Embolization of a Large Arteriovenous Malformation in the Forearm

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INTRODUCTION

Arteriovenous malformations (AVMs) arise due to developmental errors in the capillary bed during embryogenesis. The lack of a capillary bed results in rapid shunting of blood from the arterial to venous circulation. Although lesions are present at birth, they might not become evident until childhood or later in life. AVMs are sensitive to hormonal changes and often progress in adolescence, during pregnancy, and during intake of estrogen-containing contraceptives. Lesions are pulsatile with a palpable bruit or thrill, warm, and not easily compressible. The rapid shunting of blood leads to insufficient capillary perfusion with reduced oxygen delivery causing ischemia, pain, and development of wounds and bleedings. AVMs grow in size due to increased filling and enlargement of both supplying arteries and draining veins, which might cause disfigurement, destruction of tissues, and impaired organ function. When large enough, AVMs can cause congestive heart failure. Treatment of AVMs is based on endovascular embolization, surgical resection, or a combination of both. Complete cure is rare, and treatments therefore aim at controlling the malformation. Endovascular embolizations are performed using transarterial, transvenous, or direct-puncture techniques, and techniques are often combined. The embolic material can be liquid or solid, such as coils, plugs, and particles. It is important that the embolic material penetrates to the nidus and ideally to the point of the initial venous drainage.

PROCEDURE DESCRIPTION

A 17-year-old adolescent boy was referred from an outside hospital due to acute bleeding from an extensive ruptured AVM in his right forearm. The patient was taken to the OR and, in a bloodless field, the rupture was localized to a large draining subcutaneous vein, which was sutured. Subsequent digital subtraction angiography and magnetic resonance imaging revealed the true nature of the AVM with countless feeding arteries from the ulnar, interosseus, and radial arteries (Figure 1). Venous drainage was achieved through multiple large subcutaneous veins, and the lesion was embolized using a transvenous strategy. Under general anesthesia, a diagnostic catheter was advanced from the right femoral artery to the right brachial artery to visualize the AVM during the procedure. Using ultrasound guidance, an enlarged subcutaneous vein was accessed on the upper right arm. A draining vein at the nidus close to the wrist was reached using venous access with a Renegade® STC Microcatheter and a Fathom® Guidewire (Figure 2). Embolization was performed with 0.018-inch Interlock™ Coils. Control angiography revealed that this strategy was successful with markedly decreased shunting (Figure 2). The

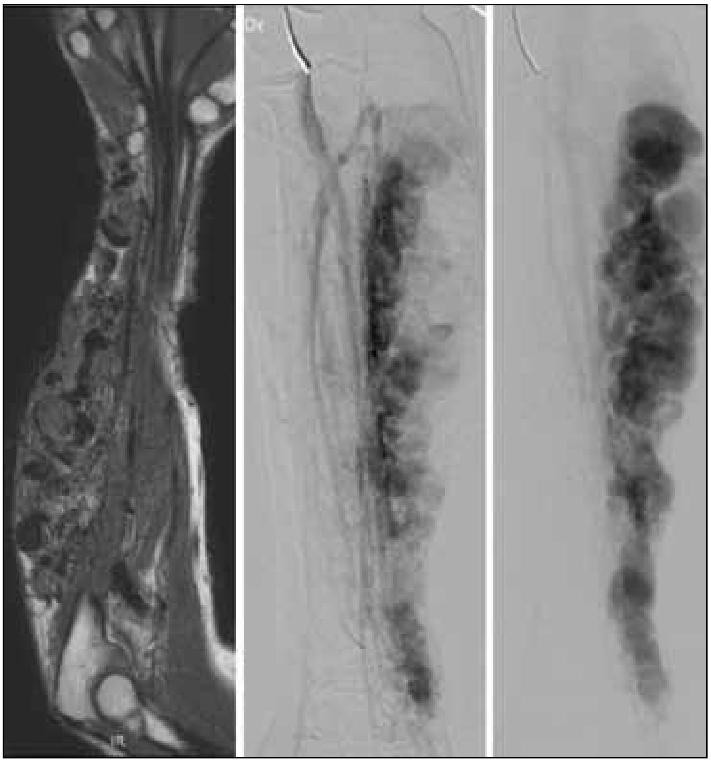

Figure 1. The AVM had countless feeding arteries from the ulnar, interosseus, and radial arteries.

Results from case studies are not necessarily predictive of results in other cases. Results in other cases may vary.

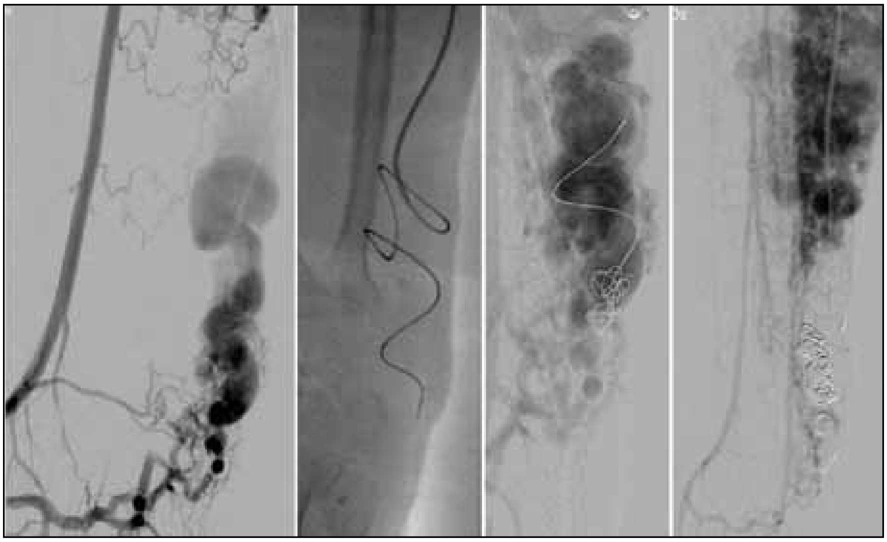

Figure 2. A draining vein at the nidus was reached via venous access with a Renegade® STC Microcatheter and a Fathom® Guidewire, and embolization was performed with 0.018-inch Interlock™ Coils. Control angiography revealed that this strategy was successful with markedly decreased shunting.

Figure 3. Final angiogram of the brachial artery.

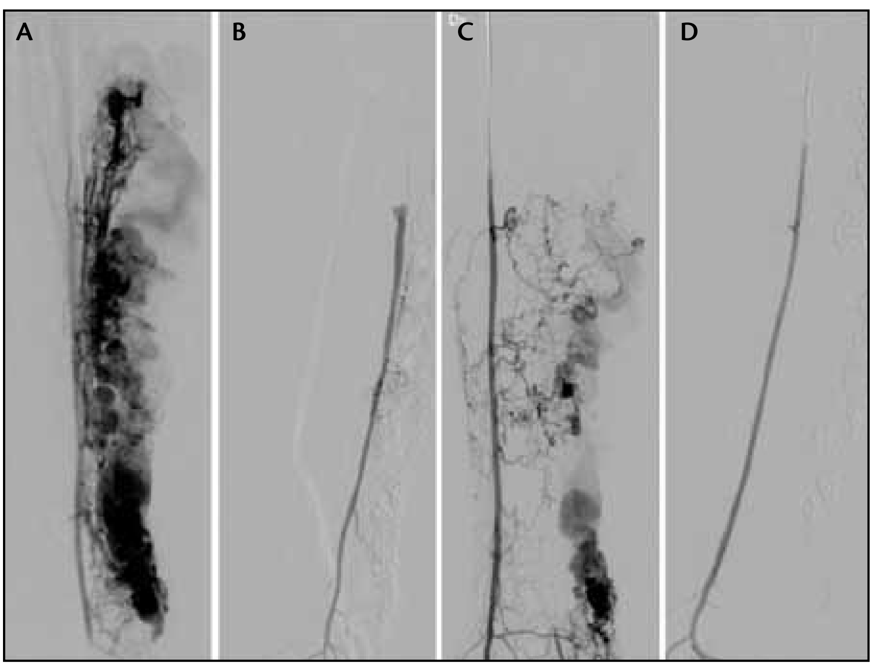

Figure 4. The final angiogram showed that almost all shunts were occluded: the ulnar artery before (A) and after (B) and the radial artery before (C) and after (D).

coiling procedure was repeated in nine separate procedures during a 6-month period with 0.018-inch Interlock™ Coils in veins that were hard to reach with a 0.035-inch system and 0.035 Interlock™ Coils in larger veins. The final angiography (Figure 3 and 4) showed that almost all shunts were occluded. The patient's symptoms of pain and discomfort, as well as the volume of the arm, were markedly reduced. At the time of the last embolization, it was observed that one coil was protruding through the skin due to shrinkage of the AVM. Because this could be a potential site of infection, the thrombosed AVM was surgically resected. The surgical resection was performed in a safe and controlled manner, without significant blood loss, due to the preoperative embolization. Postoperative healing was uneventful, and 6 months later, the patient was free of symptoms and able to return to a normal life.

DISCUSSION

AVMs are challenging lesions to treat. Embolization from the arterial side was not an option due to the countless number of arterial feeders, and the risk of spillover of embolic material would be devastating for the hand. This case demonstrates efficient closure of the draining vein at the nidus. Because lesions like this one have a very high flow rate, there is a concern that embolic material might dislodge and cause nontarget embolization. The availability of detachable, long, and fibered coils made it possible to perform the procedure in a safe and efficient manner. ■

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