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Role of Endovascular Embolization Before Surgery in Lower Limb High Flow Arteriovenous Malformation

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Keywords:

Malformation; Morphology; Embolization

1. Abstract

Arterio-venous malformation (AVM) refers to abnormal shunting of blood between arterial and venous flow, bypassing intervening capillary network. Cho-do et al, and Yakes recently introduced classification system for AVM, and their classification system is based on morphology of AVM, and these classification system help in guiding optimal mode of treatment. We present a case of lower limb high flow AVM, wherein endovascular embolization was done before surgery, based on Cho-do classification system for AVM, and this helped plastic surgeon in complete removal of right thigh AVM, without any significant blood loss.

2. Introduction

Arterio-venous malformation (AVM) refers to abnormal shunting of blood between arterial and venous flow, bypassing intervening capillary network. Anomalous region in which arterial and venous vessels connect, create low perfusion pressure area, known clinically as nidus. AVM differ from hemangioma and neoplastic disorders of vasculature, as these AVM grow at physiologically normal rate, don't regress over time, and possess normal endothelial turnover. We present a case of lower limb high flow AVM, wherein endovascular embolization was done before surgery, based on Cho-do classification system for AVM, and this helped plastic surgeon in complete removal of right thigh AVM, without any significant blood loss.

3. Case Presentation

This is case of a 37-year-old woman referred to our tertiary care centre, with swelling on medial aspect of right thigh. On examination, the patient had large, soft, non-tender swelling over right thigh, without trophic changes in skin, and normal distal pulses. Diagnostic assessment was initially done with Doppler ultrasound, revealing a vascular malformation with arterial and venous flow. CT angiography showed 17 cm long, high flow, thigh intramuscular AVM (Figure 1). Findings were further confirmed on conventional angiography, which revealed multiple feeding vessels from right internal iliac, right common femoral, right superficial femoral and right profundal femoral artery. Nidus was also seen, along with large dilated dominant outflow vein of the malformation, draining into right common iliac vein, and seen in late phase of angiography, without connections to superficial venous system (Figure 2). AVM was classified as type II, according to Cho-do classification system, with multiple arterioles shunted into a single draining vein.

Twice endovascular interventions were done within a period of 2 days, combining different embolization agents for occlusion of nidus and afferent vessels. Both sessions took place in angiosuite under local anaesthesia. In first session, embolization was done through retrograde left femoral arterial access, with selective catheter placement in feeding vessels. For common femoral afferent, we used 10 x 50 mm coil. For distal afferent arising from common femoral artery and superficial femoral artery, we used combination of lipiodol and N-butyl cyanoacrylate (NBCA) glue in ratio of 1:1 (Figure 3). Second session took place 2 days later, following same steps : retrograde left femoral puncture with selective catheter placement to gain access to remaining feeding vessels arising from internal iliac artery, using similar combination of lipiodol and NBCA glue in ratio of 1:1 (Figure 4). Patient had no complication during any session of angioembolization. CT angiography post

embolization showed coil and glue cast within right thigh, AVM, with non-opacification of feeders or AVM nidus (Figure 5). Few dilated venous channels were still seen within right thigh AVM. Patient was thereafter referred to Plastic surgery unit, and underwent surgery 4 days later. During surgery, nidus was completely resected with minimal (<300 ml) blood loss, requiring only 1 unit of blood transfusion during operation (Figure 6). Patient was discharged 3 days after surgery, and is asymptomatic after follow up of four months.

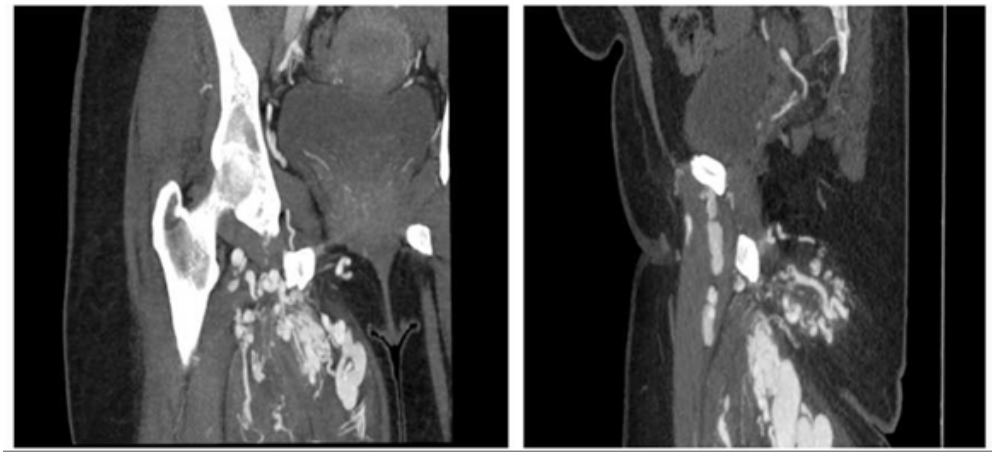

Figure 1: Coronal and sagittal reconstruction. CT angiography shows a complex intramuscular AVM, with multiple feeding arteries from right internal iliac artery, right common femoral artery, right superficial femoral artery and right profunda femoris artery.

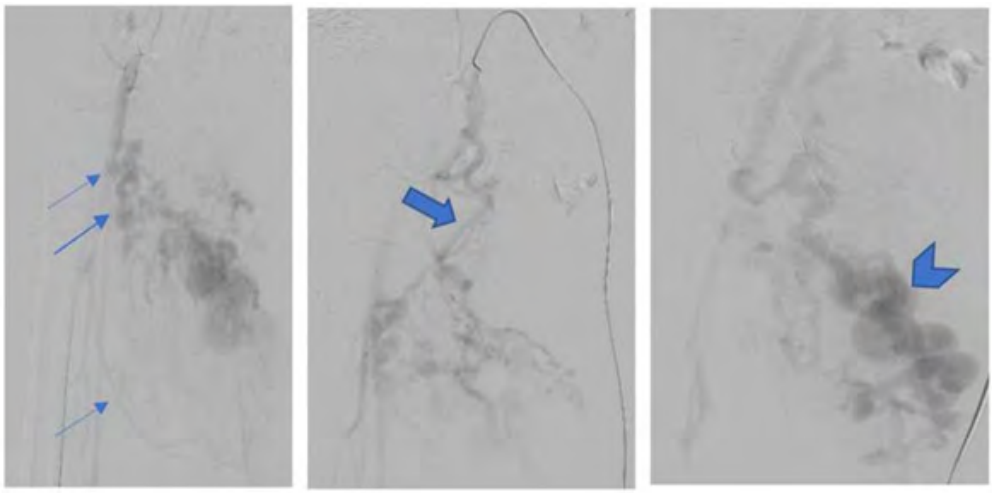

Figure 2: Digital subtraction angiography (DSA) showing multiple feeders from right common femoral artery (arrow), right superficial femoral artery and right internal iliac artery (solid arrow) with a saccular dilated draining vein (arrow head).

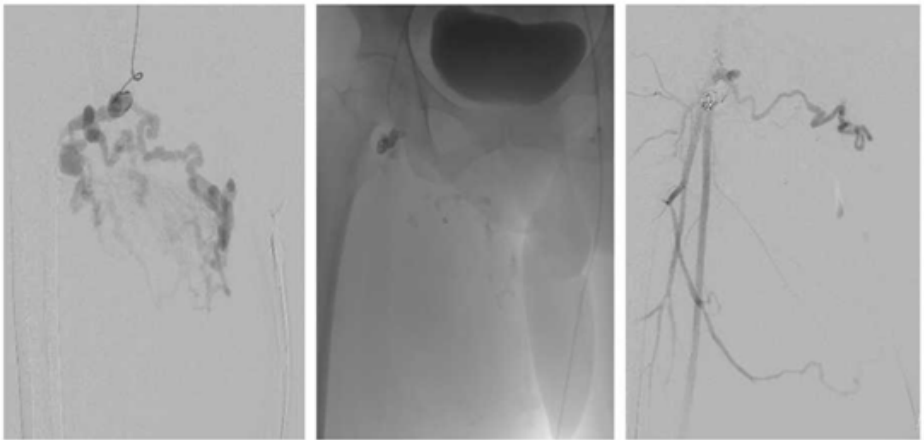

Figure 3: First session of embolization. Selective catheterization of feeder from common femoral artery with embolization using coil and NBCA glue. Post embolization DSA shows non-opacification of feeders; NBCA, N-butyl cyanoacrylate.

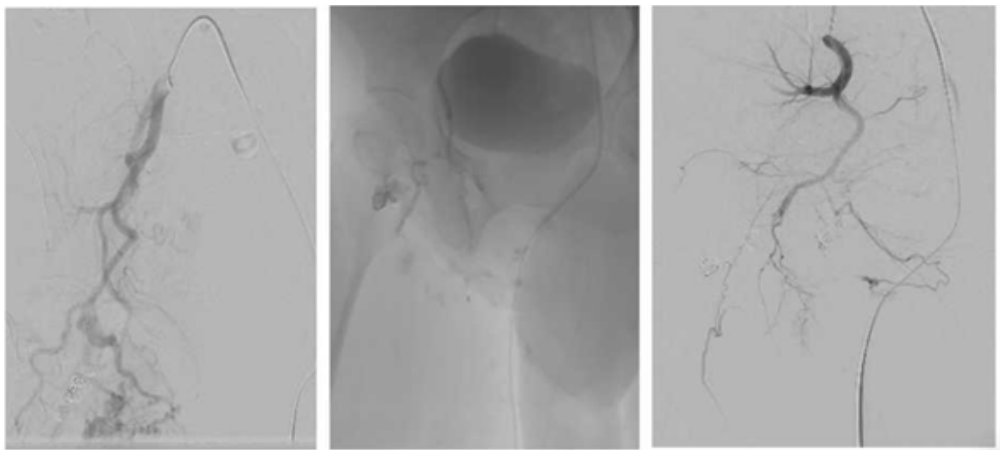

Figure 4: Second session of embolization. Selective catheterization of feeder from internal iliac artery with embolization using coil and NBCA glue. Post embolization DSA shows non-opacification of feeders; NBCA, N-butyl cyanoacrylate; DSA, Digital subtraction Angiography.

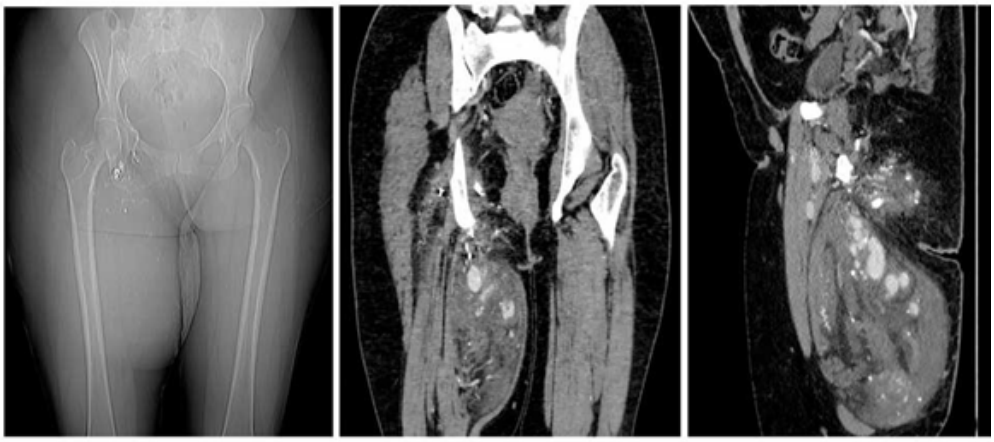

Figure 5: CT angiography post embolization. Coil and glue cast within right thigh AVM with non-opacification of feeders or AVM nidus. Few dilated venous channels were still seen within right thigh AVM.

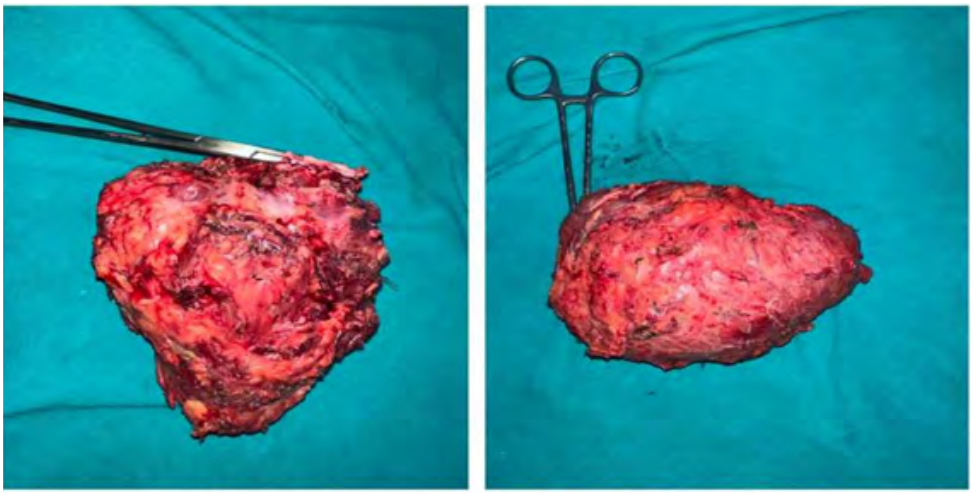

Figure 6: Post operative images of resected specimen of AVM nidus and surrounding soft tissue.

4. Discussion

Lower limb high flow arteriovenous malformation present with varied clinical presentation, ranging from subtle skin lesions to life threatening congestive heart failure, and need multidisciplinary approach for timely diagnosis and treatment. High flow peripheral arteriovenous malformation basically can be divided into two broad categories: a) arterio-venous fistula (AVF) and b) arterio-venous malformation (AVM). AVF characteristically have single vascular channel between an artery and a vein; whereas AVM characteristically have feeding artery, nidus and draining vein.1,2

Many classification systems have been used to categorize AVM. First classification system was proposed by Mulliken and Glowacki in 1982, and their classification was biological classification, based on histological features, physical findings and natural history.3 In 1993, Jackson et al, proposed a classification system, in which they divided AVM into two categories: Low flow and high flow malformation, based on flow dynamics.4 Schobinger staging system is a four stage AVM classification system, and this is based on clinical manifestations of AVM, ranging from minor dermatological changes in stage I to high output cardiac failure in stage IV.5

Most commonly accepted classification is International Society for Study of Vascular Anomalies (ISSVA) classification system, and this classification system was introduced in 1996.6 In ISSVA classification, vascular tumors are separated from vascular malformation; and vascular malformation are further subcategorized into low flow and high flow malformation. ISSVA classification was further revised in 2014, and vascular malformation were broadly categorized into following categories: simple, combined, truncular, or malformation as part of clinical syndrome.7 In 2018, ISSVA classifications was revised further, with incorporation of causative genes involved in many vascular lesions.8 Cho-do et al,9 and Yakes10 recently introduced classification system for AVM, and their classification system is based on morphology of AVM, and these classification systems help in guiding optimal mode of treatment.

Cho-do classification of AVM is based on nidus morphology:

a)Type I (Arterio-venous) : Three arteries or less shunting to single vein.

b)Type II (Arteriolo-venous) : Multiple arterioles shunting to single vein.

c)Type IIIa (Non-dilated arteriolo-venulous) : Blush of connections between arterioles and venules.

d)Type IIIb (Dilated arteriolo-venulous) : Complex vascular network between arterioles and venules.

Endovascular embolization has convincingly been established as optimum treatment technique, for managing high flow peripheral AVM.11,12 Goal of endovascular treatment of high flow peripheral AVM is to completely occlude, or embolize the nidus. Nidus occlusion triggers immense endothelial inflammation, induces thrombus formation at site of nidus, and completely blocks the dense vessel network. We typically use transarterial approach for embolotherapy, to completely occlude the nidus; supplemented in some cases by transvenous and/or direct percutaneous approach. Conventional Catheter angiography is standard evaluation technique during this procedure. We can specifically determine flow dynamics, and angioarchitecture of nidus, and this helps in choosing optimum treatment protocol. Various embolic agents are used for embolotherapy, depending on size, complexity, and morphology of high flow peripheral AVM. In our patient, we first evaluated morphology of high flow peripheral AVM, and thereafter based on Cho-do classification, we used combination of agents including coil and NBCA glue. This was immensely helpful to plastic surgeon during surgery, as he virtually got bloodless field, due to prior endovascular embolization. Moreover, due to prior embolization, right thigh AVM had clear demarcation planes, and this helped plastic surgeon in complete removal of AVM.

5. Conclusion

Combined approach involving endovascular treatment, followed by surgery is established treatment approach for peripheral high flow AVM. Cho do et al, classification helps us in guiding optimum treatment approach, based on angioarchitecture of peripheral high flow AVM.

6. Teaching Points

1.Arterio-venous malformation (AVM) refers to abnormal shunting of blood between arterial and venous flow, bypassing intervening capillary network.

2.AVM differ from hemangioma and neoplastic disorders of vasculature, as these AVM grow at physiologically normal rate, don't regress over time, and possess normal endothelial turnover.

3.Cho-do et al, and Yakes recently introduced classification system for AVM, and their classification system is based on morphology of AVM, and these classification systems help in guiding optimal mode of treatment.

4.Endovascular embolization has convincingly been established as optimum treatment technique, for managing high flow peripheral AVM.

5.Goal of endovascular treatment of high flow peripheral AVM is to completely occlude, or embolize the nidus.

7. MCQs

7.1. MCQ 1: Which classification system based on clinical manifestation of AVM:

a)Mulliken and Glowacki classification system.

b)Yakes classification system.

c)ISSVA classification system.

d)Schobinger staging system.

Answer: D

7.2. MCQ 2: Which description describes Type IIIb of Cho-do classification system:

a)Complex vascular network between arterioles and venules, with dilated arteriolo-venulous connections.

b)Three arteries or less shunting to single vein.

c)Multiple arterioles shunting to single vein.

d)Blush of connections between arterioles and venules, with non-dilated arteriolo-venulous connection.

Answer: A

8. Funding and Conflict of Interest

The authors declare that they have no conflict of interest and have not received any funding.

References

1. Dubois J, Garel L. Imaging and therapeutic approach of hemangiomas and vascular malformations in the pediatric age group. Pediatr Radiol. 1999;29(12):879-93.
2. Fayad LM, Hazirolan T, Bluemke D, Mitchell S. Vascular malformations in the extremities: emphasis on MR imaging features that guide treatment options. Skeletal radiol. 2006;35(3):127-37.
3. Mulliken JB, Fishman SJ, Burrows PE. Vascular anomalies. Curr Probl Surg. 2000;37(8):517-84.
4. Jackson IT, Carreno R, Potparic Z, Hussain K. Hemangiomas, vascular malformations, and lymphovenous malformations: classification and methods of treatment. Plast Reconstr Surg. 1993;91(7):1216-30.
5. Kohout MP, Hansen M, Pribaz JJ, Mulliken JB. Arteriovenous malformations of the head and neck : natural history and management. Plast Reconstr Surg. 1998;102(3):643-54.
6. Enjolras O. Classification and management of the various superficial vascular anomalies: hemangiomas and vascular malformations. J Dermatol. 1997;24(11):701-10.
7. Wassef M, Blei F, Adams D, Alomari A, Baselga E, Berenstein A, et al. ISSVA Board and Scientific Committee. Vascular anomalies classification: recommendations from the International Society for the study of Vascular Anomlies. Paediatrics. 2015;136(1):203-14.
8. Kunimoto K, Yamamoto Y, Jinnin M. ISSVA Classification of Vascular Anomalies and Molecular Biology. Int J Mol Sci. 2022;23(4):2358.
9. Cho SK, Do YS, Shin SW, Kim DI, Kim YW, Park KB, et al. Arteriovenous malformations of the body and extremities: Analysis of therapeutic outcomes and approaches according to a modified angiographic classification. J Endovasc Ther. 2006;13:527-38.
10. Yakes WF. Yakes' AVM Classification System. J Vasc Interv Radiol. 2015;26:S224.
11. Khurana A, Hangge PT, Albadawi H, Knuttinen MG, Alzubaidi SJ, Naidu SG, et al. The Use of Transarterial Approaches in Peripheral Arteriovenous Malformations (AVMs). J Clin Med. 2018;7(5):109.
12. Malik V, Kramadhari H, Rathod J, Munde YW. Peripheral Arteriovenous Malformations: Imaging and Endovascular Management Strategies. J Clin Interv Radiol. 2021;6(8):43-51.