A unilateral dermatomal venous malformation

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Venous malformations (VMs) are the most common vascular malformations, forming 44% to 64% of all vascular malformations. We report a case of a patient suffering from unilateral dermatomal VM. The VM was strictly confined to the right C6 dermatome. We propose that unilateral dermatomal VM is a prime example of somatic mosaicism in vascular development. Unilateral dermatomal VM seems to have a similar pathogenesis to the Sturge-Weber syndrome and may also be caused by somatic mutations disrupting the development of skin veins. (J Vasc Surg Cases 2015;1:272-5.)

Venous malformations (VMs) are the most common vascular malformations, forming 44% to 64% of all vascular malformations.[1,2] According to the Hamburg classification, VMs are classified as truncular or extratruncular, with 40% of VMs being located at the extremities, 20% on the trunk, and 40% on the head and neck.[1,3] VMs are dysplastic venous channels with only minimal linkage to adjacent veins. They are slow-flow lesions that occur sporadically and are focal in 99% of cases.[4]

Vascular anomalies in general comprise vascular tumors and vascular malformations. Infantile hemangiomas, namely, congenital hemangiomas, "tufted angiomas," hemangioendotheliomas, pyogenous granuloma, and other rare forms, count among vascular tumors. On the other hand, vascular malformations comprise low-flow lesions (venous, capillary, lymphatic, and mixed) and high-flow lesions (arterial-arteriovenous).[5]

VMs are manifested as bluish lesions that may expand with Valsalva maneuver and after compression. VMs can cause bleeding and change of color of the adjacent skin, and when there is congestion or clotting within the VM, it may cause pain for the patient.[2]

There are two types of VMs, corresponding to the anatomic location: focal and diffuse. Focal VMs are confined to one tissue layer: muscle, skin, or mucosa.[2] Diffuse VMs involve several layers of tissue, commonly including muscle, subcutaneous fat, and skin. Unlike focal VMs, diffuse VMs communicate with main conducting veins. Diffuse VMs usually require multiple treatment sessions (whereas focal VMs are effectively treated with sclerotherapy) and have a high probability of recurrence.[2] VMs are usually of benign behavior and may also be managed conservatively with compression devices to prevent thrombosis or pain. However, when VMs lead to pain or swelling, further diagnostic workup and treatment are required.

We report a case of a 50-year-old man suffering from unilateral dermatomal VM.

CASE REPORT

A 50-year-old man presented to the hospital suffering from a unilateral dermatomal VM.[6-9] He was referred to the hospital by his general practitioner for evaluation of painful nodules on his right forearm.

The first subcutaneous nodules appeared on the right thenar eminence and at the forearm approximately at the age of 14 years and were surgically removed in the patient's adolescence.

At the age of 35 years, subcutaneous nodules of his right thenar eminence appeared and were surgically removed. In addition, the patient had new, about 3 cm in diameter, painful nodules on the right forearm, also in locations that had been operated on in his adolescence, suggestive of disease recurrence.

Digital subtraction angiography showed normal anatomic development of the radial, ulnar, and interosseous arteries without any arteriovenous shunts (Fig 1, *A*). Direct injection of contrast substance into the largest VM of the thenar revealed irregular vascular cavities within the vein (Fig 1, *B*) and normal development of the major brachial veins. The venous tumors were confined to the subcutis and dermis of the dermatome C6 and did not infiltrate the muscles of the right hand and right forearm. Interestingly, only the forearm was affected, whereas the C6 dermatome also extends to the upper arm. There was no family history of similar lesions and no skeletal abnormalities, and no other findings suggestive of a VM were noted elsewhere.

When he returned to the hospital at the age of 50 years, new small vascular lesions had developed. There were no visceral lesions and no enchondromas, underlining the general benign course of this disease. After magnetic resonance tomography of the right forearm (Fig 1, *C*), the tender, elastic nodules measuring 5 to 20 mm were once again surgically removed. Histopathologic evaluation of the resected hemangiomas revealed well-circumscribed hypervascularized lesions consisting of dilated blood vessels with focal thrombi and slightly thickened vascular walls. The lesions were restricted to the C6 dermatome on the right forearm and

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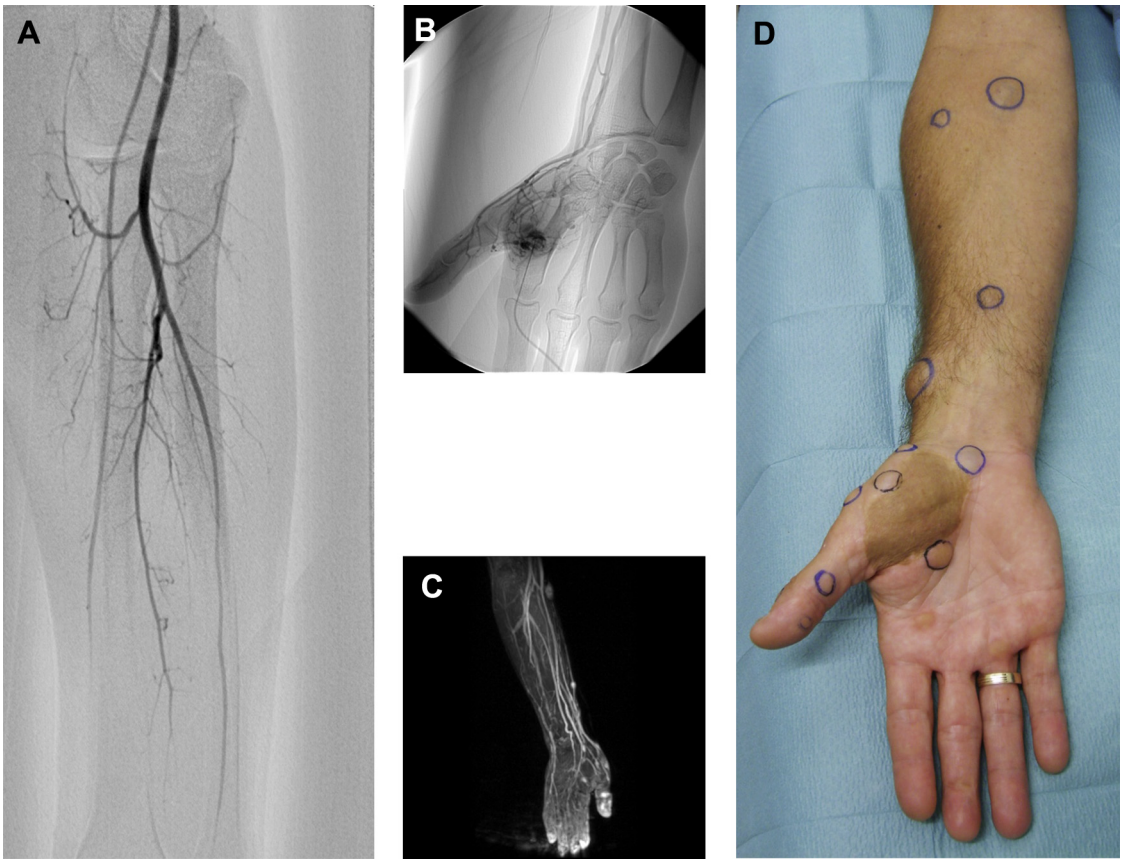

Fig 1. Unilateral dermatomal venous malformation (VM). Digital subtraction angiography shows **(A)** normal vascular development of the brachial, radial, and ulnar arteries and **(B)** small peripheral VMs. **C,** Magnetic resonance angiography confirms this distribution pattern. **D,** Dermal VMs are strictly confined to the C6 dermatome.

have not recurred up to now on the right thenar, where dermis and subcutis had been radically resected and had been replaced by autologous skin transplantation from the left groin when the patient was 35 years old (Fig 1, *D*). According to the Hamburg classification of vascular malformations, this lesion is a venous, extratruncular, and limited malformation.[10]

Fig 2 shows the histologic appearance.

Fig 3 illustrates the junction of the tumor to the blood vessels of the thumb, showing an intraoperative image from the latest surgical procedure in June 2015.

The patient consented to publication of this report.

DISCUSSION

In the literature, cases of unilateral dermatomal cavernous hemangiomatosis have been described. In these cases, the tumors were also strictly segmental in nature and followed a benign course without malignant transformation and without co-occurrence of gastrointestinal lesions.[6-9] Most important, the multiple dermal hemangiomas were restricted to single unilateral dermatomes, like in our case of VM. This fact supports the hypothesis of a distinct dermatomal angiogenesis, in which the mosaic heterogeneity in vascular development plays a major role and leads to vascular malformations only in confined anatomic regions.

Nascent vascular smooth muscle cells (VSMCs) derive from multiple and nonoverlapping embryonic origins that are reflected in different anatomic locations in the adult. The heterogeneous mosaic pattern of VSMC development accounts for distinct morphologic and functional properties of veins and arteries in different anatomic regions. Smooth muscle cells of the aorticopulmonary septum, aortic arch, right subclavian artery, and cranial vessels derive from the neuronal crest cells of the ectoderm, whereas VSMCs of the descending aorta, coronary arteries, and left subclavian artery originate from the mesoderm, for instance.[11] This evolutionarily conserved pathway for segmental vascular development leads to vascular smooth muscle heterogeneity. Moreover, the patterning and differentiation of the venous and arterial networks in the skin are closely modulated by neurons and neuronal-associated tissues such as Schwann cells.[12] Skin arteries are specifically aligned with peripheral nerves, where sensory nerves determine the pattern of arterial differentiation and blood vessel branching.[13] This constitutional smooth muscle heterogeneity leads to different susceptibility of various vascular beds for adaptive and pathologic responses. VSMC heterogeneity is strikingly exemplified by somatic mosaicism in diseases such as Sturge-Weber syndrome and port-wine