Coil Migration to the Pulmonary Artery during Endovascular Embolization Treatment in a Patient with Arteriovenous Malformation in the Right Ear

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Abstract

Coils are typically utilized as one of the most popular embolization agents. Coil migration to the pulmonary artery rarely occurs and is associated with a high tendency of severe pulmonary or cardiovascular complications. We herein present a 25-year-old man with arteriovenous malformations in the right ear. Two coils 4-mm in diameter and 3-mm in length migrated to the pulmonary artery during embolization. No further damage related to the coil migration was found during a 2-year follow-up period. In addition, the possible mechanisms of coil migration are discussed.

Key words: arteriovenous malformations, coils migration

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Introduction

Arteriovenous malformations (AVMs) of the face and neck present one of the most formidable challenges in the fields of plastic surgery, neurosurgery and interventional radiology. These high-flow vascular malformations can cause tremendous cosmetic, functional and psychological problems. More importantly, these lesions can be life-threatening. The management of these relentless lesions mandates a comprehensive team approach (1, 2).

Interventional radiological procedures are preferred over surgery due to being less invasive and having a high success rate in the long-term follow-up. Coils, including stainless steel coils, platinum coils or detachable coils, are typically used as one of the most common embolization agents to embolize the AVMs alone, to embolize the expanded tortuous reflux veins or to eliminate the AVMs combined with absolute ethanol or other embolization agents (3).

Although the risks of coil migration or nontarget embolization into the venous system or pulmonary artery are considered when treating these lesions, coil migration is rarely observed at the time of coil placement during the procedure. In this report, we described a case in which coil migration was observed in the pulmonary artery during embolization and the 2-year follow-up.

Case Report

A 25-year-old man was referred to our hospital and presented with a red, pulsating mass and severe bleeding in the right ear. Transarterial angiography demonstrated an AVM in the right ear characterized with expanded tortuous reflux veins (Fig. 1). After a thorough angiographic evaluation, we planned to reduce the vein outflow by reflux vein embolization with platinum coils through a direct puncture, followed by absolute ethanol embolization through either transarterial or the direct puncture approach. The venous pouch was directly punctured with a 16 G needle (Lichtwitz antrum needle, MEDICON, Tuttingen, Germany). Once the position of the needle into the venous pouch was verified on the direct venogram, the core needle was removed and a 2.2F microcatheter was induced through the needle. With the guidance of a guide wire, the microcatheter was induced as close as possible to the exit of the dilated outflow vein. Then, 0.018 mm NEST coils (Cook, Bloomington, USA) were released through the 2.2F microcatheter. The first coil, 4-mm in diameter and 3-mm in length, was released and settled at the venous sac close to the fistula (Fig. 2). However, rapid migration of the second released 0.018 mm NEST coil via the

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Figure 1. Arteriography demonstrated that the AVM in the right ear was characterized with expanded tortuous reflux veins (arrow).

Figure 2. The first released coil settled at the venous sac close to the fistula (arrow).

Figure 3. An X-ray showed that two coils had migrated to the pulmonary artery (arrows).

Figure 4. The venous pouch was blocked with 0.018 mm electrolytically detachable coils (68 cm in length) combined with 0.018 mm NEST coils (arrow). The AVMs were effectively controlled after 6 procedures of ethanol embolization.

To maximize the chance for the long-term occlusion of an arteriovenous fistula, it is generally recommended to treat...
either the fistula directly with an embolization agent or to treat both the nidus of the lesion and the reflux venous segment. Although many agents have been utilized in the available literature, we restricted ourselves to report on the complication of dislocated coils into the pulmonary artery and their potential consequences on the pulmonary vasculature.

The risk of ectopic embolization with coils, including the detachable coils, ranges from 0.7 to 4% (4, 5). The cases of high-flow malformations in the dominant outflow vein have an even higher risk of embolization. The cause of this migration may be due to a size mismatch between the embolized coils and the caliber of the reflux venous sac. The size of the first coil or the first several coils is typically very difficult to choose. The size of the first chosen released coil should be a little larger than the diameter of the outflow vein. Outflow vein ligation may also be used to avoid coil migration from the venous sac. Currently, electrolytically detachable coils are more frequently utilized to release previously free coils to avoid such complications.

Another possible mechanism is that the reflux venous expansion may be due to an increased blood pressure because of the partial block of the outflow vein. In most cases, the coils migrated to a local nontarget structure and no further treatment was required (6-9). It has been rarely reported that the coils migrated to the pulmonary artery (7, 9). A cardiopulmonary collapse caused by pulmonary artery embolization is the most severe complication and is irreversible. In this situation, a special instrument, such as the Amplatz GooseNeck Snare (eV3, Irvine, USA), is required to retrieve the ectopic embolized coils (10).

Fortunately, no further damage related to the coils migration was found in the present study. One main reason for the migration may be that the size of the coils was not large enough to block the main trunk of the pulmonary artery, thereby allowing most of the pulmonary function to be preserved at a very good level, as previously describe by Bankier et al. (11). Another possible reason may be because the patient is young and the compensatory ability of his organs is considerably good. Thus, a longer follow-up period is necessary to detect the potential damages.

Because no cardiopulmonary parameter changes occurred, we continued embolization with close observation following the advice of an anesthetist. Despite not conducting pulmonary angiography on the present case, we fully believe that pulmonary angiography is the best method to evaluate the content of embolization of the pulmonary artery during the embolization procedure and should be applied immediately after the migration of the coil. Furthermore, careful attention must be taken to avoid thrombus formation, especially if the migration of larger coils occurs.

The introduction of detachable coils combined with feeding artery embolization and/or temporary balloon obstruction of the reflux vein can reduce the incidence of coil migration to the pulmonary artery to some extent (12, 13). The present case occurred before we could introduce electrolytically detachable coils. Therefore, using coils of the correct size and gentle manipulation of the coil placement, including the careful observation of the embolized coils, are essential during the endovascular treatment of the AVMs. Insufficiently sized coils, once deposited to the pulmonary artery, have a low probability of causing severe pulmonary embolism and subsequent cardiopulmonary collapse. Sometimes, detachable coils or other methods are also necessary to avoid severe cardiopulmonary complications caused by ectopic embolization with the coils.

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References