




Painful suprapatellar mass

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Discussion

Ultrasound examination of the left knee demonstrated a 11 × 11 × 5 mm well-circumscribed hypoechoic subcutaneous mass with central tiny cystic space superficial to the quadriceps tendon (Fig. 1a). Spectral Doppler showed marked vascularity and ‘vascular stalk sign’. Arterial flow and to a lesser degree venous flow were demonstrated (Fig. 1b). The mass was non-compressible and very tender during assessment. On magnetic resonance imaging (MRI), it was T1W hypointense, T2W hyperintense and avidly enhancing (Fig. 2a–c). Internal cystic change was observed. Full-thickness sagittal maximum-intensity-projection (MIP) image from the time-resolved MR angiography (MRA) showed early marked arterial enhancement (Fig. 3). Imaging features were suggestive of glomus tumor. Surgical excision of the mass was performed, and histological diagnosis of glomus tumor was confirmed (Fig. 4). Knee pain had dissipated on follow-up.

Glomus tumor, first described by Masson in 1924, is a rare benign vascular tumor arising from the dermal neurovascular glomus body, which is a specialised arteriovenous anastomosis responsible for blood flow and thermoregulation of the skin [1]. It accounts for 1.6% of all soft tissue tumors, and is typically located at subungual region [2]. Extradigital glomus tumor (EDGT) comprises approximate 61% of all glomus tumors with a male–female ratio

of 4:1 [3]. The mean size of EDGT is 0.66 cm, with knee being the second most common location [3]. Classic triad of symptoms- paroxysmal pain, cold intolerance and exquisite tenderness to touch is noted in 63–100% of cases [3]. Absence of classical symptoms in EDGT makes diagnosis challenging.

Glomus tumours are generally considered benign with limited risk of recurrence. Malignant glomus tumour is exceedingly rare. Criteria for malignant glomus tumour, symplastic glomus tumor and glomus tumor of uncertain malignant potential have been proposed [4]. Recently, Specht et al. has eliminated size and location from the diagnostic criteria for malignancy [5].

On ultrasound, glomus tumor classically appears as a hypervascular oval circumscribed hypoechoic nodule. Small central cystic space has been described. Spectral Doppler demonstrates both venous and arterial intralesional flow [6]. ‘Vascular stalk sign’, describing the presence of prominent vascular flow connecting the lesion to the adjacent soft tissue, was found in 67% of the tumor [6]. Due to its high vascularity, glomus tumor is T2W hyperintense and avidly enhancing. T1W hyperintense signal represents haemorrhage. Typical MRA findings include early and marked arterial enhancement, and tumor blush in venous and delayed phase [7, 8]. MRA maybe the only sequence to depict small early tumor [8]. The treatment of choice is complete surgical excision. Recurrence of symptoms may suggest inadequate excision [3].

The imaging differentials for our case include slow-flow vascular malformation, neurogenic tumor and angioleiomyoma. Unlike glomus tumor, venous malformation is compressible and demonstrates only venous flow on spectral ultrasound. Phleboliths, fat components and fluid–fluid levels typically present in venous malformation are not found in glomus tumor [9, 10]. Neurogenic tumor has typical ultrasound appearance of neural thickening of the entering and exiting nerves [10]. It demonstrates pathognomonic ‘target’ and ‘split fat’ sign on MRI [9]. Classic colour Doppler appearance of angioleiomyoma is linear clustered vessels with convergence to one point [10]. On

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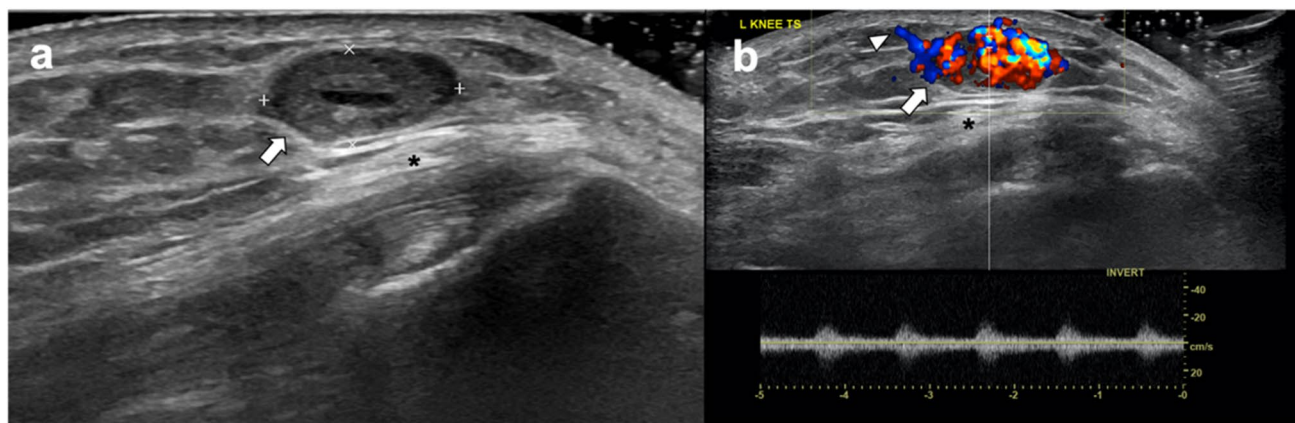


Fig 1 (a, b): Ultrasound images of the left knee. **a** Greyscale ultrasound shows a $1.1 \times 1.1 \times 0.5$ cm well circumscribed hypoechoic subcutaneous mass (arrow) with central tiny cystic space at the anterior knee superficial to quadriceps tendon (asterisk). **b** Doppler examina-

tion demonstrates internal hypervascularity, prominent vessel connecting the lesion (arrow) to adjacent soft tissue termed ‘vascular stalk sign’ (arrowhead). Spectral doppler demonstrates both arterial and to a lesser degree venous flow.



Fig 2 (a–c): MRI examination of the left knee. **a** Sagittal T1-weighted MRI image shows a 1.1 cm homogenous hypointense well circumscribed subcutaneous mass (arrow) at the pre-patellar region of left knee. **b** Sagittal T2-weighted, fat-saturated MRI image

shows that the mass (arrow) is T2W hyperintense with tiny internal cystic changes. Mild periphery subcutaneous edema is noted. **c** Sagittal T1-weighted, fat-saturated post-contrast MRI image shows vivid homogenous enhancement of the mass (arrow).

MRI, it is T1W isointense to muscle with typical T2W hypointense rim which represent fibrous capsule [9].

EDGT should be considered as a possible diagnosis when a painful hypervascular nodule demonstrates both arterial and venous flow on Spectral Doppler, and hyperintense T2W signal with early intense arterial enhancement on MRI. MRA is a sensitive tool which allows early diagnosis of small EDGT. Recognising the clinical and radiological features of EDGT is of paramount importance for correct diagnosis and early treatment.

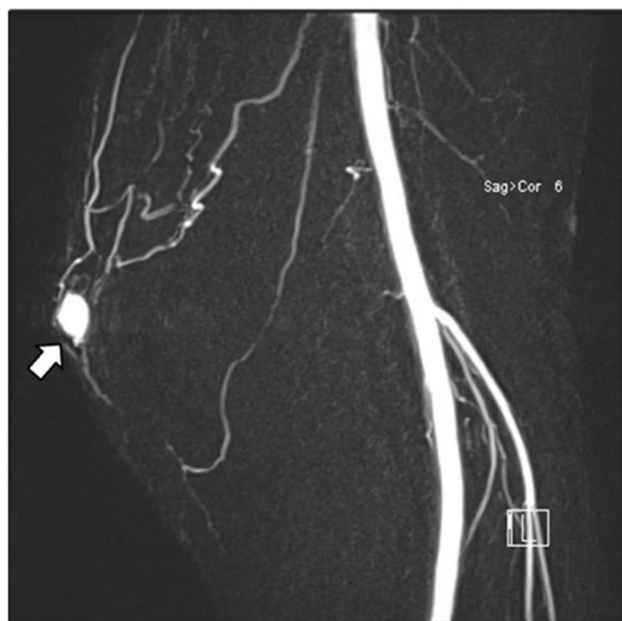


Fig. 3 Full-thickness sagittal maximum-intensity-projection (MIP) image from the time-resolved MR angiography (MRA) shows early and marked enhancement of the mass (arrow) in the arterial phase

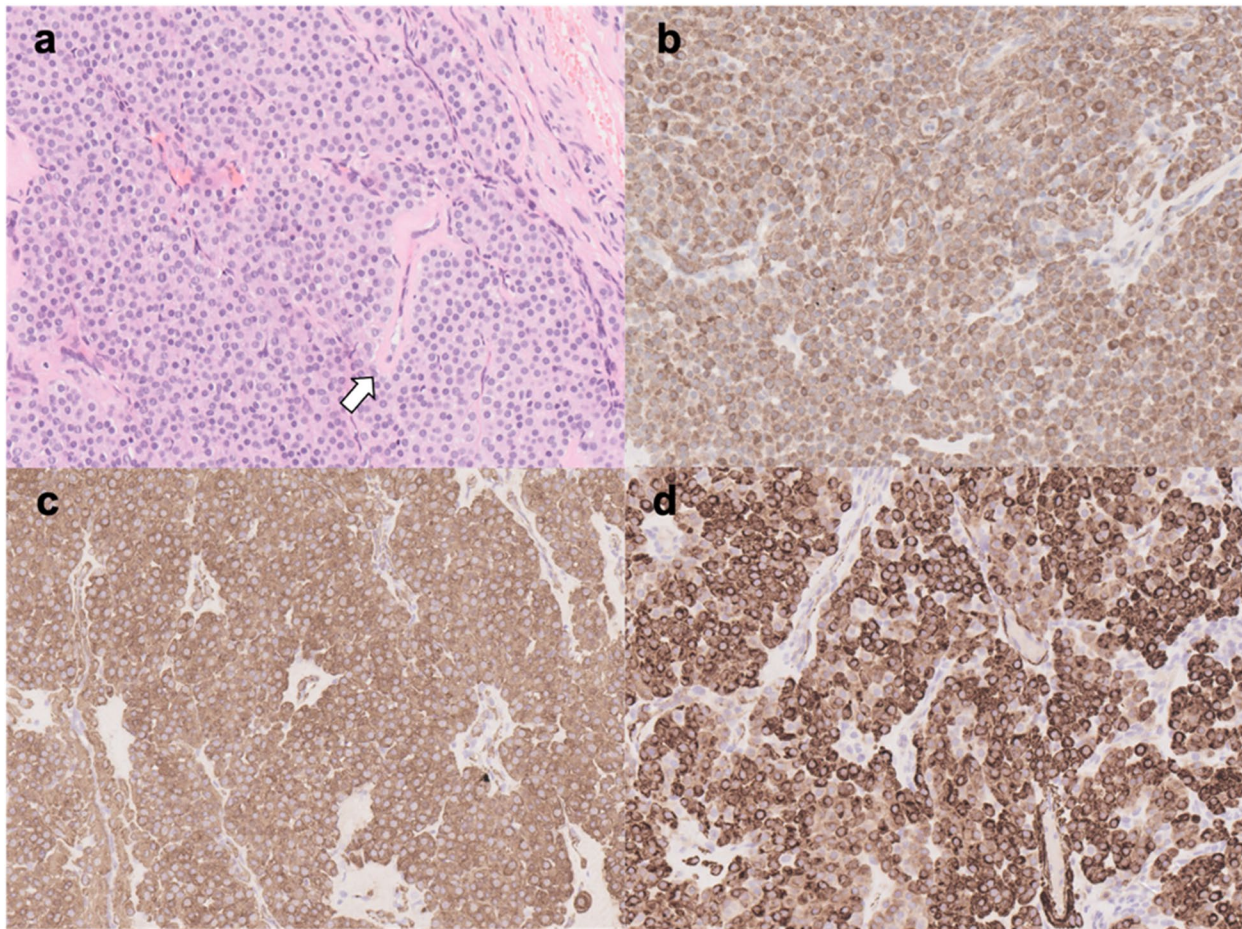


Fig 4 (a–d) Glomus tumor histopathology. **a** Haematoxylin and eosin stain shows characteristic round cells with round nuclei and moderate amount of eosinophilic cytoplasm traversed by capillary sized vessels

(arrow). Immunohistochemical stains were positive for **b** calponin, **c** actin and **d** h-caldesmon, as is typically seen in glomus tumors.

Declarations

Conflict of interest The authors declare no competing interests.

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