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Radiologically Suspected Tenosynovial Giant Cell Tumor of the Forefoot Presenting as a Large Ulcerated Plantar Mass: Imaging Findings, Differential Diagnosis and Diagnostic Challenges – A Case Report

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Case Report

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Abstract

Background

Tenosynovial giant cell tumor is a rare, usually benign but locally aggressive neoplasm of the synovium, bursae and tendon sheaths. Pedal involvement is uncommon, and a large ulcerated plantar mass can be mistaken for chronic infection or a sarcoma, particularly in regions where mycetoma is endemic. We report an unusual large ulcerated plantar forefoot presentation in which imaging suggested this tumor, while cytology showed spindle cell atypia.

Case presentation

A 40-year-old Sudanese man, previously a farm worker and later employed in mining areas, presented with a one-year history of a painless plantar forefoot nodule that gradually enlarged, became ulcerated with discharge and caused pain on walking and inability to wear footwear. He was febrile (39–41°C) with local warmth of the forefoot, and his blood pressure and heart rate were stable. Ultrasound showed a solid hypoechoic mass with minimal vascularity encasing the plantar aspect of the second toe, without collection or grains. Fine-needle aspiration of the 6 × 6 cm firm, fixed mass yielded bloody aspirate with spindle and oval cells, suggestive of a spindle cell neoplasm; culture grew Proteus species. Magnetic resonance imaging showed a large, well-defined, lobulated soft-tissue mass with low-to-intermediate T1 signal and heterogeneous T2 signal, reported as consistent with tenosynovial giant cell tumor. Because of the ulcerated, discharging lesion and the growth of Proteus species, he was treated empirically with oral co-trimoxazole and itraconazole. Biopsy and immunohistochemistry have not yet been performed because the patient is clinically stable; he remains under follow-up.

Conclusions

Tenosynovial giant cell tumor should be considered in a large, slowly growing plantar forefoot mass even when ulcerated and infected, including in mycetoma-endemic regions. Magnetic resonance imaging is the key imaging study, but cytological atypia and atypical clinical features mean that biopsy with immunohistochemistry is essential to exclude malignancy and infection before definitive treatment.

Background

Tenosynovial giant cell tumors (TGCT) are a group of typically benign lesions arising from the synovium of joints, bursae and tendon sheaths. They are classified by growth pattern as localized or diffuse (the latter formerly called pigmented villonodular synovitis) [1]. Although rare, TGCT is among the more common soft-tissue tumors of the foot and ankle [2]. It is driven by overexpression of colony stimulating factor 1 (CSF1), which recruits non-neoplastic inflammatory cells into the tumor mass [1, 3]. Because symptoms are non-specific, diagnosis is often delayed and the differential diagnosis is wide [4, 5]. Where mycetoma is endemic, as in Sudan [6], a chronic discharging foot mass is often presumed to be infective, which may delay recognition of a tumor.

We report a large ulcerated plantar forefoot mass in which magnetic resonance imaging (MRI) features were reported as consistent with TGCT, while cytology showed spindle cells with atypia. The case illustrates the diagnostic challenge of a rare tumor that mimics both infective and malignant lesions.

Case presentation

Patient information and history

A 40-year-old Sudanese man, presented with pain in the plantar aspect of the left forefoot. Two to two and a half years earlier he had worked in an agricultural area without any complaint. He then moved to work in mining areas, and about one year before presentation he noticed a very small, painless nodule on the plantar surface of the forefoot. It enlarged gradually over time and eventually became painful on walking but not at rest. He could no longer wear shoes or indoor footwear or walk long distances. A discharge from the lesion had been present for two months. There was no relevant past medical history and no family history of a similar condition.

Clinical findings

The lesion was a firm, fixed, ulcerated mass on the plantar surface of the left forefoot centred on the second toe, measuring approximately 6 × 6 cm. The patient was febrile, with body temperature ranging between 39 and 41°C, and the plantar forefoot was warm. Blood pressure was stable (110–120/65–80 mmHg) and the heart rate was stable and regular, without abnormality on examination. Pulsation could not be felt in the affected foot.

Timeline

Table 1
Timeline of the episode of care (times are relative to the first presentation)

Time	Event
About 2–2.5 years before presentation	Working in an agricultural area without any complaint
Subsequently	Moved to work in mining areas
About 1 year before presentation	Noticed a very small, painless nodule on the plantar surface of the left forefoot; gradual enlargement, later pain on walking and inability to wear footwear
About 2 months before presentation	Onset of discharge from the lesion
Presentation	Firm, fixed, ulcerated mass of about 6 × 6 cm; fever of 39–41°C and local warmth; ultrasound, fine-needle aspiration cytology, culture and MRI performed
After the diagnostic work-up	Oral co-trimoxazole and itraconazole started empirically, each for an intended duration of two months
Current status	Clinically stable and under follow-up; biopsy and immunohistochemistry not yet performed (no date set)

Diagnostic assessment

Ultrasound. A sizable soft-tissue mass with reduced echo pattern and minimal vascular flow was seen on the plantar surface of the second toe, extending into the first and second interdigital spaces. It caused irritation of the distal phalanx cortex without erosion. There was no collection and no grains. MRI was recommended.

Fine-needle aspiration (FNA) cytology. FNA of the fixed, firm, ulcerated 6 × 6 cm mass yielded bloody aspirate. Microscopy showed spindle and oval cells with coarse chromatin and occasional bizarre nuclei, without inflammation. The interpretation was suggestive of a spindle cell neoplasm, with biopsy and immunohistochemistry (IHC) advised.

Microbiology. Culture of the aspirate grew Proteus species (Table 2).

Table 2
Antimicrobial susceptibility of Proteus species isolated from the aspirate

Sensitive	Resistant
Ciprofloxacin	Cefepime
Levofloxacin	Ceftazidime
Piperacillin-tazobactam	
Co-trimoxazole	
Ceftriaxone	
Meropenem	
Imipenem	
Amikacin	
Amoxicillin-clavulanic acid	

Magnetic resonance imaging. MRI of the left forefoot (axial, coronal and sagittal T1, T1 Dixon, T2 and proton-density fat-suppressed sequences, with 3D maximum-intensity-projection reformats) showed a large, well-defined, lobulated soft-tissue mass in the plantar forefoot, centred on the second toe and extending into the adjacent interdigital spaces, with displacement of the neighbouring toes (Figs. 1 and 2). On T1-weighted images the mass showed low-to-intermediate signal intensity with scattered internal low-signal foci, and of heterogeneous, predominantly intermediate-to-low signal on T2-weighted images with scattered markedly low-signal areas and small foci of high signal, a pattern compatible with hemosiderin and fibrous components. Fat-suppressed proton-density images showed heterogeneous signal change in the surrounding forefoot soft tissues (Fig. 3). The adjacent phalanges retained normal high T1 marrow signal and no definite cortical erosion was seen on the images reviewed. The 3D reformats demonstrated the lobulated contour of the mass and its relation to the adjacent toes (Fig. 4). The MRI report concluded that the features were consistent with tenosynovial giant cell tumor.

Treatment and current status

Given the ulcerated, discharging lesion, culture growth of Proteus species and the clinical suspicion of a chronic infective process, the patient was prescribed oral co-trimoxazole (Septrin), one tablet daily, and oral itraconazole 100 mg every 12 hours, each for an intended duration of two months. Biopsy and IHC have not yet been performed because the patient is clinically stable; no date has been set. The patient is currently under follow-up, and definitive management will be decided after tissue diagnosis.

Discussion

Clinical and epidemiological considerations

TGCT is classified as localized or diffuse and as intra- or extra-articular [1]. It most often presents between the third and fifth decades [1, 2], which fits our 40-year-old patient, although a slight female predominance is reported [2, 5]. The foot is an uncommon site: in the Dutch registry data cited by Khan et al., the foot accounted for only 6% of localized and 4% of diffuse cases [4]. Symptoms are non-specific and the median interval from onset to diagnosis has been reported as about 18 months [5], and between 12 months and 3 years in other reports [1, 4], in keeping with the one-year history here. Pain on weight-bearing and difficulty with footwear were also the main complaints in a previously reported pedal case [4].

Localized lesions in the foot and ankle are usually small (0.5–4 cm), whereas diffuse lesions are larger, firm and often multinodular [2, 3]. The size of our lesion (about 6 cm) and its extension across the interdigital spaces are more in keeping with diffuse-type behaviour, although tendon sheath origin and the final subtype can only be settled with histology. Ulceration with discharge was not described in the reference cases reviewed [4, 5] and is therefore an atypical feature that broadened the differential diagnosis.

Imaging findings

MRI is the most important imaging modality for diagnosis, extent and treatment planning [1, 3]. Typical findings include a well-circumscribed nodular lesion with intermediate-to-low signal areas on T1- and T2-weighted images due to hemosiderin, blooming on gradient-echo sequences, and heterogeneous enhancement after gadolinium [1]. Low signal on both T1 and T2 was also the key finding in the pedal case reported by Khan et al. [4]. The signal pattern in our patient was compatible with this description. Ultrasound is non-specific; TGCT typically appears as a hypoechoic, well-circumscribed mass, usually with increased Doppler flow [1]. Our ultrasound showed minimal vascular flow, a difference that illustrates the limited specificity of sonography. Bone involvement, when present, occurs mainly in diffuse disease and in confined joints [1]; the preserved marrow signal and absence of definite erosion in our patient are reassuring, but tendon, joint and marrow involvement should be confirmed on the full MRI study.

Cytology and the need for tissue diagnosis

The cytological finding of spindle and oval cells with coarse chromatin and occasional bizarre nuclei, together with a bloody aspirate, is compatible with a hemorrhagic cellular tumor, but it is not specific. Mononuclear histiocyte-like cells, multinucleated giant cells and hemosiderin are characteristic of TGCT, and the diagnosis is usually made on routine hematoxylin and eosin (H&E)-stained sections [1, 4]. However, spindling, enlarged atypical mononuclear cells with prominent nucleoli, increased mitoses and necrosis raise the possibility of malignant TGCT [1, 4], and malignant transformation has been estimated at 1–3% of cases [3]. Because TGCT shares clinical, MRI and histological features with sarcomas such

as synovial sarcoma, biopsy remains the most powerful diagnostic tool [3]. A biopsy should be performed whenever imaging is even slightly inconclusive [1]. In the present case biopsy and IHC are therefore essential.

Differential diagnosis

The main considerations are summarized in Table 3. Mycetoma is a chronic granulomatous disease characterized by painless subcutaneous masses with sinuses discharging grains, most often in the foot, and Sudan is considered the most endemic country [6]. In the Eastern Sennar case-control study, a history of local trauma, livestock ownership and young adult age increased the odds of mycetoma, and cases were confirmed by ultrasound showing echogenic grains [6]. Our patient had agricultural exposure and a chronic discharging foot lesion, so mycetoma was a reasonable working diagnosis, and empirical antifungal and antibiotic treatment was given while tissue diagnosis was pending. Patients with mycetoma often present late with advanced disease [7], and traditional healers are frequently the first point of contact [8], so a long course before presentation does not by itself distinguish infection from tumor. However, ultrasound showed no grains or collection, and the cytology showed no inflammation, which argues against mycetoma as the primary process.

The fever (39–41°C) and local warmth are not described in the reference TGCT cases [4, 5]. They favour superimposed infection of the ulcerated mass, which is consistent with the growth of Proteus species and the empirical antimicrobial treatment, and they keep infection on the differential until biopsy, culture and histology are available. The absence of a palpable pulse in the affected foot should also be documented and assessed with vascular examination.

Table 3
Differential diagnosis of the plantar forefoot mass in this patient

Differential diagnosis	Features in favour in this case	Features against / status
Eumycetoma or other chronic infection	Endemic setting, agricultural exposure [6], chronic discharge, fever and local warmth, empirical itraconazole given	No grains or collection on ultrasound (grains are the ultrasound hallmark [6]); solid mass; cytology without inflammation; culture grew only Proteus species (probable secondary infection)
Synovial sarcoma and other spindle cell sarcomas	Spindle cells with bizarre nuclei on FNA; large, fixed, ulcerated mass; sarcomas share MRI features with TGCT [3]	MRI report favoured TGCT; histology and IHC required
Malignant TGCT	Cytological atypia; rare degeneration of TGCT (1–3%) [3]; atypia and spindling raise concern [4]	Cannot be assessed without histology (mitoses, necrosis, nucleoli) [1]
Plantar fibromatosis, lipoma, hemangioma, ganglion	Low-signal, well-demarcated mass resembles fibromatosis [4]	Size, extension and ulceration are atypical; hemosiderin-like signal favours TGCT

Comparison with the published literature

Table 4 compares the present case with the two case reports and the foot and ankle meta-analysis among the studies reviewed. Reported pedal TGCT lesions are typically small and cured by excision [4]. Our lesion differs by its large size, ulceration and cytological atypia. Ansel et al. also showed that TGCT can coexist with and be mistaken for a sarcoma, which delayed its recognition [5].

Table 4
Comparison of the present case with previously published studies

Study	Design	Site / patient	Lesion	Diagnosis and management	Key point for comparison
Khan et al. 2024 [4]	Case report	Plantar lateral left hallux; 30-year-old woman	1.3 × 0.8 cm, well circumscribed; low T1 and T2 signal; no bone erosion	Excision; histology confirmed TGCT of flexor tendon sheath	Pedal TGCT with low T1/T2 signal; MRI could not exclude other lesions, so excision and histology were needed
Ansel et al. 2023 [5]	Case report	Knee; 37-year-old man	Well-defined low-signal diffuse TGCT lesion	Synchronous leiomyosarcoma; synovial biopsy confirmed TGCT	TGCT can coexist with and mimic sarcoma; diagnostic delay is common (median 18 months)
Siegel et al. 2021 [2]	Systematic review and meta-analysis	Foot and ankle; 382 patients (212 diffuse, 170 localized)	Localized lesions usually 0.5–4 cm; diffuse lesions larger	Open surgery most common; recurrence 21% (diffuse) and 7% (localized)	Complication rate 24% (diffuse) and 12% (localized); structured MRI follow-up proposed
Present case	Case report	Plantar forefoot, second toe; 40-year-old man	About 6 × 6 cm, ulcerated, extending into interdigital spaces; low-to-intermediate T1 signal	MRI features of TGCT; biopsy and IHC pending	Much larger than typical pedal lesions; ulceration and spindle cell atypia on FNA are unusual and require tissue diagnosis

Management and follow-up

Surgical excision is the mainstay of treatment [1, 5]. In the foot and ankle, a pooled analysis of 382 patients found recurrence rates of 21% for diffuse and 7% for localized TGCT, with complication rates of 24% and 12%, and open surgery was the most commonly used approach [2]. External beam radiotherapy is not recommended for hand and foot lesions [3]. For inoperable or recurrent disease, colony stimulating factor 1 receptor (CSF1R) inhibitors such as pexidartinib are options, with hepatotoxicity requiring close monitoring [3, 5]. Siegel et al. propose clinical and MRI follow-up at 3 months, twice yearly for 2 years and then annually to year 5 for diffuse disease, and at 3–6 months then annually for 3 years for localized disease [2]. Our patient will require this planning once the histological diagnosis and surgical margins are known.

Scientific and educational significance

Scientific

This case adds to the limited literature on pedal TGCT, describing a large, ulcerated plantar forefoot lesion with MRI features of TGCT, a pre-histology cytological picture of a spindle cell neoplasm, and a clinical setting in which infection was a leading alternative diagnosis. It documents the imaging and cytological features that should prompt early tissue sampling.

Educational

Radiologists and clinicians should consider TGCT in any slowly growing foot mass, recognize its MRI signal characteristics, and remember that ulceration, large size or cytological atypia mandate biopsy with IHC to exclude sarcoma or malignant TGCT. In endemic regions, a discharging foot mass should not be attributed to infection without imaging and tissue confirmation.

Strengths and limitations

Strengths of this report include the detailed multiplanar MRI documentation with figures, the correlation of imaging with ultrasound, cytological and microbiological findings, and the structured comparison with the published literature. The main limitation is that the diagnosis rests on imaging and cytology. The patient has not yet undergone biopsy or immunohistochemistry because he is clinically stable and the procedure has not been scheduled, so TGCT is not histologically confirmed, and malignant TGCT, sarcoma and infection cannot be excluded. The fever and local warmth suggest superimposed infection, which may influence imaging and cytological findings. Gradient-echo, contrast-enhanced and diffusion sequences were not available for review, treatment outcome and follow-up are not yet known, and this is a single case.

Learning points

- TGCT can present as a large plantar forefoot mass and should be part of the differential diagnosis of foot masses.
- Low-to-intermediate T1 signal with low-signal foci on T1 and T2 suggests hemosiderin and supports TGCT.
- Ulceration, large size and spindle cell atypia require biopsy and IHC to exclude sarcoma or malignant TGCT.
- In endemic areas, absence of grains and inflammation argues against mycetoma, but tissue confirmation is required.

Conclusions

A large, slowly growing plantar forefoot mass with MRI features of TGCT should be evaluated with early biopsy and IHC, particularly when it is ulcerated or shows cytological atypia. MRI guides the diagnosis

and surgical planning, but only histology can confirm the diagnosis and exclude malignancy before definitive treatment.

Abbreviations

CSF1
colony stimulating factor 1
CSF1R
colony stimulating factor 1 receptor
FNA
fine-needle aspiration
H&E
hematoxylin and eosin
IHC
immunohistochemistry
MRI
magnetic resonance imaging
TGCT
tenosynovial giant cell tumor
T1
T2,T1- and T2-weighted.

Declarations

Ethics approval and consent to participate: Written informed consent to participate in this case report was obtained from the patient, who also agreed to the use of his clinical data and MRI images. Formal ethics committee approval was not required, as this is a single-patient case report with no experimental intervention.

Consent for publication: Written informed consent for publication of his clinical details and any accompanying images was obtained from the patient. A copy of the written consent is available for review by the Editor-in-Chief of this journal on request.

Availability of data and materials: The datasets (clinical, laboratory and imaging data) generated and/or analysed during the current case report are available from the corresponding author on reasonable request.

Competing interests: The authors declare that they have no competing interests.

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Authors' contributions: MI contributed to data collection, drafting and critical revision of the manuscript, approved the final version and agrees to be accountable for all aspects of the work. MI read and approved the final manuscript.

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References

1. Kager M, Kager R, Fałek P, Fałek A, Szczypiór G, Niemunis-Sawicka J, et al. Tenosynovial giant cell tumor. Folia Med Cracov. 2022;62(2):93–107. doi:10.24425/fmc.2022.141702
2. Siegel M, Bode L, Südkamp N, Kühle J, Zwingmann J, Schmal H, et al. Treatment, recurrence rates and follow-up of tenosynovial giant cell tumor (TGCT) of the foot and ankle—a systematic review and meta-analysis. PLoS ONE. 2021;16(12):e0260795. doi:10.1371/journal.pone.0260795
3. Robert M, Farese H, Miossec P. Update on tenosynovial giant cell tumor, an inflammatory arthritis with neoplastic features. Front Immunol. 2022;13:820046. doi:10.3389/fimmu.2022.820046
4. Khan KH, Angstadt L, Chun W, Arriola AGP. Atypical presentation of tenosynovial giant cell tumor on the hallucal flexor tendon sheath: a case report. J Am Podiatr Med Assoc. 2024;114(4). doi:10.7547/23-073
5. Ansel S, Yan X, Chong P, Lo S, McCleery M, Mahendra A, et al. Tenosynovial giant cell tumor: a case report. J Med Case Rep. 2023;17:419. doi:10.1186/s13256-023-04156-w
6. Hassan R, Deribe K, Simpson H, Bremner S, Elhadi O, Alnour M, et al. Individual risk factors of mycetoma occurrence in Eastern Sennar locality, Sennar State, Sudan: a case-control study. Trop Med Infect Dis. 2022;7(8):174. doi:10.3390/tropicalmed7080174
7. Fahal AH, Ahmed ES, Mahmoud AH, Saaed AA. The Mycetoma Research Center, University of Khartoum, Sudan's experience in community engagement initiatives spans 3 decades. PLoS Negl Trop Dis. 2024;18(8):e0012304. doi:10.1371/journal.pntd.0012304
8. Elsheikh M, Trueba M, Zaman S. Traditional healing and mycetoma management in East Sennar State (Sudan): a qualitative exploration. Int J Equity Health. 2025;24:296. doi:10.1186/s12939-025-02641-w

Figures

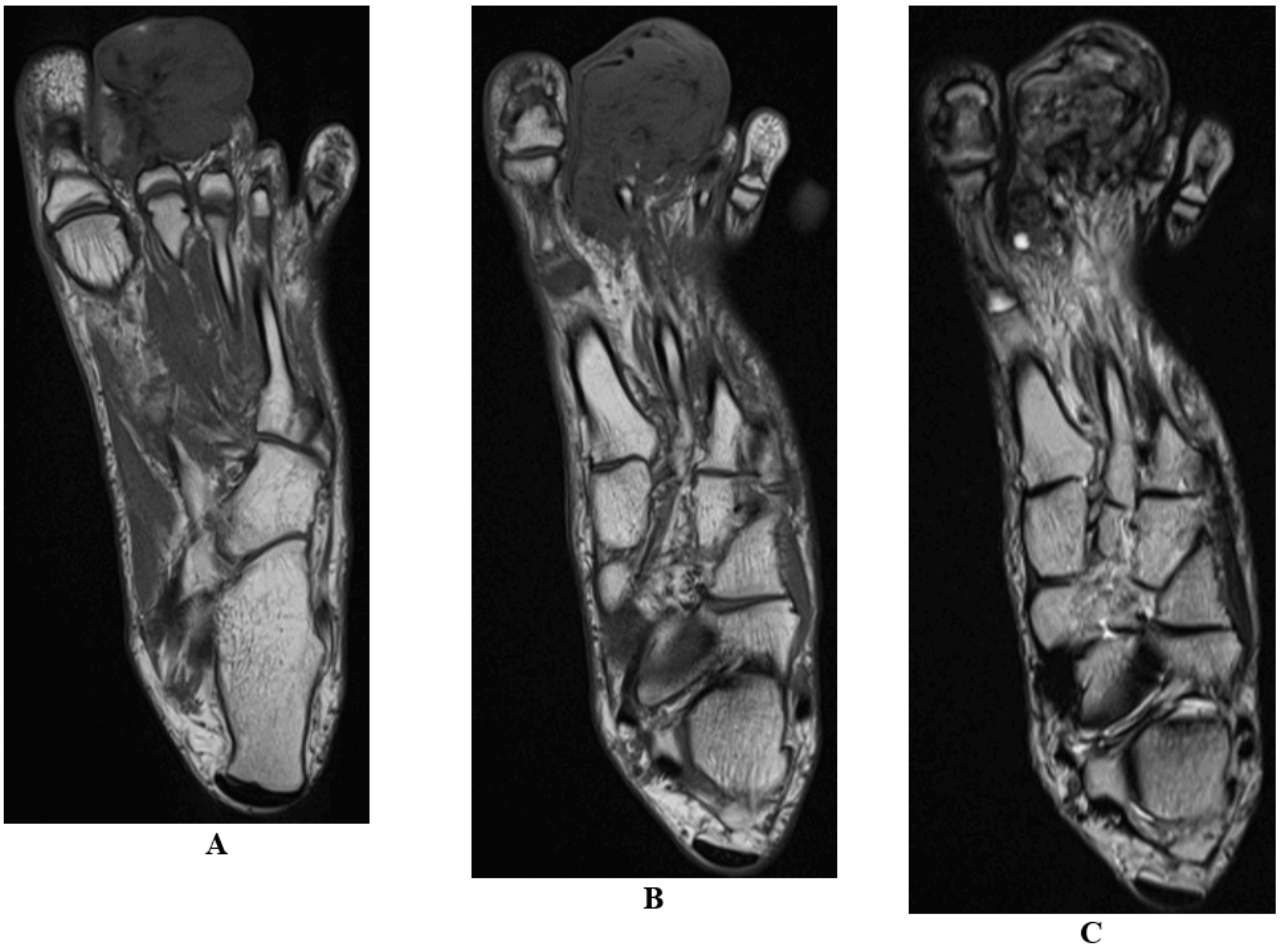


Figure 1

Axial (transverse) MRI of the left forefoot. (A, B) T1-weighted images showing a large, well-defined, lobulated plantar mass of low-to-intermediate signal with internal low-signal foci. (C) T2-weighted image showing heterogeneous signal with scattered low-signal areas.

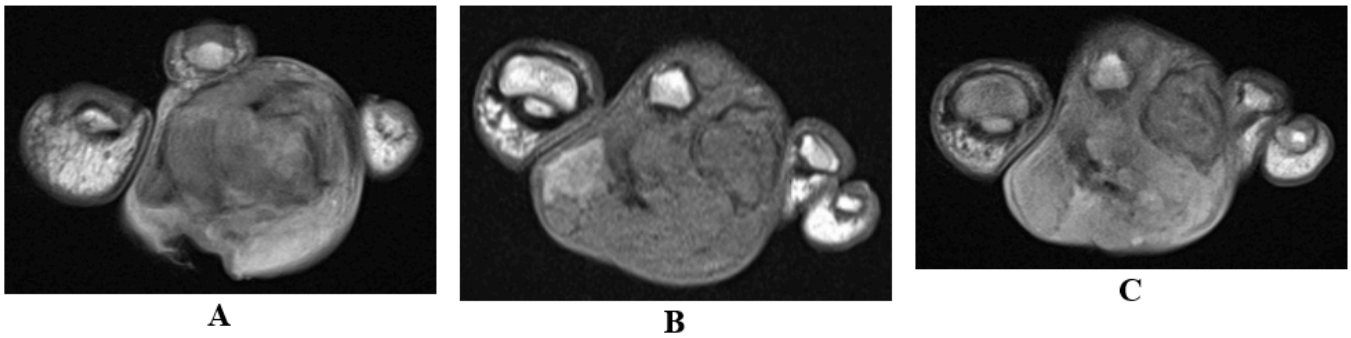


Figure 2

Coronal T1-weighted (A, C) and T1 Dixon in-phase (B) MRI through the forefoot showing the rounded mass abutting the second toe, with preserved high-signal marrow in the adjacent phalanges.

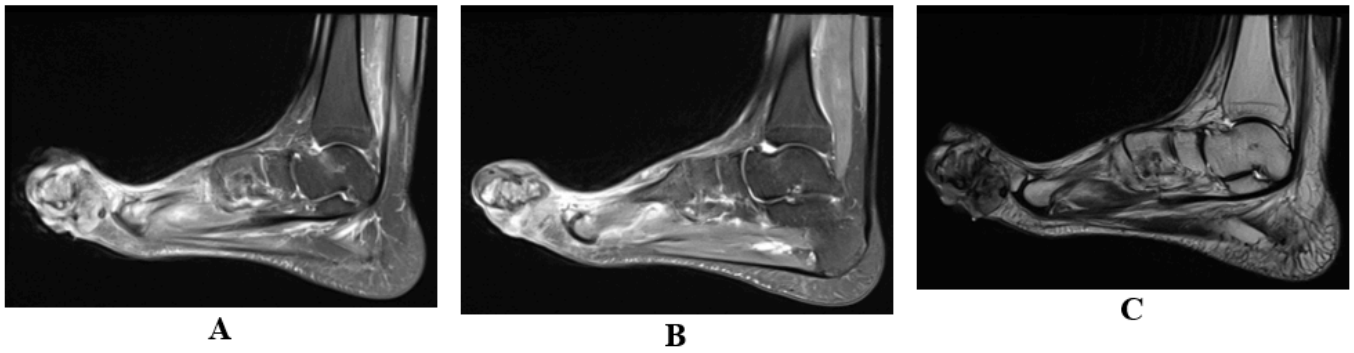


Figure 3

Sagittal proton-density fat-suppressed (A, B) and T2-weighted (C) MRI of the left foot showing the distal forefoot lesion and heterogeneous signal in the surrounding soft tissues.

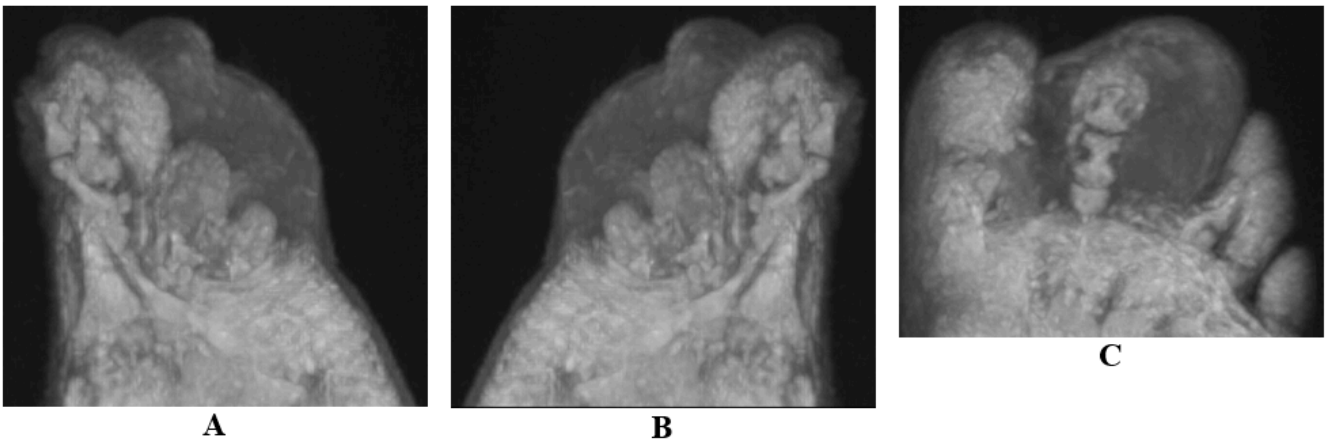


Figure 4

Three-dimensional maximum-intensity-projection reformats (A–C) showing the lobulated contour of the forefoot mass and its relation to the adjacent toes.