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A Rare Case of Glomus Tumour on the Knee: Case Report and Literature Review

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Abstract

We present a case of glomus tumour of the knee in an 82-year-old Japanese woman. The patient noticed a painful eruption on her right knee 6 years before our first examination. At first examination, a well-defined, subcutaneous, elastic, firm nodule 1 cm in diameter was present over the central portion of the patella. The lesion was easily surgically removed in block. On gross examination, the excised lesion was a well-defined smooth-surfaced mass measuring 8 mm × 6 mm × 5 mm. Histological and immunohistochemically findings for the nodule were consistent with the diagnosis of glomus Tumour. Pain was resolved immediately postoperatively. As of the last follow-up, 5 months postoperatively, the patient reported continued relief from pain. We summarized reported 29 cases of glomus Tumour of the knee, including the present case. Our summary revealed that glomus Tumours can develop in the knee in various anatomical sites, including the skin, deep adipose tissue, muscle, quadriceps tendon, and Hoffa's fat pad.

Keywords: Glomus tumour; Knee; Pain; Smooth muscle actin; Subcutaneous

Introduction

Glomus tumour is an uncommon benign hamartoma derived from the glomus body [1-4]. This Tumour is most often found in the skin, particularly the subungual region and palm, followed by the foot and forearm. However, glomus Tumour can occur within a wide anatomical distribution, including rarely in mucosa and internal organs [5,6]. We present herein a rare case of glomus Tumour on the knee skin, and review reported cases of glomus Tumour of the knee.

Case Report

An 82-year-old Japanese woman presented with a 6-year history of a tender, subcutaneous eruption on the right knee. Physical examination revealed a well-defined, subcutaneous, elastic, firm nodule 1 cm in diameter over the central portion of the patella (Figure 1a). The skin surface was slightly elevated, with a very slight purplish hue. The patient reported no history of injury to the knee. The lesion was easily surgically removed en bloc from the dermis under local anaesthesia. On gross examination, the excised lesion was a well-defined smooth-surfaced mass measuring 8 mm × 6 mm × 5 mm (Figure 1b). Around half of the mass was purplish-gray and the remaining portion was brownish. The resected specimen was examined histologically. The whole specimen was surrounded by a connective tissue capsule (Figures 1c and 1d). Half of the specimen was occupied with a markedly enlarged vascular lumen filled with erythrocytes (Figure 1c). The other half portion was composed of solid sheets of small, uniformly shaped cells with eosinophilic cytoplasm and round or ovoid nuclei (Figures 1d and 1e). Various sized blood vessels were distributed in the cell sheets. Immunohistochemical studies revealed that the small, uniformly shaped cells were positive for α-smoot muscle actin (SMA) (Figure 1f), and negative for desmin, epithelial membrane antigen (EMA), S-100, and AE1/AE3 (data not shown). Based on these clinical and histopathological findings, the cutaneous lesion 4 was diagnosed as a glomus Tumour. Pain was resolved immediately postoperatively. As of the last follow-up, 5 months postoperatively, the patient reported continued relief from pain.

Discussion

Including the present case, a total of 29 cases of glomus Tumour of the knee have been described in the English literature (Table 1).

The mean age of patients was 52.8 years (range: 17-82 years), markedly higher than that for glomus Tumour overall (young adults in the third and fourth decade of life). 3 Our patient was the oldest among the 29 cases reported. Men were affected much more often than women (male-to-female ratio, 23:6), contrasting with the clear female predilection for subungual glomus Tumour, which is a major clinical type of glomus Tumour. 3 Concerning which knee was affected, no difference in laterality was apparent (right-to-left ratio, 15:11; information on laterality was unavailable in Patients 10, 16, and 22). In all except 4 cases, the lesions were located on the anterior side of the knee, such as the patella, medial joint line and lateral side of the knee, while 4 patients (Patients 2, 4, 8, and 25) had lesions on the posterior side of the knee. The depth of lesions was described in 24 cases (information on histological location of the Tumour was absent for Patients 2, 4, 8, 13, 15, 25, and 27). Generally (18 cases), lesions were located in the skin, including the dermis (Patient 29), subcutaneous tissue (Patients 1, 3, 5, 6, 7, 10, 11, 12, 14, 16, 17, 18, 21, 22, 24, 26), and subcutaneous tissue~outside the skin (Patient 19). All cases with lesions in the skin were accompanied by changes in surface skin condition, such as swelling, subcutaneous nodule, and papule. No lesions except that in Patient 19 developed outside the skin surface. In Patient 19, the Tumour developed outside the skin, showing mushroom-like appearance. On the other hand, in some cases, lesions were located deep within the knee joint, such as between

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the hamstring muscle bellies (Patient 8), beneath the plica synovialis (Patient 9), in the Hoffa's fat pad (Patient 20), in the suprapatellar fat pad (Patient 23), and in the quadriceps 5 tendon (Patient 28). In those cases, no surface skin change was apparent. Tumour size was variable, ranging from 4-5 mm (Patients 6 and 15) to 60 mm × 50 mm × 50 mm (Patients 10 and 24). Most patients (20 of the 27 cases for which information of the department in which the patient was treated was available) were examined in a department of orthopedic surgery using imaging modalities including plain radiography, magnetic resonance imaging (MRI), and arthroscopy. Only two patients (Patients 4 and 29) were treated in a department of dermatology. All except Patient 4 reported pain over a relatively long period (mean duration, 6.5 years).

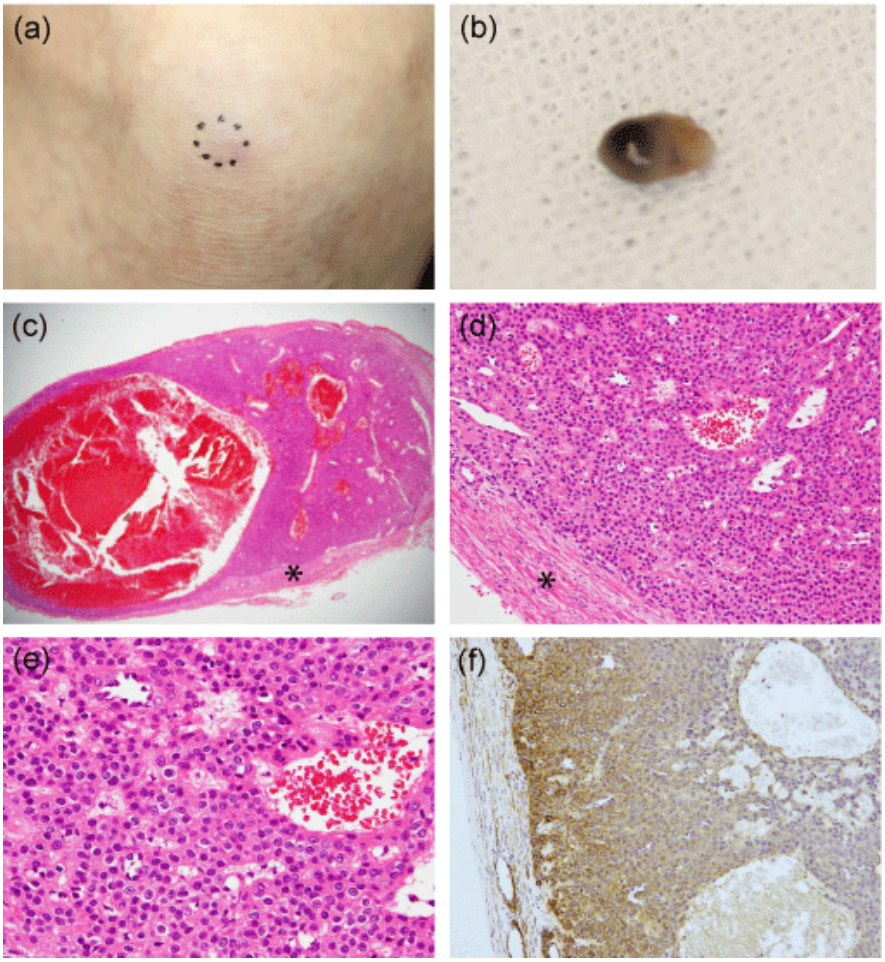

Figure 1: a, b) Clinical appearance of the skin lesion. A well-defined, intradermal, elastic, firm nodule of 1.0 cm in diameter over the central portion of patella (a). The skin surface is slightly elevated and shows a very slightly purplish hue (b). c–f) Histopathological findings for the excised nodule. The nodule is surrounded by connective tissue capsule (c, d). The half portion of the specimen is occupied with a markedly enlarged vascular lumen filled with erythrocytes (c). The other half portion is composed of solid sheets of small uniform cells with eosinophilic cytoplasm and round or ovoid nuclei, interspread with various-sized vascular channels (d, e). (c: hematoxylin and eosin, original magnification X20; d: hematoxylin and eosin, original magnification X100; e: hematoxylin and eosin, original magnification X200). By immunohistochemistry, the small uniform cells are immunoreactive for α-SMA (f) (original magnification X100).

Patient number	Age, sex	Location	Size (method for measuring the size)	Department in which patient was treated	Imaging modality used for diagnosis	Surface skin condition	Pain (duration)	Gross appearance of the excised specimen	Histological finding	Treatment and ioutcome	Others	Ref. (year)
1	69, F	Medial and lower border of left patella	30 mm (Physical examination)	Rheumatology	• Plain radiograph	A warm, purplish swelling	+(13 years)	• A solid,well encapsulated tumor 3.6 cm in diameter in the subcutaneous tissue	• Glomus tumor • Glomus cells of varying size, which are uniform and intimately connected with the numerous vascular structures	Surgical resection → Resolution of the pain	No history of trauma	(1966) [7]
2	54, M	Right popliteal fossa	ND	Orthopedic surgery	ND	ND	+(ND)	• Small nodule in adipose tissue	Glomus tumor	Surgical resection → ND	Seven glomus tumors developed between 24 to 54 years old in right popliteal fossa and right leg.	(1982) [1]

3	49, M	Superpatellar region of right knee	10 mm (Physical examination)	Plastic and reconstructive surgery	None	A boggy 1 cm mobile mass deep within the subcutaneous fat tissue	+(3 years)	A 1 cm well-defined, soft, oblong, pink mass	• Glomangioma • The tumor is composed of large vascular sinusoids lined by a monolayer of endothelial cells beneath which there is a littoral arrangement of one to several layers of small, uniform, round cells with pink, occasionally vacuolated cytoplasm lying in a dense collagenous stroma. • Positive immunostaining for vimentin and negative immunostaining for CEA, EMA, S-100 and CAM5.2.	Surgical resection → Resolution of the pain		(1993) [2]
4	52, M	Behind left knee	12 mm (Physical examination)	Dermatology	None	A cystic mobile papule	-	ND	Glomus tumor (probably in the subcutaneous tissue)	ND	• No description on the histological location of the tumor • There was another glomus tumor on the left thigh.	(1994) [8]
5	73, M	Medial joint line of right knee	50 mm (finding at operation)	ND	• Plain radiograph • Arthroscopy • MRI	A small, palpable, exquisitely tender swelling	+(3 years)	5 cm grey/ white, narrow tubular lesion in the subcutaneous tissue	Glomus tumor	Surgical resection → ND	• Decreased range of motion in the knee(-) • Medial joint line osteoarthritis and chondrocalcinosis	(2002) [9]
6	54, M	Lateral side of left knee	5 mm (MRI)	Orthopedic surgery	• Plain radiograph • MRI	ND	+(3 years)	A roundish, well-defined, smooth-surfaced, soft, pink mass, 7 × 6 × 4 mm in size, in the subcutaneous tissue	• Glomus tumor • Clumps of glomus cells varying in size, intimately connected with numerous vascular structures	Surgical resection → Resolution of the pain	No history of trauma	(2004) [10]
7	53, M	Just below medial joint line of left knee	20 ×15 mm (MRI)	Orthopedic surgery	• Plain radiograph • MRI	A1 cm purple-colored, soft, and extremely tender swelling	+(20 years)	The tumor was 20 × 10 × 20 mm in size and was localized to the subcutaneous tissue surrounded by a brown connective tissue capsule.	• Glomus tumor • Positive immunostaining for actin and vimentin and negative immunostaining for desmin and S-100	Surgical resection →Resolution of the pain	• The pain appeared after a fall on his leg. • Difficulty in walking (+) • Decreased range of motion in the knee(+)	(2006) [11]
8	57, F	Posterior aspect of left knee	ND	Orthopedic surgery	• Plain radiograph • MRI • arteriogram	No palpable mass	+(6 months)	ND	• Malignant glomus tumor • Cords of epithelioid glomus cells with amphophilic-to-clear cytoplasm and uniform round nuclei in hyalinized stroma separated from the vessels • Areas of typical benign glomus tumor are surrounded by malignant glomus tumor with mitosis and atypia. • Positive immunostaining for SMA.	ND	• History of excision of a left popliteal soft tissue mass 35 year earlier • MRI demonstrated two nodular masses in the popiteal fat and two nodular masses between the hamstring muscle bellies. • Difficulty in walking (-) • Decreased range of motion in the knee(-)	(2007) [12]

9	33, M	Lateral side of right knee	6 × 12 × 16 mm (Direct measurement of the resected tumor)	Orthopedic surgery	• Plain radiograph • MRI • CT scan • Arthroscopy	No palpable mass	+(10 years)	The tumor was present beneath the plica synovialis and had a red aspect, and was a roundish, soft, well limited mass measuring 6 × 12 × 16 mm.	Glomangioma	Surgical resection →Resolution of the pain	• No history of trauma • Difficulty in walking (+) • Decreased range of motion in the knee(-)	(2007) [13]
10	71, M	Patella (No information on right or left knee)	60 × 50 × 50 mm (Direct measurement of the resected tumor)	Pathology	None	A tender sub-cutaneous swelling over the patella	+(Several years)	A subcutaneous, well-circumscribed mass, 60 × 50 × 50 mm, fixed to the patella	• Glomus tumor with uncertain malignant potential • Focal marked nuclear atypia • The tumor is composed of solid sheets of uniform, small round to short spindle cells interspread with various-sized vessels, some with a hemangiopericytoma-like configuration. • Tumor cells have round to ovoid nuclei with small or indistinct nucleoli, and slightly eosinophilic cytoplasms with distinct cell border. • The tumor cells display focal transition from typical glomus cells to elongated cells resembling smooth muscle. • Some areas show marked pleomorphism, hyperchromatia and hypercellularity. • There is No atypical mitotic figures. • Positive immunostaining for SMA, type IV collagen and H-caldesmon and negative immunostaining for cytokeratin, AE1/AE/3, S-100, CD99, desmin and EMA.	Surgical resection →ND	No history of trauma	(2008) [14]
11	69, M	Above the edge of the proximal medial quadrant of the right patella	10 × 10 mm (Direct measurement of the resected tumor)	Orthopedic surgery	None	A soft and bluish mass was visible.	+(5 years)	• A bluish mass, 10 ×10 mm in size, with visible capillaries passing through in a stellate arrangement, possibly in the subcutaneous tissue	Glomangioma	Surgical resection→ Resolution of the pain	• The pain appeared 3 years after trauma to the patella. • Difficulty in walking (-) • Decreased range of motion in the knee(-)	(2008) [15]
12	48, F	Medial side of the tibial tuberosity of the right knee joint	23 × 10 × 20 mm (Ultrasound scan)	Orthopedic surgery	• Plain radiograph • Arthroscopy • Ultrasound scan	Normal	+(3 years)	A highly vascular 15 × 20 mm mass which was bluish in color, had the consistency of jelly, and had visible blood vessels traversing, possibly in the subcutaneous tissue	• Glomangioma • Numerous mononucleated glomus cells with pale and eosinophilic cytoplasm and a large central round or uniform oval nucleus and focal edematous stroma • Positive immunostaining for SMA and desmin and negative immunostaining for chromogranin.	Surgical resection→ Resolution of the pain	• The pain appeared 3 years after the patient twisted the knee. • Decreased range of motion in the knee(+)	(2008) [15]
13	47, M	Medial aspect of the right knee	8 × 5 mm (Direct measurement of the resected tumor)	Orthopedic surgery	• Plain radiograph • Ultrasound scan	No palpable abnormality	+(1 year)	An encapsulated, reddish-brown, fleshy tumor measuring 8 × 5 mm	• Glomus tumor • Rounded glomus cells and vascular structures • Association with a well defined nucleus “set off from the amphophilic or eosinophilic cytoplasm”.	Surgical resection→ Resolution of the pain	• No history of trauma • No description on the histological location of the tumor	(2009) [16]

14	65, M	Lateral aspect of the right knee	18 mm (Ultrasound scan)	Orthopedic surgery	• Plain radiograph • Ultrasound scan	Uniform swelling, 2.5 cm in size	+(10 months)	A well-defined 15 × 15 × 12 mm reddish, fleshy lesion weighing 3 g in the subcutaneous tissue	Glomus tumor	Surgical resection Resolution of the pain	• No history of trauma • No description on the histological location of the tumor	(2009) [16]
15	60, M	Anterior aspect of the right knee	4-5 mm (Direct measuring the resected tumor)	Orthopedic surgery	• Arthroscopy • Plain radiograph	A small infrapatellar bursa, 1.5 to 2 cm in diameter	+(4 years)	A 4-5 mm fleshy mass	• Glomus tumor • Glomus cells with eosinophilic cytoplasm and large pale round uniform nuclei • A surrounding fibrous capsule with numerous vascular channels	Surgical resection→ Resolution of the pain	• No description on the histological location of the tumor	(2009) [16]
16	65, M	Supero-lateral aspect of the patella (No information on right or left knee)	20 × 8 × 4 mm (Direct measurement of the resected tumor)	Orthopedic surgery	•Weight-bearing radiograph	A small area of localized swelling	+(ND)	A subcutaneous olive-sized lesion measuring 20 × 8 × 4 mm	• Glomus tumor • Fibro-fatty tissue with focal areas of glomus cell and vascular spaces of varying sizes	Surgical resection→ Resolution of the pain	• No history of trauma	(2009) [16]
17	72, M	Anterolateral aspect of the left knee joint	10 mm (Ultrasound scan)	ND	• Plain radiograph • Ultrasound scan	ND	+(1 year)	The mass was localized to the subcutaneous tissue and had a well-defined fusiform shape and a bluish hue with a small feeding vessel.	• Glomus tumor • 10 mm × 8 mm × 8 mm tumor with a thick fibrous capsule, with numerous dilated capillaries surrounded by sheets of small uniform round cells with round nuclei	Surgical resection→ Resolution of the pain	• The pain appeared 1 year after total knee replacement for osteoarthritis. • The lesion was present near the scar caused by the operation for osteoarthritis but did not involve the scar.	(2009) [17]
18	75, M	Inferior border of the left anterior knee	15 mm × 11 mm × 20 mm (MRI)	Orthopedic surgery	• Plain radiograph • MRI	A soft, mobile, red-purple colorectal lesion, measuring 2 × 2 cm	+(30 years)	A well-circumscribed mass in the subcutaneous tissue	• Glomangioma • Glomus cells with uniform, oval-round shaped nuclei, large eosinophilic cytoplasm, and vascular structures	Surgical resection→ Resolution of the pain	• Decreased range of motion in the knee(-)	(2010) [18]
19	10, M	Medial aspect of the right knee	• 50 mm (Physical examination • 65 × 35 × 15 mm (MRI)	Pediatric orthopedics	• Plain radiograph • MRI	A 5 cm round, well-circumscribed mobile mass	+(2 weeks)	• After the incisional biopsy, the tumor developed outside the skin and became mushroom-like	Glomus tumor	Surgical resection→ Resolution of the pain	• The pain appeared after a fall on his leg.	(2012) [19]
20	42, F	Inferior aspect of the patella in Hoffa's fat pad of the right knee	10 × 10 mm (MRI)	Orthopedic surgery	• Plain radiograph • MRI • Arthroscopy	• Plain radiograph • MRI • Arthroscopy	+(1 year)	A pedunculated 8 × 5 mm reddish-brown nodule arising from Hoffa's fat pad	• Glomus tumor • A well-circumscribed, encapsulated lesion composed of hyalinized variably sized blood vessels lined by flattened endothelium with the perivascular region showing a solid proliferation of monomorphic round to oval cells with fine chromatin, inconspicuous nucleoli and moderate cytoplasm • Positive immunostaining for SMA	Arthroscopic excision→ Resolution of the pain	-	(2013) [20]
21	51, M	Lower lateral portion of the left knee	ND	Orthopedic surgery	• Plain radiograph • MRI • Ultrasound scan	A small, faint reddish macule	+(8 years)	The mass was localized to the subcutaneous tissue	• Glomangioma • Round glomus cells with lightly stained cytoplasm and uniform, centrally located oval nuclei • A prominent vascular component • Positive immunostaining for SMA	Surgical resection→ Resolution of the pain	-	(2014) [21]

22	63, M	Anterior aspect of the knee superficial to the patellar tendon (No information on right or left knee)	22 × 11 mm (Ultrasound scan)	Orthopedic surgery	• Plain radiograph • Ultrasound scan	A well-defined subcutaneous, mobile mass	+(30 years)	The mass was subcutaneous, well defined and extended down to the level of the patellar paratenon with no intra-articular extension.	• Glomus tumor • Positive immunostaining for SMA	Surgical resection→ Resolution of the pain		(2014) [22]
23	51, M	Medial aspect of the supra-patellar fat pad of the right knee	7 mm (MRI)	Orthopedic surgery	• Plain radiograph • MRI • Arthroscopy • Ultrasound scan	ND	+(10 years)		• Glomus tumor • Well-circumscribed homogenous and vascular nodule located in suprapatellar fat pad • Characteristic round cells, with eosinophilic cytoplasm, round and mostly central nuclei, and the accompanying blood vessels in a myxoid/hyaline stroma • Positive staining for caldesmon and SMA	Surgical resection→ Resolution of the pain	• The pain began following a single episode of low-level trauma. • Difficulty in walking (+) • Decreased range of motion in the knee(+)	(2015) [23]
24	49, M	Anteroinferior aspect of the left knee	• 60 × 50 × 50 mm (Physical examination) • 64 × 59 × 41 mm (MRI)	Surgery	• Plain radiograph • MRI	The mass demonstrated small areas of ulceration and surrounding erythema and warmth.	+(1 year)	A gray/brown multinodular, encapusulated, and hemorrhagic mass measuring 55 × 43 × 27 mm in the prepatellar subcutaneous fat	• Glomangioma • A monomorphic population of small, round, eosinophilic cells with minimal atypia with positive staining for SMA and negative staining for cytokeratin, S-100, and CK-34	Surgical resection→ Resolution of the pain	• The patient was a diesel mechanic and spent many hours on his knee and had multiple episodes of minor penetrating injuries to the area. • Decreased range of motion in the knee(+)	(2015) [24]
25	17, M	Left popliteal fossa	5 mm (MRI)	Orthopedic Surgery	• MRI	No palpable mass	+(3 years)	A 5-mm well-circumscribed bluish-red nodule	• Glomus tumor • The tumor comprised vascular, smooth muscle and neural components, as well as solid sheets of glomus cells. • The tumor cells were positive for a-SMA and negative for desmin.	Surgical resection→ Resolution of the pain	• Difficulty in walking (+) • Decreased range of motion in the knee(+) • No description on the histological location of the tumor	(2016) [25]
26	38, M	Anterior-upper side of the patella of right knee	7 × 3 mm (MRI)	Orthopedic Surgery	• Plain radiograph • MRI	A small whitish nodule, measuring 10 mm in diameter, not attached to deep planes	+(16 months)	A small rounded mass, well delineated, encapusulated and purplish in the subcutaneous tissue	Glomus tumor	Surgical resection→ Resolution of the pain	No history of trauma	(2016) [26]
27	40, F	Anteriorla-teral part of the left knee	• 8 mm (Physical examination) • 4 mm (MRI)	Orthopedic surgery	• Plain radiograph • MRI	A small, firm and mobile nodule without inflammatory signs next	+(14 months)	A small and well-circumscribed whitish mass	Glomus tumor	Surgical resection→ Resolution of the pain	• No history of trauma • No description on the histological location of the tumor	(2016) [26]
28	22, M	Lower end of the right thigh	18 × 10 mm (Doppler ultrasound)	Orthopedic Surgery	• Plain radiograph • Doppler Ultrasound	No palpable mass	+(4 years)	A tumor measuring 18 × 10 mm, brownish, encapsulated in the quadriceps tendon	Glomus tumor	Surgical resection→ Resolution of the pain	• No history of trauma	(2016) [26]
29	82, F	Center of the right patella	10 × 9 × 2 mm (Physical examination)	Dermatology	None	Slightly elevated subcutaneous nodule with purplish surface skin	+(6 years)	A brown to purplish-gray and encapusulated mass measuring 8 × 6 × 5 mm in the dermis	• Glomus tumor • The tumor cells were positive for a-SMA, and negative for desmin, CD34, EMA, S-100 and AE1/AE3.	Surgical resection Resolution of the pain	• No history of trauma	Present case
ND: Not Described; CEA: Carcinoembryonic Antigen; EMA: Epithelial Membrane Antigen; MRI: Magnetic Resonance Imaging; SMA: Smooth Muscle Actin; CT: Computed Tomography												

Table 1: Summary of Reported Cases of Glomus Tumour of the Knee.

In most patients, the pain was very severe. For example, Patient 3 described intense pain even on insignificant friction from clothing. In Patient 6, the pain was so severe that he suddenly woke from sleep when bedclothes touched the affected knee. Furthermore, difficulty with walking and/or decreased range of motion in the knee was also observed in some cases. Histopathologically, most lesions were diagnosed as glomus Tumour (21 cases) or glomangioma (7 cases). In the case of Patient 8, the Tumour was diagnosed as malignant glomus Tumour. Immunohistochemcally, lesions were commonly positive for SMA when the immunostaining for this antigen was examined. In addition, lesions in some cases showed positive staining for vimentin (Patients 3, 7, and 29), caldesmon (Patients 10 and 23), and type IV collagen (Patient 10). Concerning desmin, controversial results were obtained. Specifically, the lesion in Patient 12 stained positively for desmin, while lesions in Patients 25 and 29 showed negativities for this antigen. In all cases with benign glomus Tumours and glomaniomas associated with pain, the pain disappeared after resection of the Tumour. In cases where history of injury to the knee was examined, no history of injury to the knee was elicited in 11 cases (Patients 1, 6, 9, 10, 13, 14, 16, and 26-29). Conversely, trauma or mechanical stimulation was suggested to be involved in the development of the lesion in 7 cases (Patients 7, 11, 12, 17, 19, 23, and 24). Our summary of 29 cases of glomus Tumour of the knee revealed that glomus Tumours can develop in the knee in various anatomical sites, including the skin, deep 6 adipose tissue, muscle, quadriceps tendon, and Hoffa's fat pad. In addition, most patients with glomus Tumour in the knee first visit a department of orthopedic surgery, not a department of dermatology, even when the lesion is accompanied by surface skin changes. This is perhaps because the lesions were situated in deep subcutaneous tissue and were associated with pain, which may make patients think that the lesions are related to the knee joint. However, based on our summary, we would like to emphasize that dermatologists should be aware that glomus Tumour can occur in the skin and consider this Tumour as a differential diagnosis when encountering a patient with a subcutaneous nodule associated with pain.

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