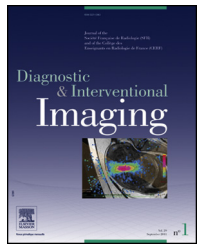

TECHNICAL NOTE /*Neuroradiology*

Retrieval of a dislocated coil and stent-assisted coiling by Solitaire® stent during endovascular treatment of an intracranial aneurysm

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Coil embolization is an effective and safe procedure for the treatment of intracranial aneurysms. It is known to produce good clinical outcomes and provide sufficient protection against recurrent bleeding [1—4]. In a systematic review, Brilstra et al. retrieved 19 (1.4%) re-bleeding episodes, 36 (2.6%) aneurysmal ruptures, 124 (9%) ischemic and 55 (4%) permanent complications in 1383 patients with ruptured and unruptured aneurysms treated with coil embolization. Complications occurring during coil embolization include rupture of aneurysm, arterial dissection, bleeding and microembolic complications. Coil dislocation is another rare complication of coil embolization which occurs in 2—6% of the procedures [3,5—7]. Thromboembolic complications during endovascular treatment could be caused by coil dislocation or thrombus formation in parent vessel because of vasospasm [2]. Dislocation can be fixed by retrieval of the coil from the aneurysm or placement of the coil back in the aneurysm [3,8]. Retrieval of a dislocated coil can be achieved by snares and stent retrievers.

We present herein a case where Solitaire® stent (Ev3, Irvine, CA, USA) was used for retrieval of a dislocated coil, which protruded into the proximal part of the internal carotid artery (ICA) during endovascular treatment and secondly for total aneurysm treatment by stent-assisted coiling technique in the same patient.

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Case report

An intracranial aneurysm was detected by magnetic resonance imaging (MRI), which was performed due to ptosis affecting the right eye in a 70-year-old woman who otherwise had normal laboratory and neurological examination results. Selective cerebral digital subtraction angiography (DSA) revealed a wide-necked aneurysm of 19 × 24 mm at the junction of right ICA and posterior communicating artery (PCOM) (Fig. 1A). Endovascular intervention was planned for treatment of this aneurysm.

Following the induction of general anesthesia, an 8F vascular sheath was inserted in the right common femoral artery, and systemic heparinization was performed with activated clotting time < 300 s. The right ICA was selectively catheterized and the aneurysm was evaluated. Then, hydrophilic 0.016″ microguidewire (Terumo) and Excelsior 1018 microcatheter (Stryker) were introduced into the aneurysm, and the embolization procedure was initiated using 3D Guglielmi detachable coil (Stryker) of 18 mm × 30 cm. Following the placement of the seventh coil with a size of 8 mm × 25 cm, it was detected that the coil protruded into the ICA. Therefore, Excelsior 1018 microcatheter was retrieved from the aneurysm with a 0.016″ microguidewire, and Prowler Select Plus microcatheter (Codman) was placed adjacent to the protruding coil using 0.016″ microguidewire (Fig. 1B). After three trials, the protruding coil was caught by the distal end and carefully retrieved from the ICA using Solitaire® stent of 4 mm × 20 mm which was introduced into Prowler Select Plus microcatheter (Figs. 1C, D and 2). Later on, Excelsior SL-10 microcatheter (Stryker) was placed back in the aneurysm with a hydrophilic 0.012″ microguidewire (Terumo), and the aneurysm neck was modeled by Solitaire® stent with the help of Prowler Select Plus microcatheter. Then, stent-assisted coiling technique was employed for total embolization with Target 360° (Stryker) coils of various sizes which were introduced into Excelsior SL-10 microcatheter (Fig. 1E). Control cerebral DSA showed that the aneurysm was totally occluded (Fig. 1F). No postoperative clinical deficit was experienced by the patient who had a good overall health status was discharged from the hospital the next day after the operation. Acetylsalicylic acid 300 mg per day for lifetime and clopidogrel 75 mg per day for 3 months were prescribed after endovascular treatment. There was neither aneurysmal recurrence or neurologic deficit after a follow-up of three months (Fig. 2D, E).

Discussion

Coil dislocation which may occur during endovascular treatment of intracranial aneurysms is a serious intraprocedural complication. A protruding coil, a stretched coil, a fractured coil or a dislocated coil create a thrombogenic focus inside the vessel. This thrombogenic focus may cause distal vascular embolism or vascular occlusion, which may end up with wide region infarction or death [7]. Therefore, such a coil requires urgent retrieval.

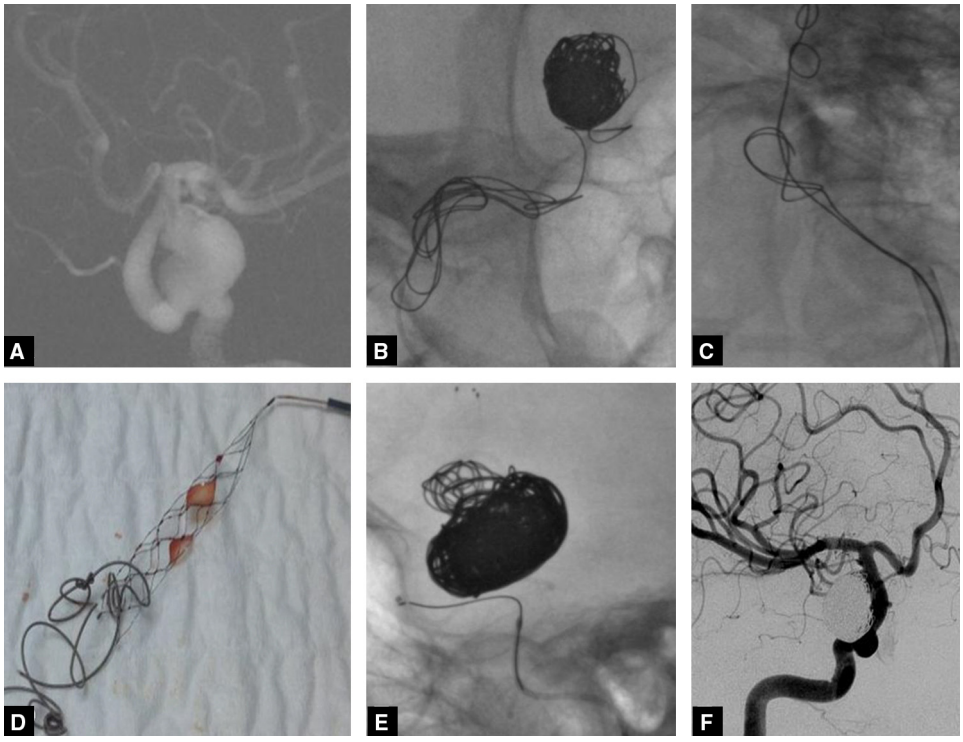

Figure 1. Cerebral digital subtraction angiography in lateral projection shows a wide-necked aneurysm at the junction of right internal carotid artery (ICA) and posterior communicating artery (PCOM) (A). Coil protrusion from the aneurysm into the ICA during coil embolization, and placement of Solitaire® stent (Ev3, Irvine, CA, USA) adjacent to the protruding coil with a microcatheter (B). Catching of the protruding coil by Solitaire® stent and removal from the guiding catheter (C). Image of the coil retrieved by Solitaire® stent. (D). Aneurysm neck modeling by Solitaire® stent and aneurysm embolization with coils of various sizes by stent-assisted coiling technique (E). Total occlusion of the aneurysm in the control angiography performed after coil embolization (F).

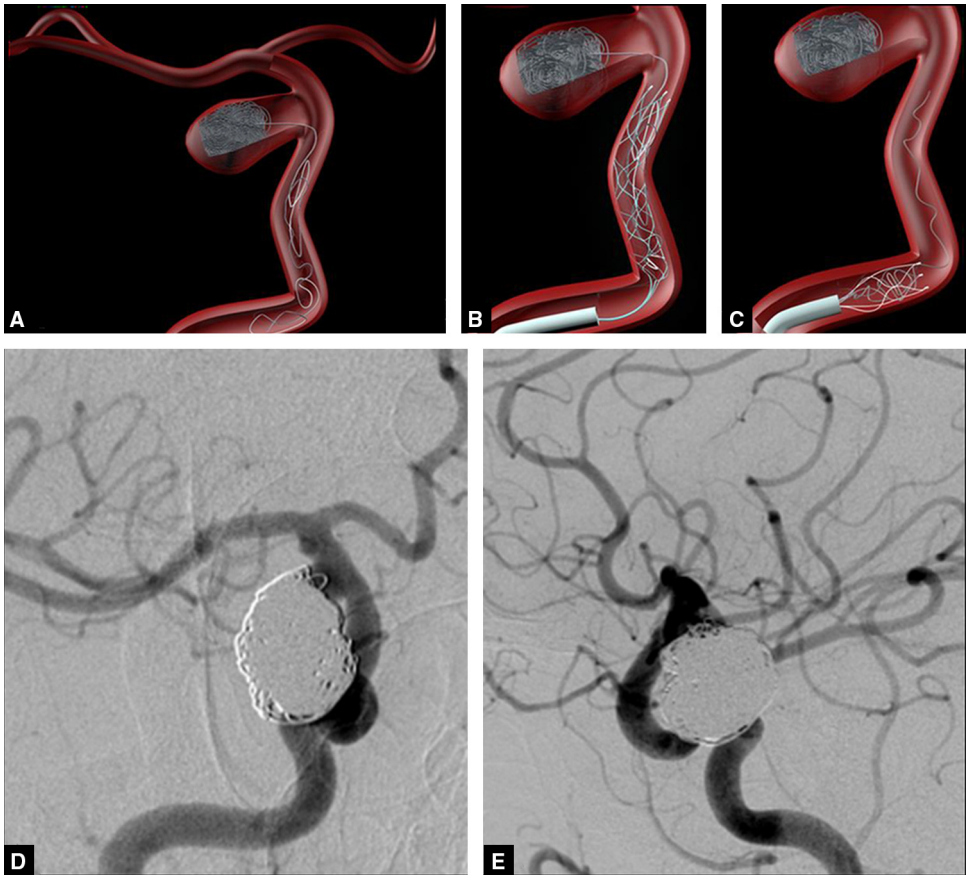

Figure 2. Schematic figures show catching of the protruding coil by the distal end with the help of Solitaire® stent and removal from the ICA (A—C). There was no aneurysmal recurrence at the 3rd month control images (D, E).

The risk of coil dislocation depends on anatomic and technical factors. Undersized and/or unstable long coils can dislocate especially in wide-neck aneurysms. Using balloon or stent assistance and deployment of new coils within a stable coil basket can decrease the risk [9].

There is no standard method for retrieval of dislocated coils [6,7,9]. Various endovascular methods for retrieval of dislocated coils have been reported in a limited number of cases [6]. Wire techniques, snares, retriever devices and stent retrievers are the main endovascular methods employed for dislocated coil retrieval. Microsurgery or stent placement in the dislocated free end of the coil may also be an option for retrieval of dislocated coils wherever the above mentioned endovascular methods are inaccessible [7].

Wire techniques have also been reported for retrieval of dislocated coils [7]. Standard et al. [10] employed two Dasher 10 wires (Target Therapeutics) and dual guidewire technique for retrieval of an unraveled coil during endovascular coiling of a ruptured anterior inferior cerebellar arterial aneurysm. Lee [1] reported the use of wires in the form of snares. Watanabe et al. [11] used snare catheter Retriever-18 (Target Therapeutics) for retrieval of a dislocated coil protruding into basilar artery from superior cerebellar arterial aneurysm with a size of $5 \times 4 \times 3$ mm. In addition to the above mentioned methods, Goose Neck microsnare (Microvena Corp.) can also be used during endovascular embolization of intracranial aneurysms of various sizes and locations [12]. Microsnares can be an option for retrieval of dislocated coils in many cases; however, the difficulty for catching the protruding end of the coil and manipulation-induced vascular spasms may pose a problem [8].

Various retriever devices may be employed for retrieval of dislocated coils during endovascular embolization of intracranial aneurysms. Vora et al. [13] used L5 MERCI retriever (Concentric Medical) and O'Hare et al. [14] used X6 MERCI retriever (Concentric Medical). Among these devices, MERCI retriever is an FDA approved device originally designed for mechanic thrombectomy. It can also be used for retrieval of intravascular foreign bodies [13,14].

Hopf-Jensen et al. [3] and O'Hare et al. [8] successfully used Solitaire® stent for retrieval of dislocated coils during coil embolization. In their series of 14 cases, Leslie-Mazwi et al. [9] used either Solitaire® stent or Catch Plus (Balt Extrusion) for retrieval of dislocated coils detected during embolization of aneurysms of various sizes and localizations. Similarly, Liu et al. [6] reported the use of Trevo stentriever (Concentric Medical) for recovery of malpositioned coils.

Solitaire® stent, a stentriever, was originally designed as a retrievable stent [8]. One of its areas of use is mechanic thrombectomy [3]. Although it was not originally designed for coil recovery, it was proved to be effective in retrieval of dislocated coils [6]. Large cell retriever properties and electrolyte detachment design are important advantages of Solitaire® stent [15]. Given several application capabilities by these properties; potential complications can be

prevented and the circulation can be maintained by fully applying the stent and entrapping the dislocated coil at the vessel wall.

Therefore, in our patient, we used Solitaire® stent firstly for retrieval of a dislocated coil protruding from the aneurysm into the proximal part of the ICA and secondly for total aneurysm embolization by stent-assisted coiling technique. Use of Solitaire® stent for the purpose of coil recovery has been reported in the literature. However, to the best of our knowledge, this is the first case where the same Solitaire® stent was used both for dislocated coil recovery and aneurysm embolization by stent-assisted coiling technique in the same patient.

Disclosure of interest

The authors declare that they have no competing interest.

References

[1] Lee CY. Use of wire as a snare for endovascular retrieval of displaced or stretched coils: rescue from a technical complication. Neuroradiology 2011;53:31—5.
[2] Van Rooij WJ, Sluzewski M, Beute GN, Nijssen PC. Procedural complications of coiling of ruptured intracranial aneurysms: incidence and risk factors in a consecutive series of 681 patients. AJNR Am J Neuroradiol 2006;27:1498—501.
[3] Hopf-Jensen S, Hensler HM, Preiss M, Müller-Hülsbeck S. Solitaire® stent for endovascular coil retrieval. J Clin Neurosci 2013;20:884—6.
[4] Brilstra EH, Rinkel GJ, van der Graaf Y, van Rooij WJ, Algra A. Treatment of intracranial aneurysms by embolization with coils: a systematic review. Stroke 1999;30:470—6.
[5] Park HK, Horowitz M, Jungreis C, Genevro J, Koebbe C, Levy E, et al. Periprocedural morbidity and mortality associated with endovascular treatment of intracranial aneurysms. AJNR Am J Neuroradiol 2005;26:506—14.
[6] Liu KC, Ding D, Starke RM, Geraghty SR, Jensen ME. Intraprocedural retrieval of migrated coils during endovascular aneurysm treatment with the Trevo Stentriever device. J Clin Neurosci 2014;21:503—6.
[7] Ding D, Liu KC. Management strategies for intraprocedural coil migration during endovascular treatment of intracranial aneurysms. J Neurointerv Surg 2014;6:428—31.
[8] O'Hare AM, Rogopoulos AM, Stracke PC, Chapot RG. Retrieval of displaced coil using a Solitaire® stent. Clin Neuroradiol 2010;20:251—4.
[9] Leslie-Mazwi TM, Heddier M, Nordmeyer H, Stauder M, Velasco A, Mosimann PJ, et al. Stent retriever use for retrieval of displaced microcoils: a consecutive case series. AJNR Am J Neuroradiol 2013;34:1996—9.
[10] Standard SC, Chavis TD, Wakhloo AK, Ahuja A, Guterman LR, Hopkins LN. Retrieval of a Guglielmi detachable coil after unraveling and fracture: case report and experimental results. Neurosurgery 1994;35:994—9.
[11] Watanabe A, Hirano K, Mizukawa K, Kamada M, Okamura H, Suzuki Y, et al. Retrieval of a migrated detachable coil: case report. Neurol Med Chir 1995;35:247—50.
[12] Koseoglu K, Parildar M, Oran I, Memis A. Retrieval of intravascular foreign bodies with goose neck snare. Eur J Radiol 2004;49:281—5.
[13] Vora N, Thomas A, Germanwala A, Jovin T, Horowitz M. Retrieval of a displaced detachable coil and intracranial stent with an L5 Merci Retriever during endovascular embolization of an intracranial aneurysm. J Neuroimaging 2008;18:81—4.
[14] O'Hare A, Brennan P, Thornton J. Retrieval of a migrated coil using an X6 MERCI device. Interv Neuroradiol 2009;15:99—102.
[15] Rahal JP, Dandamudi VS, Safain MG, Malek AM. Double waffle-cone technique using twin Solitaire detachable stents for treatment of an ultra-wide necked aneurysm. J Clin Neurosci 2014;21:1019—23.