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**Glomangiomas: case report with immunohistochemical study and literature review**

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**Abstract**

**BACKGROUND**

Glomangiomas (also known as diffuse glomus tumor) is extremely rare, accounting for only 5% of glomus tumors. The prevalence of glomus tumors is only 2% of soft tissue tumors. Lesions can recur after resection. Although growth may be diffuse or infiltrating and invasive, definitive identifying standards for malignant glomus tumors are lacking. This article describes a case of glomangiomas with many nodular masses in the soft tissues of the right foot and calf. A review of the Chinese and English-language literature is included.

**CASE SUMMARY**

A case of glomangiomas in a 55-year-old Chinese woman who presented clinically with many nodular masses in the soft tissues of the right foot and calf. The tumor was examined histologically and immunostaining was performed.

**CONCLUSION**

Glomangiomas occurs most often in young people, in the distal extremities, but is rare. Multiple nodules are even rarer. Only 15 clinicopathological analyses of glomangiomas have been reported in the combined Chinese- and English-language literature. In the present case, microscopically, nested vascular globular cells were

observed around the blood vessel wall. Immunohistochemistry revealed diffuse immunoreactivity for smooth muscle actin, vimentin, type IV collagen, and Bcl-2. Caldesmon, CD34, and calponin were weakly, partially, and slightly positive, respectively. There was no recurrence one year after resection.

**Key Words:** glomangiomas; glomus tumor; foot and ankle; perivascular tumors

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**Core Tip:** We describe a case of glomangiomas with many nodular masses in the soft tissues of the right foot and calf, presented by a 55-year-old woman. Pigmented villous nodular synovitis was observed *via* imaging. Microscopically, nested vascular globular cells around the blood vessel wall were observed. After resection, there was no recurrence during the one-year follow-up. Although growth may be diffuse or infiltrating and invasive, glomangiomas does not meet the identifying standards for malignant glomus tumors.

## **INTRODUCTION**

The 2020<sup>2</sup> World Health Organization (WHO) Classification of Tumors of Soft Tissue and Bone<sup>[1]</sup> (Fourth Edition) defined glomus tumor as a mesenchymal tumor in normal glomus, with cells resembling modified smooth muscle cells. Glomus tumor may be classified as benign, intermediate glomangiomas (also known as diffuse glomus tumor), or malignant (ICD-O:8711/0, ICD-O:8711/1, and ICD-O:8711/3, respectively). Glomus tumors account for fewer than 2% of soft tissue tumors, and glomus hemangioma disease makes up 5% of glomus tumors.

Glomangiomas is very rare but occurs most often in young people, in the distal extremities. It is multiple, deep, wide ranging, and often causes pain. The lesions can recur after resection. The tumor shows diffuse growth, with an overall structure that is

similar to angiomatosis, except that the vessel wall is surrounded by nests of glomus cells.<sup>[2]</sup> Although it may be diffuse or infiltrative and aggressive, it lacks the standard morphology of malignancy.

## **CASE PRESENTATION**

### ***Chief complaints***

A 55-year-old female presented with idiopathic pain in the dorsum of the right foot and lateral leg, of more than 2 mo.

### ***History of present illness***

There was no obvious cause for pain on the back of the right foot and the outside of the lower leg for more than 2 mo. But when the pain was severe, it affected movement of the affected limb.

**1**

### ***History of past illness***

The patient had no significant medical history.

### ***Personal and family history***

The personal and family history did not reveal any problems.

### ***Physical examination***

Physical examination revealed pigmentation of about 6 × 6 cm on the right foot dorsum, with a clear boundary and pain upon pressure; local pressing pain on the lateral side of the right leg; limited ankle joint activity; good peripheral blood supply; and normal sensation. During surgery, many nodular masses around the ankle joint were observed, and the incision surface of the tumor was brown.

### ***Laboratory examinations***

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The prothrombin and partial thromboplastin times slightly low, and d-dimers were normal. The blood biochemistries and urinalysis were normal. The blood analysis, electrocardiogram, chest x-ray and arterial blood gas were also normal.

### *Imaging examinations*

Magnetic resonance imaging showed multiple nodules and soft tissue swelling around the right ankle, which was consistent with pigmented villonodular synovitis.

### *Pathological examination*

Pathological examination revealed grayish-yellow irregular tissues, with a total volume of  $7 \times 6 \times 1.5$  cm, with multiple nodules within. The largest was  $2.5 \times 1.5 \times 1.2$  cm, and the smallest was  $0.8 \times 0.7 \times 0.5$  cm. The section was grayish-white and grayish-yellow, and slightly tough (Figure 1). Under the microscope, the tumor cells in the fibrous connective tissue were nodular and lobulated, and the tumor cells grew around blood vessels. The blood vessels consisted of small arteries and veins, capillaries, and dilated veins showing diffuse hyperplasia (Figure 2A). With eosinophilic staining, the tumor cells appeared round or oval, uniform in size, with abundant cytoplasm and clear boundary. Necrosis and pleomorphism were absent. In the surrounding adipose tissue, a proliferation of oval cells adjacent to small vessels was observed, which was consistent with tumor cell morphology (Figure 2B). Mast cells were scattered in the stroma (Figure 2C).

Immunohistochemistry revealed diffuse immunoreactivity for smooth muscle actin (SMA, Figure 3), vimentin, type IV collagen, and Bcl-2. Caldesmon was weakly positive, CD34 was partially positive, and calponin was slightly positive. The Ki-67 value-added index was about 3%. Desmin, S-100, and HMB-45 were negative.

### **FINAL DIAGNOSIS**

The pathological diagnosis was glomangiomatosis of the right ankle joint.

## **TREATMENT**

Extended resection of the tumor.

## **OUTCOME AND FOLLOW-UP**

After the extensive resection, no recurrence was found at the 2-year follow-up and the prognosis was good.

## **DISCUSSION**

<sup>5</sup> The 2020 World Health Organization (WHO) Classification of Tumors of Soft Tissue and Bone (Fourth Edition) defined glomus tumor as a mesenchymal tumor in normal glomus, with cells similar to modified smooth muscle cells. Glomus tumor may be classified as benign, intermediate glomangiomas (also known as diffuse glomus tumor), or malignant (ICD-O:8711/0, ICD-O:8711/1, and ICD-O:8711/3, respectively). Glomus tumors account for fewer than 2% of soft tissue tumors, and glomus hemangioma disease makes up 5% of glomus tumors.<sup>[1]</sup>

Glomangiomas are very rare but occur most often in young people, in the distal extremities. It is multiple, deep, wide ranging, and often produces pain. The lesions can recur after resection. The tumor shows diffuse growth, with an overall structure that is similar to angiomas, except that the vessel wall is surrounded by nests of glomus cells.<sup>[2]</sup> Although it may be diffuse or infiltrative and aggressive, it lacks the standard morphology of malignancy.

Due to its rarity, only 15 clinicopathological analyses have been reported in the Chinese and English literature <sup>[2-11]</sup> (Tables 1, 2). Among a total of 16 patients, 5 and 11 were women and men, respectively. The average and median ages were 32 and 31.5 years. Eleven and 3 cases (68.75% and 18.75%) involved the lower and upper limbs. Other sites (25%) included the head and neck, chest wall, and paravertebral region. Unlike classic glomus tumor, none of these tumors were found under the nail, but mostly in the hand, wrist, and foot, and the location was deep. The sizes of the lesions ranged from 1.5 to 22 cm. Therefore, glomangiomas are larger than glomus tumor,

with extensive lesions and deep location, [2-11] and all cases were infiltrative. In the present case, lesions were on the back of the right foot and the outer side of the calf, and ranged from 0.8 to 2.5 cm in diameter. The deep location and clinical and imaging considerations led to a diagnosis of pigmented villous nodular synovitis.

Unlike classic glomus tumor, there have been no reports of symptoms related to glomangiomas in childhood, although the possibility cannot be ruled out. If perhaps it is present in childhood, nevertheless symptoms do not develop until early adulthood. Pain is an obvious symptom of the disease.[3, 4]

Histologically, the overall structure of glomangiomas resembles diffuse angiomatosis, except that in the former, glomus cells surround blood vessels. Among the 16 reported cases, all showed a diffuse and infiltrative growth pattern. Skeletal muscle infiltration was observed in 5 cases, and extensive nerve and peripheral invasion was seen in one case. However, some authors suggest that the glomus cells and angiomatosis components in glomus hemangioma, often accompanied by adipose tissue, is a sign of mesenchymal proliferation, and not simple glomus cell proliferation.[3, 10] Further study is necessary to determine whether adipose is one of its components or whether it infiltrates into the adipose tissue.

Fan *et al* [9] reported a case of glomus angiomatosis in a 33-year-old man who showed multiple glomus angiomatosis on the medial right foot and right lower leg. The patient developed repeated pain in the right ankle during 2 years, worsening in the week before presentation. Immunohistochemistry was positive for SMA and negative for CD34. Fitzhugh *et al* [10] reported a 33-year-old man with a mass on the distal right calf. Immunohistochemistry showed that the tumor cells were diffusely and strongly positive for SMA, and the vascular components were strongly positive for CD31 and CD34. In the current case, the tumor cells are diffusely and strongly positive for SMA, and negative for CD31 and CD34, which is consistent with the immunohistochemical expression of the above cases.

Masson proposed in 1924 that glomus angiomatosis may be caused by the overgrowth of normal globular cells.[11] Glomus tumor is a kind of interstitial tumor



composed of variant smooth muscle cells similar to normal blood vessels. Glomus cells are located around the wall of the small bulb arteriovenous anastomosis. They are a variant of smooth muscle cells. Pericytes include vascular glomus cells. Pericytes were first discovered by Rouget in 1873 and further described by Zimmerman in 1923.<sup>[3]</sup> Most glomus hemangioma clinically manifests as small benign tumors, most often found in the dermis of the hand, especially in the subungual area, and distributed throughout the body. Most globular tumors have occurred at all ages.

Glomangiomas are a rare type of glomus tumor. Its overall structure resembles diffuse hemangioma, but the vessel wall surrounds the nest bulb cells. Combined with histological morphology and immunohistochemical staining of SMA and collagen IV, a diagnosis of glomus hemangioma is not difficult. The disease may be differentiated from other suspects by the characteristic features of each, as follows. For example, epithelioid angiolipoma is composed of blood vessels, smooth muscle, and fat. The tumor cells immunohistochemically show the presence of HMB45 and MelanA.<sup>[10]</sup> In paraganglioma, the tumor cells are arranged in an organ-like structure, and the stroma is rich in capillaries. Synaptophysin and chromogranin A can be observed in the main cells, while Sertoli cells show S-100 protein, but not SMA.<sup>[1]</sup> The cells in malignant glomus tumor are heteromorphic, and the mitosis is pathological. Angiomas are composed of blood vessels of different sizes, but globular angiomas are surrounded by spheroid cells around the blood vessel wall, while the former is not surrounded by spheroid cells.

Studies of the molecular genetics of glomangiomas mainly focus on multiple familial cases. These studies show an autosomal dominant hereditary disease, caused by an inactivation mutation of the gene that encodes glomulin (GLMN) in the short arm of chromosome 1. It is possible that there is a family history of glomus angiomas, because genetic studies have revealed the truncation of the globulin gene on chromosome 1p21-22, and 4 germline mutations have been found.<sup>[11]</sup> However, there are also cases reported in which there was no familial genetic predisposition.



The treatment of glomangiomas is surgical resection. Although glomangiomas grow diffusely, conservative treatment is still advocated.<sup>[3]</sup> Local recurrence is related to the difficulty of resection. Zhou *et al*<sup>[3]</sup> retrospectively analyzed 11 cases of glomus tumors at home and abroad: 3 cases were not completely resected, 5 had positive margins at the first operation, 5 recurred after surgery, and 1 relapsed 6 times during 14 years. The patient described in the present article was followed for 1 year after resection and no recurrence was found. Since the tumors in some cases were palliatively removed, glomangiomas should be regarded as a persistent disease rather than local recurrence. Therefore, complete resection of the mass is the most important prognostic factor. Due to the small number of known cases, the effect of adjuvant therapy is uncertain.

## CONCLUSION

Glomangiomas are very rare but occur most often in young people, in the distal extremities. Its overall structure resembles diffuse hemangioma, but the vessel wall surrounds the nest of cells. Multiple nodules in glomangiomas are even rarer. The treatment of glomangiomas is surgical resection.

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