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Case Report

Arteriovenous Malformation of the Thenar Region: A Diagnostic Challenge

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Arteriovenous malformations (AVMs) of the hand are rare, high-flow vascular anomalies that present diagnostic and therapeutic challenges owing to variable clinical manifestations and complex regional anatomy. We report a 38-year-old man with a 2-year history of a painful, progressively enlarging mass in the right thenar region associated with impaired grasp and pinch. Initial evaluation with radiographs and ultrasound was nondiagnostic. Magnetic resonance imaging demonstrated a well-circumscribed lesion in the first web space but did not reliably characterize its vascular nature. Complete surgical excision was undertaken. Histopathological analysis demonstrated a proliferation of arterial and venous channels within a fibroadipose stroma, consistent with a type B AVM. At 2-year follow-up, there was no evidence of recurrence and functional outcomes were satisfactory. This case underscores the limitations of conventional imaging in detecting high-flow vascular lesions of the hand and highlights the importance of maintaining diagnostic suspicion for AVMs in atypical soft tissue masses.

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Vascular malformations (VMs) are congenital anomalies arising from aberrant vascular morphogenesis and are characterized by progressive enlargement over time. These lesions are classified according to vessel type and hemodynamic properties into low-flow and high-flow malformations. Arteriovenous malformations (AVMs) represent high-flow lesions defined by direct arteriovenous shunting in the absence of an intervening capillary bed, resulting in altered local and systemic hemodynamics.^{1–4}

Arteriovenous malformations of the upper extremity have been categorized into 3 types based on anatomical and hemodynamic characteristics. Type A lesions consist of arterial aneurysmal or ectatic changes. Type B lesions involve localized arteriovenous fistulous connections along a single axial artery and are typically more circumscribed. Type C lesions are diffuse, infiltrative malformations involving multiple tissue planes with complex micro- and macrofistulous networks, often associated with more aggressive clinical behavior.^{1–4}

The hand poses unique diagnostic and therapeutic challenges owing to its dense concentration of critical neurovascular and tendinous

structures within a confined space. Furthermore, clinical presentation may be nonspecific, and imaging findings can be inconclusive.^{5–11} We report a case of a thenar AVM in which preoperative imaging failed to establish the diagnosis, highlighting the limitations of routine diagnostic modalities and considerations in management.

Case Report

Written informed consent was obtained from the patients for patients' anonymized information to be published in this article.

The study was approved by the medical research and ethics committee of the Urmia University of Medical Sciences with registered numbers: IR.UMSU.REC.1404.229. Available at: <https://ethics.research.ac.ir/IR.UMSU.REC.1404.229>.

A 38-year-old man presented with a 2-year history of a progressively enlarging mass in the right thenar region, accompanied by persistent pain and functional limitation, particularly during grasping and pinch activities. There was no history of antecedent trauma or systemic disease.

Physical examination revealed a firm, nonpulsatile mass within the thenar eminence. The overlying skin was unremarkable, without discoloration, warmth, or ulceration. No bruit was appreciated. Neurologic examination was normal, although mechanical interference from the mass limited hand function.

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Figure 1. Magnetic resonance imaging of the right hand demonstrating a well-circumscribed lesion within the first web space, located between the first and second metacarpals and adjacent to the flexor tendons.

Plain radiographs demonstrated no osseous abnormalities. Ultrasonography was inconclusive and did not demonstrate definitive vascular characteristics. Magnetic resonance imaging identified a well-demarcated lesion within the first web space, situated between the first and second metacarpals and interposed between the flexor pollicis longus and the flexor tendons of the index finger (Fig. 1). Although magnetic resonance imaging delineated the anatomical extent of the lesion, it did not reliably distinguish its vascular nature or flow characteristics.

Given the progressive symptoms, functional impairment, and localized configuration of the lesion, surgical excision was pursued. Intraoperatively, the mass was found to be nonencapsulated, firm, and composed of dilated, tortuous vascular channels interspersed with surrounding fibromuscular tissue. The lesion measured approximately $4 \times 3.5 \times 3$ cm and was excised in its entirety (Fig. 2).

Histopathological evaluation demonstrated a heterogeneous proliferation of vascular channels of varying calibers, including both arterial and venous components, within a fibroadipose stroma. These findings were diagnostic of a type B arteriovenous malformation (Fig. 3).

The postoperative course was uneventful. At 2-year follow-up, the patient remained asymptomatic with no clinical evidence of recurrence and reported satisfactory restoration of hand function.

Discussion

Arteriovenous malformations of the hand present with a wide spectrum of symptoms, ranging from mild discomfort to notably

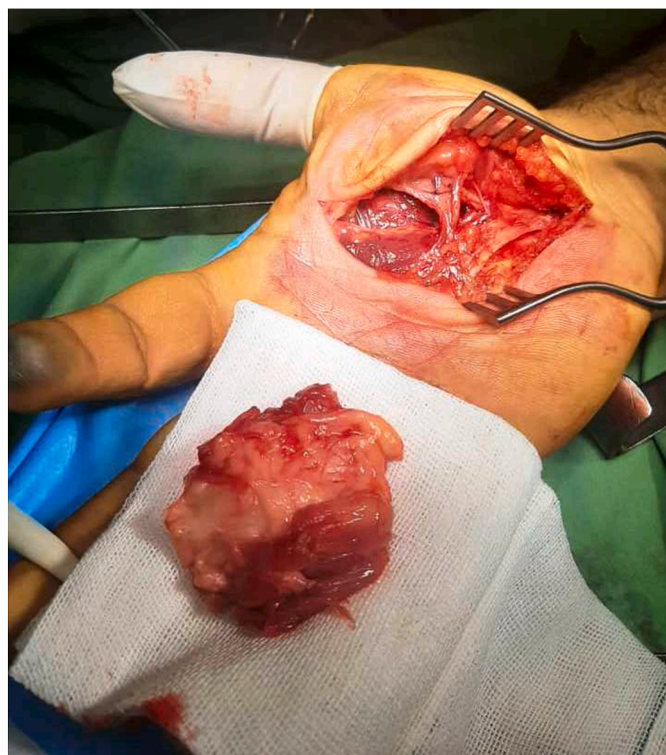


Figure 2. Intraoperative photograph showing a nonencapsulated lesion composed of dilated and tortuous vascular channels within surrounding soft tissue.



Figure 3. Histopathological section demonstrating vascular channels of varying calibers, including arterial and venous components within a fibroadipose stroma, consistent with an arteriovenous malformation (hematoxylin-eosin stain, $\times 4$).

functional impairment due to the complex anatomy of the region. In severe cases, long-standing arteriovenous shunting may result in cardiac decompensation.¹

Magnetic resonance imaging is useful for assessing lesion size and involvement of adjacent structures; however, it has limitations in evaluating flow dynamics. Clinical examination alone often underestimates the true extent of VMs. Computed tomography angiography is considered the gold standard for assessing AVMs and their hemodynamic characteristics.² In this case, angiography was not performed, as initial imaging did not strongly suggest a vascular lesion.

There is no universally accepted gold standard treatment for upper-extremity AVMs. Management strategies range from conservative observation and compression therapy to minimally invasive techniques such as embolization, sclerotherapy, and laser therapy, as well as surgical interventions including excision, debulking, or, in severe cases, amputation.^{2,5–11}

Upton et al⁴ reviewed 270 patients with VMs, of which 237 were low-flow lesions. Surgical intervention was performed in 141 patients. Among high-flow lesions, 24 of 33 patients underwent surgery, with complication rates of 28%. Notably, treatment of type C AVMs resulted in amputation in 10 of 14 cases.

Similarly, van Doesburg et al⁵ analyzed 358 upper-extremity VMs, including 208 surgically treated patients, reporting 20% minor complications, 6% major complications requiring reoperation, and a 32% recurrence rate within 1 year.

Arteriovenous malformations of the hand are rare and may pose notably diagnostic challenges. Arteriovenous malformations of the hand may mimic benign soft tissue tumors and remain unrecognized on routine imaging. Imaging modalities such as magnetic resonance imaging may not fully characterize these lesions, emphasizing the importance of comprehensive evaluation. Accurate diagnosis and appropriate management require a multidisciplinary approach; not all lesions require surgical intervention. Treatment should be individualized based on symptoms, lesion characteristics, and patient factors.^{5–11} This case emphasizes the importance of considering VMs in atypical hand masses and supports complete excision as an effective treatment in carefully selected patients with localized disease.

Conflicts of Interest

No benefits in any form have been received or will be received related directly to this article.

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Ethical approval

The study was approved by the medical research and ethics committee of the Urmia University of Medical Sciences with registered numbers: IR.UMSU.REC.1404.229. Available at: <https://ethics.research.ac.ir/IR.UMSU.REC.1404.229>

References

1. Mende K, Vargesson N, Sivakumar B. Vascular anomalies of the upper limb. *J Hand Surg Eur Vol.* 2019;44(3):233–241. <https://doi.org/10.1177/1753193418808130>
2. Mojica ES, Taghinia A, Upton J, Ayalon O. The hand surgeon's role in the management of upper-extremity arteriovenous malformation: a review of the literature. *J Hand Surg Am.* 2025;50(8):987–995. <https://doi.org/10.1016/j.jhssa.2025.02.021>
3. Taghinia AH, Upton J. Vascular anomalies. *J Hand Surg Am.* 2018;43(12):1113–1121. <https://doi.org/10.1016/j.jhssa.2018.03.046>
4. Upton J, Coombs CJ, Mulliken JB, Burrows PE, Pap S. Vascular malformations of the upper limb: a review of 270 patients. *J Hand Surg Am.* 1999;24(5):1019–1035. <https://doi.org/10.1053/jhsu.1999.1019>
5. van Doesburg MHM, Harbech H, Lokhorst MM, Breugem CC. Surgical management of vascular malformations of the upper extremity: a review of current literature. *JPRAS Open.* 2022;33:63–75. <https://doi.org/10.1016/j.jpra.2022.05.008>
6. Al-Qattan MM, Murray KA, El-Shayeb A. Arteriovenous vascular malformations confined to the hand: an algorithm of management based on a new classification. *J Hand Surg Br.* 2006;31(3):266–273. <https://doi.org/10.1016/j.jhsb.2006.01.005>
7. Jacobs BJ, Anzarut A, Guerra S, Gordillo G, Imbriglia JE. Vascular anomalies of the upper extremity. *J Hand Surg Am.* 2010;35(10):1703–1709; quiz 1709. <https://doi.org/10.1016/j.jhssa.2010.08.005>
8. Ek ET, Suh N, Carlson MG. Vascular anomalies of the hand and wrist. *J Am Acad Orthop Surg.* 2014;22(6):352–360. <https://doi.org/10.5435/JAAOS-22-06-352>
9. Marzella L, Lazzerini A, De Vitis R. Surgical management of vascular malformations in the hand and wrist. *J Hand Surg Eur Vol.* 2025;50(8):1114–1115. <https://doi.org/10.1177/17531934241306292>
10. Greenhalgh RM, Rosengarten DS, Calnan JS. A single congenital arteriovenous fistula of the hand. *Br J Surg.* 1972;59(1):76–78. <https://doi.org/10.1002/bjbs.1800590122>
11. El Youbi S, Boulman S, Naouli H, Jiber H, Bouarhroum A. Surgical management of a congenital arteriovenous fistula of the forearm. *J Surg Case Rep.* 2022;2022(6):rjac259. <https://doi.org/10.1093/jscr/rjac259>