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Particular management strategy for intraprocedural coil migration during endovascular treatment of intracranial aneurysm

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ABSTRACT

Migration of coils represents one of the most challenging complications of endovascular management of cerebral aneurysms with a potentially catastrophic result. In this article, we present the successful management of a coil migration during the endovascular occlusion of an anterior communicating artery aneurysm. A stent fixation technique was used with good vascular repermeabilisation. The reported frequency, risk factors and management strategies are also discussed.

INTRODUCTION

Cerebral aneurysms occlusion by endovascular coiling is considered the main treatment in most neurosurgical centres in the world. With this evolution of treatment, numerous studies have reported coil migration as significant intraprocedural complication which can lead to catastrophic neurological consequences without proper management. The reported rates of coil migration that range from 2% to 6% have not significantly changed over time. However, the outcome of patients with this complication has been greatly improved as a result of development of different techniques and devices for retrieval or repositioning of the migrated coils. In this paper we present a particular management strategy for correction of a distal coil migration in a patient undergoing endovascular coil embolization of an anterior communicating artery aneurysm. We also summarize the current literature describing the management of intraprocedural coil migration [2,4].

CASE PRESENTATION

A 44-year-old man addressed to emergency department from a local hospital for severe headache started in the same day. A head CT-scan investigation was performed immediately and showed a mild subarachnoid haemorrhage in the interhemispheric fissure and both

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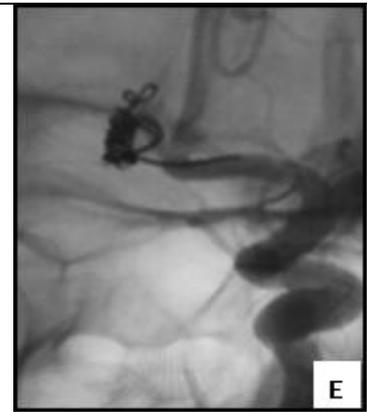
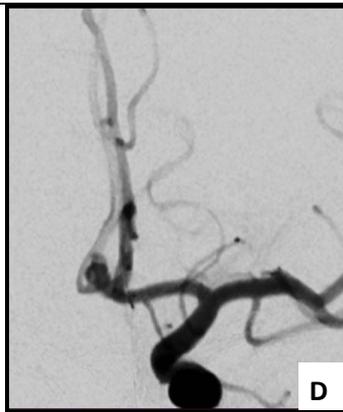
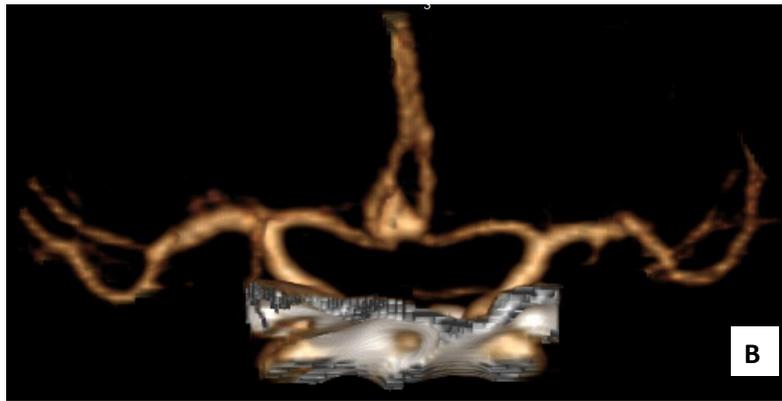
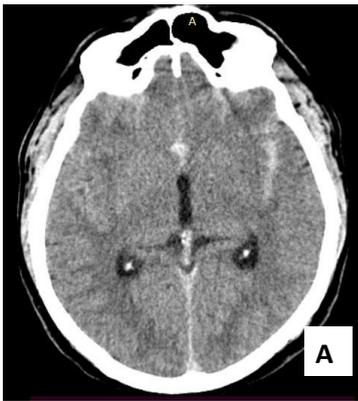
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Sylvian fissures. The CT angiography demonstrated an anterior communicating artery aneurysm as source of hemorrhage. The patient was immediately transferred to our hospital for further treatment. At admission he was confused and presented mild nuchal rigidity. His past medical history included hypertension with no regular treatment. The patient was scheduled for an endovascular aneurysm occlusion for the next day. A written informed consent was obtained prior to the treatment from the family.

The intervention was performed on a biplane angiography system (INFINIX, Toshiba, Canon Medical System) under general anesthesia by our neurosurgical team with many years of experience in neuroendovascular interventions. Femoral artery access was established with a 6 F/11 cm sheath from Merit Medical. Different angled cerebral angiography was performed to clarify the relationship of aneurysm / neck / arterial branches. The aneurysm was injected from both carotid artery but with a better visualisation from the left side injection.



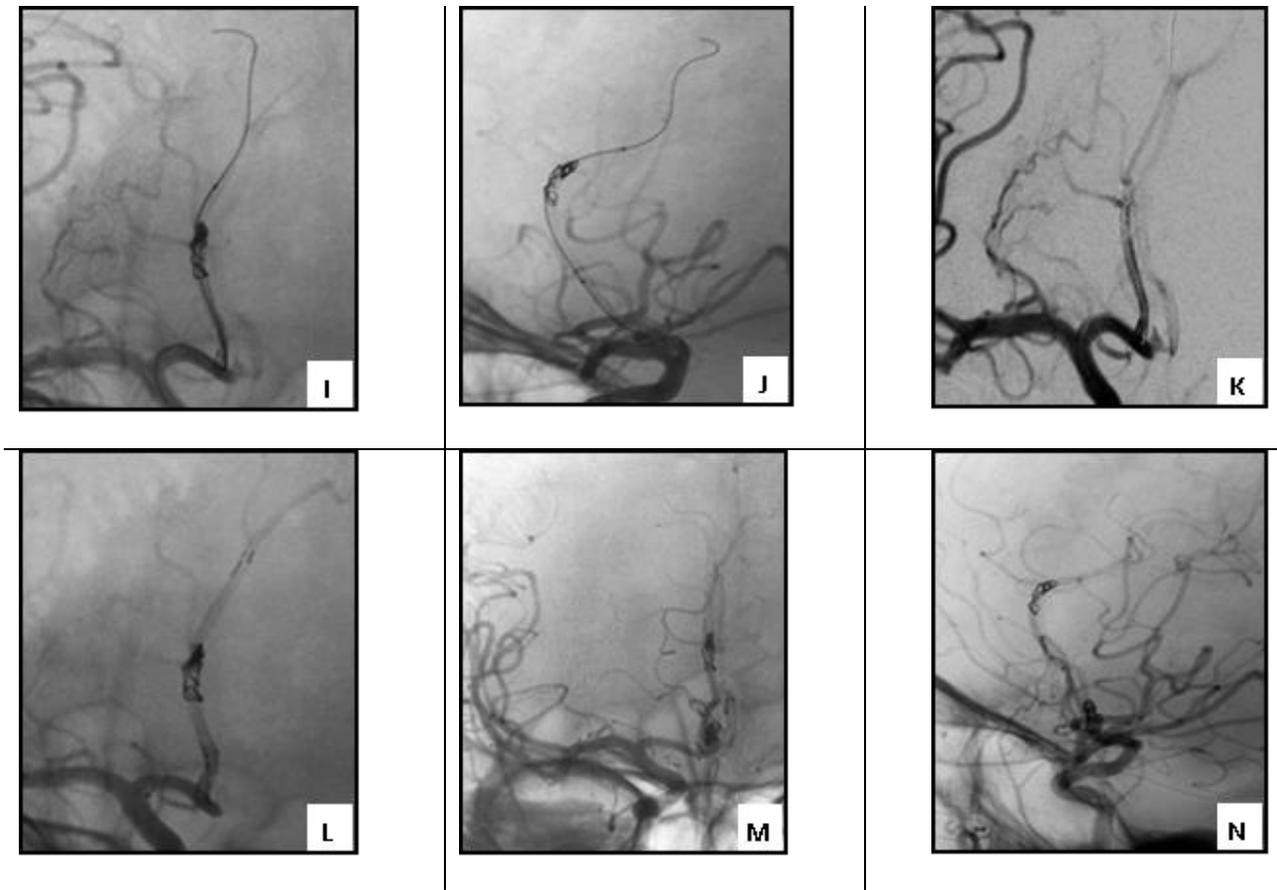


Fig. A. Diagnostic head CT; - **B** – Brain Angio-CT showing a CoA aneurysm; **C, D** – DSA right and left ICA demonstrating a CoA aneurysm; **E** – Partially coil migration to right A2; - **F, G** – Frontal and lateral view with attempt of coil retrieval; - **H** – DSA image with distal coil migration and arterial occlusion; - **I, J** – Microguide and microcatheter passing the coil; **K** – DSA image showing slightly right A2 repermeabilisation; - **L** DSA showing total right A2 repermeabilization by coil fixation with a detachable intracranial stent; **M, N** Frontal and lateral view demonstrating adequate coils occlusion of the aneurysm.

A 6F Chaperon guiding catheters (Microvention) was carefully advanced over 0.035 guidewire up to the proximal segment of the left internal carotid artery. A Prowler 10 microcatheter (Codman J&J) was then very carefully advanced over a 0.014 Transed microwire (Boston Scientific) and positioned into the aneurysm sac. One 4/8 mm GALAXY G3™ XSFT coils (Cerenovus Johnson&Johnson) was then inserted and detached into aneurysm. At the beginning of the introduction of the second coil 3/4, the tip of the microcatheter descended to the aneurysm neck. As soon as it was detached, the flow carried a part of the coil from the aneurysm to A2 segment of the right anterior cerebral artery. The next contrast injection demonstrates thrombosis of the right A2 without flow distal to the migrated coil. The right A2 was then catheterized through the left A1 with an Excelsior 10 microcatheter. The microcatheter was advanced proximal to the migrated coil, and 5 ml Heparin

solution was infused. The microcatheter was passed carefully distal to the coil, and a 3/30 mm Atlas 2 stent (Stryker) was deployed and successfully fixed and stabilized the migrated coil. The following injection demonstrates a good repermeabilisation of the right A2 segment. A new aneurysm microcatheterization with a Prowler 10 microcatheter was obtained. A complete angiographic occlusion of the aneurysm was obtained after the safe insertion and detachment of other two coils (2/ 8 mm GALAXY G3™ XSFT and 1.5/ 4 mm GALAXY G3 Mini). The microcatheter is then carefully retracted and a DSA acquisition is performed to check the permeability of all vessels. Finally, the entire guiding system is retracted with a compressive dressing of the femoral puncture site. The patient was placed into intensive care and received 75mg clopidogrel and 100mg aspirin daily. Postoperatively the patient remains neurologically

intact. A cerebral CT scan was performed 7 days postoperatively and showed the total SAH resorption. The patient was discharged home after 17 days of hospitalisation in good neurological condition.

DISCUSSION

With the increasing use of spiral embolization techniques, the migration of these removable implants during endovascular embolization of intracranial aneurysms has become a potentially serious intraprocedural complication. The phenomenon of prominence and / or migration of a coil can most often manifest itself on the circulatory hemodynamics at the level of arterial vascularization by creating a thrombogenic nidus that can have an occlusive or embolic effect. Occlusions of the major parent artery or distal vessels branches may result in a large territory infarct with sever neurological consequences.

Even if coil migration is not a common occurrence the incidence reported in the literature varied between 0.5–6% [1,2,3]. One of the largest retrospective studies on 1811 patients demonstrated an incidence of coil migration phenomenon of 2,5% [2,3,4]. Higher incidences of this phenomenon have been reported in early studies (Casasco et al, 5.6%) compared to more recent studies (Abdalkader et al, 0.3%). This discrepancy in reported rates it could be in part related to use of the term 'coil migration' in literature for different related situation like coil malpositioning, partial coil stretching, partial prolapse, and total displacement of coils from the aneurysmal cavity. On the other hand, the continuous development of coils and embolization techniques has led to a decrease in the complication rate due to the migration phenomenon[3,5].

Coil migration could be classified depending on the time of detection in acute intraprocedural or delayed postprocedural migration (after completing the coiling procedure).

A number of factors such as anatomical, flow and techniques have so far been described as being responsible for coil migration in the treatment of cerebral aneurysms. There have been reports that have shown a direct relationship between the increased risk of coil migration and the increased width of the aneurysm neck, the presence of vascular conditions and high flow conditions [2,3]. From a

technical point of view the unstable configuration, the early detachment and the oversized/undersized use of the coils are the main factors for the migration of the coils.

Coil migration management can vary depending on the migration time (acute or delayed), the location of the migrated coil (proximal or distal) and the permeability of the target vessel and the eloquence of the vascular territory. Thus, endovascular retrieval or fixation techniques, surgical extraction and conservative treatment have been described as management methods in coil migration. Migrated coil retrieval methods should be considered when the migration occurs intraprocedurally and may include stent retrievers, Snaring, Alligator, and Merci devices, aspiration and wire recanalization techniques. The fixation technique by deploying a stent across the migrated coil to restore the arterial flow may be applied in cases in which coil displacement occurs in tortuous and distal intracranial vessels or unsuccessful coil retrieval. The open surgical option must be carefully considered due to its complexity, extremely high risk of morbidity which usually outweighs the potential benefits.

Conservative medical management with antiplatelets and/or anticoagulation should be the first option when the migrated coil is too distal to safely pursue, or there is no associated vessel occlusion and as a possible option following unsuccessful attempts at recovery.

CONCLUSIONS

Coil migration during cerebral aneurism endovascular treatment it can have a devastating course in the absence of proper management. Even if no “gold standard” method has been identified for retrieval or repositioning migrated coils, several techniques and devices have proven effective in managing this type of complication. The management of our case demonstrates that stent fixation of a distal migrated coil can be used successfully to rescue patients with this potentially devastating complication.

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