Successful microsurgical extraction of a migrated coil in a pediatric patient after failed endovascular closure of a Blalock–Taussig shunt

Case report

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Coil migration is a rare but potentially serious complication of endovascular procedures. Occasionally coils can be retrieved via endovascular techniques. The authors describe the microsurgical management of a case in which endovascular techniques failed. A 2-year-old girl with pulmonary atresia and a Blalock–Taussig shunt underwent attempted endovascular closure of the shunt with Gianturco steel coils. During deployment, a coil was lost in the aorta and an angiogram showed that it had lodged in the proximal M1 segment of the middle cerebral artery. The coil could not be retrieved by endovascular techniques, and the patient was taken to the operating room to undergo a craniotomy. After the sylvian fissure was split, the coil was visible through the vessel wall. Temporary clips were placed on the proximal M1 and the proximal M2 segments, trapping the coil. A small arteriotomy was performed, the coil was removed, and the arteriotomy was closed. A cerebral angiogram showed excellent perfusion with no dissections. The patient’s motor examination demonstrated a mild hemiparesis on the left with no tremulousness. Coil migration can be treated by microsurgical techniques in pediatric patients with a good clinical outcome.

KEY WORDS • coil migration • shunt complication • microsurgery • pediatric neurosurgery

**Case Report**

**History and Presentation.** This 2-year-old girl with a medical history notable for pulmonary atresia was undergoing endovascular closure of a Blalock–Taussig shunt. The shunt was being closed with Gianturco steel coils (Cook, Inc.) with a Dacron coating. During deployment a coil was lost in the ascending aorta. An emergency cerebral angiogram was obtained, which demonstrated a coil lodged in the proximal M1 segment of the MCA causing occlusion of the distal vessel (Fig. 1A).

The patient began receiving a phenylephrine drip. The neurointerventional team attempted to retrieve the coil by using a microsnare device. Multiple attempts were made to extract the coil mass by using 2- and 4-mm EV3 gooseneck microsnare devices as well as a Merci device (Concentric Medical, Inc.). In addition, attempts were made to pass the area of occlusion using 0.014-, 0.010-, and 0.008-in microwires and various microcatheters. The tightness of the coil mass prevented passage of even a microwire past the blocked segment of the artery as well as grasping with any of the retrieval devices. After attempting to extract the coil for nearly 45 minutes, it was decided that emergency surgical intervention was the best way to prevent possible infarction of the area distal to the occlusion. Approximately 2 hours after occlusion of the MCA by the migrated coil the patient was taken to the operating room for a craniotomy.

**Operation.** Preoperatively an STA–MCA bypass was considered, but it was rejected in favor of an arteriotomy be-

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Abbreviations used in this paper: CT = computed tomography; MCA = middle cerebral artery; STA = superficial temporal artery.
cause of the additional time required to map out and dissect the STA. Furthermore, the small size of the STA in a 2-year-old girl would not only make the anastomosis more technically challenging than an arteriotomy, but also would have too low a flow rate to sufficiently supplant the high flow rate of the MCA, and the vessel would be at high risk for thrombosis.

A right frontal craniotomy was performed. The sylvian fissure was split and the coil was readily visible through the vessel wall (Fig. 2). Temporary clips were placed on the proximal M₁ and the proximal M₂ segments, thereby trapping the coil. A No. 11 blade knife was used to perform the small arteriotomy, and a micro right-angle hook was used to tease out the coil. We encountered vigorous bleeding through perforating vessels on the posterior portion of the distal M₁ segment. Two interrupted 8-0 Prolene sutures were used to close the arteriotomy.

The patient underwent emergency head CT scanning, which was performed 5 hours and 45 minutes after the coil was lodged in the M₁ segment. There were minimal changes in the basal ganglia consistent with ischemia, but the remainder of the findings on the images were unremarkable (Fig. 3A–C). Follow-up head CT scans were obtained 18 hours after the operation (23 hours and 45 minutes after the occlusion was stable; Fig. 3D–F).

Postoperative Course. The patient underwent extubation on postoperative Day 1 after an angiogram showed excellent profusion and no dissections (Fig. 1B). There was narrowing of the proximal temporal M₁ segment that was likely due to vasospasm. A motor examination demonstrated mild left hemiparesis with subtle tremulousness that resolved over the next 48 hours. The patient was discharged home on postoperative Day 5. At the 1-month follow up the patient was neurologically intact, walking without difficulty, and returned to her baseline condition according to her mother.

Discussion

Endovascular techniques are routinely used in children to treat superfluous vascular connections and to close shunts. Endovascular coil embolization of shunts can be associated with the complication of coil migration. Treatment of coil migration typically first involves endovascular techniques. A variety of devices including microsnares and microforceps have been used to retrieve migrated coils with varying success.

When endovascular techniques are unsuccessful, microsurgery is often required to minimize morbidity. Deshmukh et al. and Short et al. have described cases in which microsurgery was required after coil migration and failed endovascular retrieval. Unlike these cases, which involved adult patients, the patient in our case was 2 years of age. Also, in the other reports the cases involved migration of coils placed into the cerebral circulation, whereas our case resulted from the distal migration of a cardiac coil into the cerebral circulation.

Together with the previously described cases of surgical salvage of coil migration, this case illustrates that surgical removal of migrated coils is technically possible.

Conclusions

Distal coil migration with occlusion of the vessel can be effectively treated in a pediatric patient. Microsurgery is a legitimate option in restoring cerebral blood flow when en-
dovascular techniques are not successful, even in the pediatric patient population.

References


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