Arteriovenous Malformations: From Head to Toe

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Purpose

High flow vascular malformations including congenital arteriovenous malformations (AVM) and acquired arteriovenous fistulas (AVF) occur throughout the body. This exhibit provides a pictorial review of the diagnosis, classification, and treatment throughout the body from head to toe. Through cases, we showcase nuances of treatment specific to lesion classification and site involved.

Materials and Methods

A selection of representative cases are presented. Specifically, vascular lesions within the head, lungs, abdomen, pelvis, and the extremities will be reviewed. These series of cases explore the various approaches to treating AVMs and acquired AVFs in a number of organ systems.

Case 1: Head

70-year-old female with worst headache of life who was found to have right occipital intraparenchymal hemorrhage with intraventricular extension. Head CTA was suspicious for dural AVF (dAVF), which was confirmed on cerebral angiography and treated.

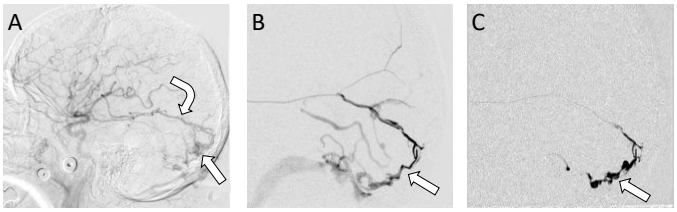

Figure 1 – (A) Lateral external carotid arteriogram shows Cognard 4 dAVF (straight arrow) supplied by middle meningial artery (MMA) parietal branch (curved arrow). (B) Lateral selective MMA parietal branch arteriogram demonstrates draining cortical vein (straight arrow) to sigmoid sinus. (C) Following embolization with Onyx 34 with embolization material extending into draining vein (straight arrow).

Embolic: Ethylene vinyl alcohol copolymer 8% (Onyx 34 [(Micro Therapeutics, Inc., Irvine, CA])

Discussion: Cognard type IV dAVF due to venous ectasia and direct cortical vein drainage. Type IV has highest risk of spontaneous hemorrhage, as seen in this case. Onyx was used from an arterial approach while ensuring embolization material spanned the fistula into the draining vein.

Case 2: Chest and Head

47-year-old male with incidental "mass" on CXR found to have multiple pulmonary AVMs. Subsequently diagnosed with hereditary hemorrhagic telangiectasia (HHT) and cerebral AVMs.

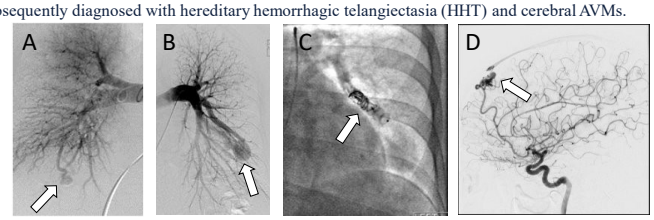

Figure 2 – (A) Right lower and (B) left lower lobe pulmonary AVMs (arrows). (C) Post-embolization left lower lobar arteriogram. (D) Cerebral AVM fed by anterior cerebral artery and draining into superior sagittal sinus.

Embolic: 10mm Amplatzer II plug and multiple Nestor Coils (LLL AVM), 6mm Amplatzer IV vascular plug (RLL AVM). Cerebral AVM not embolized; treated with gamma knife radiosurgery.

Discussion: Patients with HHT have AVMs involving numerous organ systems. The cerebral AVM was not treated due to multiple en passage vessels, which increase the risk of infarct if treated.

Case 3: Abdomen

54-year-old male with cirrhosis and portal HTN presenting with hematochezia. History of small bowel suspected Dieulafoy lesion. CTA showing small bowel AVM.

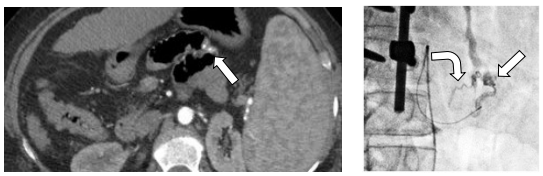

Figure 3 – (A) CTA showing an AVM in the proximal small bowel (arrow). (B) Superior mesenteric arteriogram showing small bowel AVM (arrow) with draining vein (curved arrow); subsequently embolized with glue.

Embolic: 0.1 cc of 1:2 ratio n-BCA:lipiodol.

Discussion: Vascular lesions including angiodysplasia, Dieulafoy lesions, and AVMs are a common source of GI bleeding. This AVM rebled, was treated again with glue, and did not subsequently recur.

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Case 4: Pelvis

31-year-old female with recent fetal demise and D&C who presents with abnormal vaginal bleeding. US demonstrated a uterine AVM, confirmed and treated angiographically.

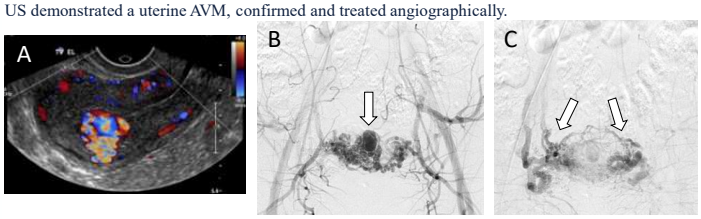

Figure 4 – (A) Doppler ultrasound showing turbulent flow through the AVM. (B) Pelvic angiogram showing uterine AVM (arrow) supplied by branches of both uterine arteries. (C) Slightly delayed phase of pelvic angiogram demonstrating rapid venous shunting (arrows) into the uterine venous plexus and internal iliac veins.

Embolic: 700-900μm and 500-700μm embospheres followed by thick gelfoam slurry.

Discussion: Uterine AVMs can be congenital or acquired, such as after curettage, miscarriage, multiple gestations, or cesarean section.

Case Group 5: Leg and Foot

Case 1: 29-year-old male with stab wound to lower leg approximately 1 month prior presenting with spontaneous bleeding from leg wound. CTA showed large pseudoaneurysm (PSA) and AVF.

Case 2: 37-year-old female with 1 year of swelling, discoloration, and mild discomfort of the foot who was found to have a plantar AVF on CTA.

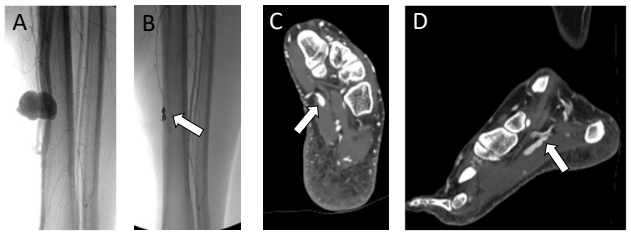

Figure 5 – (A,B) Posterior tibial arteriogram before and after coil embolization of a traumatic PSA and AVF. (C,D) CTA of the foot showing a plantar AVF (arrows), which was managed conservatively.

Embolic: In case 1, two Nester (Cook Medical, Bloomington, IN) coils across origin due to development of collaterals over the month since injury. In case 2, no embolization performed.

Discussion: In case 1, the traumatic PSA and fistula was treated with coils across the fistula origin. In case 2, the patient opted for conservative management with clinical follow up given mild symptoms.

Results

These cases of AVM and AVF demonstrate the variety of organ systems that can be affected by these high-flow vascular lesions as well as a general treatment approach that can be taken by the interventional radiologist. This review of a somewhat infrequently encountered entity in most practices will allow the reader to approach future cases with greater confidence.

Summary

	AVM	AVF
Classification	General: • **Schobinger**: classification of symptomatology • **ISSVA 2018** classification • **Cho** or **Yakes & Baumgartner**: based on angioarchitecture Intracranial: • **Spetzler-Martin**: Based on nidus size, eloquent brain, venous drainage. Consider en passage vessels.	General: • Typically defined by feeding artery or site of injury Intracranial: • **Cognard** or **Borden**: Both based on venous drainage. Provides prognostic information and risk of hemorrhage
Treatment	Liquid embolic agents including n-butyl cyanoacrylate (NBCA, glue), Ethylene vinyl alcohol copolymer (EVOH, Onyx), or ethanol Coils and vascular plugs for large feeding vessels Particles in select cases, such as uterine AVM	

Conclusions

The general approach to AVM and AVF treatment presented here and the series of example cases spanning organ systems will serve to increase the reader's confidence in approaching and treating this interesting type of vascular lesion. This series of cases demonstrates our institutional experience while highlighting keys to success and potential hazards in treating AVMs and AVFs.

References

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2. Mulligan PR, Prajapati HJ, Martin LG, Patel TH. Vascular anomalies: classification, imaging characteristics and implications for interventional radiology treatment approaches. Br J Radiol. 2014;87(1035):20130392. doi:10.1259/bjr.20130392