Received: 5 February 2022 | Revised: 11 May 2022 | Accepted: 26 May 2022

DOI: 10.1002/ccr3.5953

CASE REPORT

Clinical Case Reports Open Access WILEY

Surgical excision of complex lipoma from the foot: A case report

Akram Uddin[1,2] | **George Flanagan**[1] | **Ian Reilly**[1,3]

[1]Department of Podiatric Surgery, Northamptonshire Healthcare NHS Foundation Trust, Northamptonshire, UK

[2]Department of Podiatric Surgery, Essex Partnership University NHS Foundation Trust, Bedford, UK

[3]Department of Podiatry, University of Huddersfield, Huddersfield, UK

Correspondence
Ian Reilly, Department of Podiatric Surgery, Northamptonshire Healthcare Foundation NHS Trust, Danetre Hospital, Daventry, Northamptonshire NN11 4DY, UK.
Email: ian.reilly@nhs.net

Funding information
This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

Abstract

Malignant soft tissue tumors of the foot and ankle are rare but diagnostic imaging and/or interventional biopsy are vital to establish the nature and grading of a suspicious tumor prior to definitive surgical intervention. The purpose of the study is to provide an account on how a symptomatic mass of the plantar aspect of the foot warranted a referral to a sarcoma center, highlighting the importance of having access to diagnostic imaging and a pathway to refer suspected cases to specialist centers. A single patient with a symptomatic soft tissue tumor of the plantar foot was referred from our service to the regional sarcoma center who considered to be benign, and therefore, open surgical resection was performed by our team. Histopathological analysis identified the excised mass as a lipoma. At 2 years, postoperatively there was no recurrence, and the patient presented with an asymptomatic foot. United Kingdom (UK) guidelines suggest that all soft tissue masses of suspicious nature, greater than 50 mm, deep seated irrespective of size, or fast growing lesions should be referred to a sarcoma unit prior to surgical management. European guidance identifies a threshold of 15 mm for a mass in the foot. Patients presenting with red flag symptoms irrespective of size of mass should be referred to a sarcoma center. Advanced imaging and multidisciplinary input to enable appropriate surgical planning is recommended for suspicious soft tissue tumors that present to the foot and ankle surgeon.

KEYWORDS

benign tumor, core needle biopsy, fine-needle aspiration, lipoma, liposarcoma, malignant tumor, soft tissue tumor

1 | INTRODUCTION

Lipoma is the most common form of soft tissue benign tumor that occurs as a result of hypertrophy of adipose cells.[1–5] The World Health Organization (WHO) categorizes lipomas, angiolipomas, and liposarcomas as adipocytic tumors[6] and is considered to be the largest single group of mesenchymal tumors[7] of lipogenic differentiation.[1,8] The etiology and pathophysiology of lipoma is unknown.[2,3,9] Lipomas grow slowly within the subcutaneous region[4,10] and classically present as asymptomatic soft, subcutaneous and oval masses that are palpable

and mobile.[2–4] Subcutaneous lipomas are usually thin encapsulated with lobular patterns, and deeper-seated lipomas have an irregular configuration.[4,9] Lipomas can occur at any age and are the most common soft tissue tumor found in humans, accounting for 50% of all benign soft tissue tumors.[3,11] They can present anywhere in the body where adipose tissue presents.[12] Lipomas are four times more prevalent in males than females, often occurring in obese subjects between the ages of 40–60.[2,3,9,10] The incidence of benign lipoma to the sole of the foot is uncommon.[13–15]

Primary malignant and metastatic tumors in the foot and ankle have been reported to be rare.[16] An atypical lipomatous tumor is considered synonymous with a well-differentiated liposarcoma, and it is identified as the most common soft tissue sarcoma in adults.[17] In adults, liposarcomas are the second most common malignancy of soft tissues usually involving the lower extremity and are very rare in the adult foot.[8,18,19] Accurate diagnosis is vital when managing soft tissue tumors, and this is achieved in combination with clinical, radiological, and histological examinations.[20,21]

Diagnostic imaging may not be fully conclusive for a benign lipoma: uncertainty occurs when the features are not typical of a lipoma and differentiation of lipoma variants from liposarcoma is required, therefore necessitating resection for a definitive histological diagnosis.[14] The appearance of lipomatous tumors on MRI reflects the degree of differentiation.[8] MRI represents the modality of choice to investigate the nature of the soft tissue tumors and is helpful to the surgeon when planning excision.[12,22] Biopsy techniques include fine-needle aspiration (FNA), core needle biopsy, and incisional biopsy, and these procedures are important for diagnostic, staging, and surgery planning.[19,20,23] Open excisional biopsy remains the gold standard for histologic diagnosis of lipoma.[9]

The non-surgical options for lipomas include corticosteroids, phosphatidylcholine, and sodium deoxycholate injections, all aiming to achieve chemical lipolysis or atrophy of the lesion.[4,24,25] Extracorporeal acoustic wave therapy, laser lipolysis, and high intensity focused ultrasound have also been identified as safe and well-tolerated treatments.[26–28] Statin therapy is identified to induce apoptosis in lipoma cells.[29] Open surgical excision is the most common intervention with recurrence rate reported to be less than 5%[4] contrary to intramuscular lipomas with recurrence reported as high as 50–80%.[30] The recurrence rate for benign soft tissue tumors is generally low after marginal resection in contrast to soft tissue sarcomas where mortality rate is significantly high.[31]

The purpose of the study is to provide an account on how a symptomatic mass of the plantar aspect of the foot warranted a referral to a sarcoma center, highlighting the importance of having access to diagnostic imaging and a pathway to refer suspected cases to specialist centers.

2 | CASE REPORT

A 49-year-old female patient was referred to podiatric surgery by her General Practitioner (GP) for a symptomatic mass on the plantar aspect of her left foot. The patient was classified as American Society of Anaesthesiologists[32] (ASA) physical status grade II. The patient's medical history included sickle cell trait (HbAS), malaria, ocular hypertension, glaucoma, and hypertension, and she was on repeat pharmacotherapy of amitriptyline, bimatoprost/timolol, doxazosin, and desunin. The patient was a non-smoker and reported nil consumption of alcohol. The patient reported an allergy (Type I) to proguanil and chloroquine phosphate. There was no other current or history of previous soft tissue mass or family history. There was no history of recent foreign travel, insect or animal bite or any lower limb injury. The patients' occupational role was in acute nursing care.

The patient attended systemically well and reported good well-being, and there were no reported red flag symptoms. There was no allodynia, and the patient allowed the foot to be examined. Symptoms were described as a deep dull “aching sensation” though she rated 9/10 on the Visual Analogue Pain Scale (VAS) when further questioned on her symptoms. The pain was worst when weight bearing although rest pain was also present. Pain responded to over-the-counter paracetamol. The mass on examination was dense and appeared fixed in volume with no dispersity. When weight bearing the patient displayed plantar ground contact, however, expressed discomfort and compensated with varus stance. The patient reported footwear was becoming uncomfortable due to notable mass expansion. The patient-reported duration of the mass was 2 months with gradual increase in size. The GP suspected a plantar fibroma and requested an ultrasound scan (USS). The radiologist's report of the USS dismissed a plantar fibroma and advised “further assessment,” and a magnetic resonance image (MRI) was performed (see Figures 1,2,3).

On clinical examination, a single, atypical, non-uniform mass was located sub-dermally to the plantar aspect of the left foot. The mass extended from the plantar aspect of the medial cuneiform, extending plantar distally to the 1st ray and proximal to the 1st metatarso-phalangeal joint. Clinically, the mass measured 60 mm × 25 mm with protrusion expansion of 8 mm. There were no trophic changes, the skin tone and cutaneous colouration was unvarying. There was no temperature difference of clinical significance. This was examined with an infrared

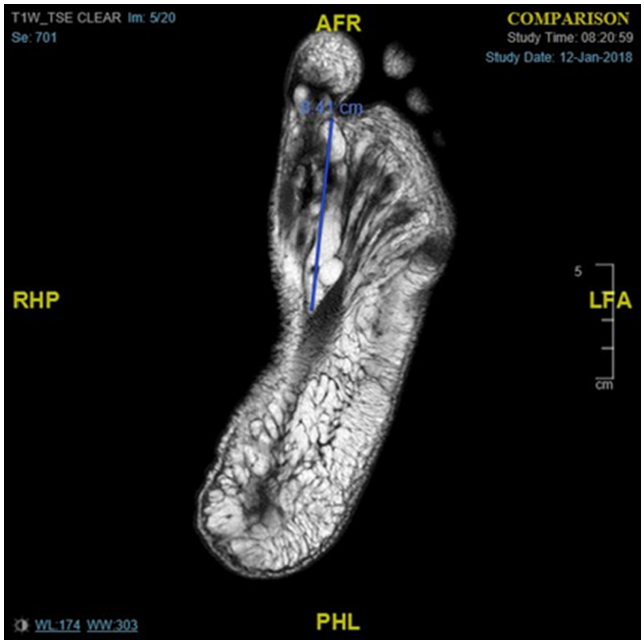

FIGURE 1 Pre-operative MRI images

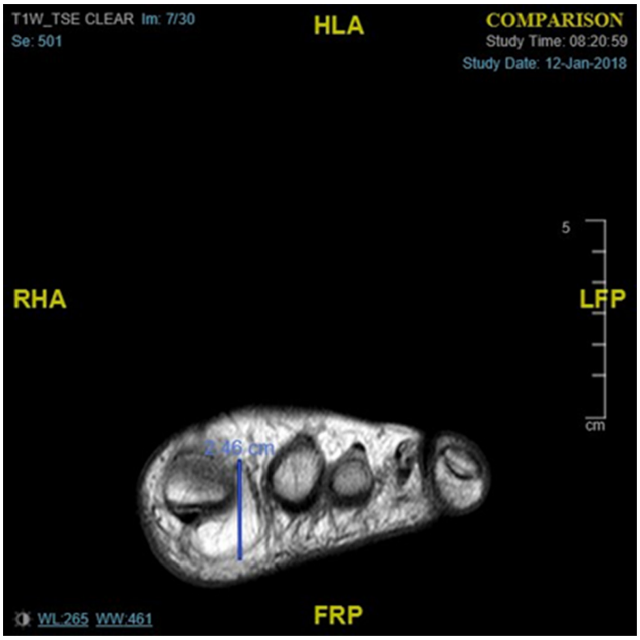

FIGURE 2 Pre-operative MRI images

thermographic scanner comparing the mass site to the proximal lower limb and comparison to the opposite limb. The foot displayed no structural abnormality or asymmetry. The mass was non-pulsatile, and Doppler examination identified no audible vascular echo or on mass pressure and release. All three pedal arteries (posterior tibial, dorsalis pedis, and peroneal) were triphasic on handheld Doppler. Venous examination identified no abnormality. There were no clinical signs or symptoms of lymphangitis

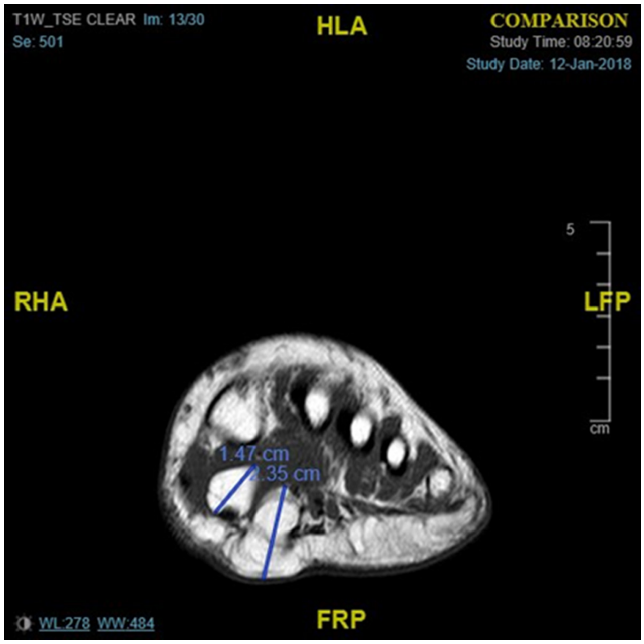

FIGURE 3 Pre-operative MRI images

or lymphadenitis. The patient displayed no sensorimotor or autonomic neuropathy to both limbs. Sensory testing identified normal cutaneous innervation to each dermatome areas. Motor assessment of the intrinsic and extrinsic foot muscles demonstrated satisfactory function and resistance. Proprioception examination was unremarkable. Cutaneous colouration, hydration, tone, and dermal elasticity were symmetrical. The contralateral foot was asymptomatic and defined no features of soft tissue mass occurrence.

The MRI reported a lobulated soft tissue mass which returned high T1 signal and suppressed uniformly on the fat suppression sequences involving the subcutaneous tissue and extending into the muscular compartments and superiorly extends into the first interspace. The lesion measured 80×15 mm in the maximum axial dimension and 23 mm in the anterior-posterior dimension. Posterior to this there is a further discrete lesion and the level of the tarsal bones within the subcutaneous tissue measuring 9 ×9 mm. The report concluded that the features are in keeping with a complex lipoma but underlying sarcomatous change cannot be excluded given the size of the lesion. Consequently, our team did not directly proceed to excision.

3 | REFERRAL TO SARCOMA SERVICE

The National Institute for Health and Care Excellence (NICE) reports sarcomas are rare, but to avoid delay in diagnosis patients with suspected sarcomas need to be

recognized early and quickly referred to the sarcoma service.[33] The NICE Suspected Cancer: Recognition and Referral guidance[34] recommends an urgent ultrasound scan (USS) within 2 weeks to assess for soft tissue sarcoma in adults with an unexplained lump that is increasing in size. The guidance also highlights if the USS findings are suggestive of a soft tissue sarcoma, uncertain and clinical concern persists to consider a suspected cancer pathway referral within 2 weeks for an adult. It is essential to assess the continued support for the patient while waiting for the referral appointment and the patient given opportunity to express concerns or ask questions.[34]

The Northamptonshire NHS department of podiatric surgery run a morbidity and mortality (M&M) meeting every month. The meeting involves discussing cases that may warrant further diagnostics, referral, or support from primary and secondary centers. Furthermore, complex cases requiring additional perioperative planning or equipment needs are agreed upon. Upon reviewing this case, diagnostic USS, and MRI scans, it was decided to refer the patient to the regional sarcoma unit prior to performing surgical resection. This decision was made following our local Sarcoma Service guidelines[35] and NICE[33,34] recommendations (Figure 4).

The patient was well informed of the outcome following the M&M meeting with a face-to-face consultation, and she agreed to be referred to the local sarcoma service. This consultation was important as it made the patient feel they were part of the decision-making process and an opportunity to give support and a sense of understanding all diagnostic options and safety were core to our treatment planning. After the patient attended the sarcoma unit, written confirmation was received from the service confirming the lesion to be urgently excised for histopathological examination and requested that our team perform the surgery. The patient was booked for preoperative assessment and surgical planning. Routine preoperative blood tests requested were within normal physiological range.

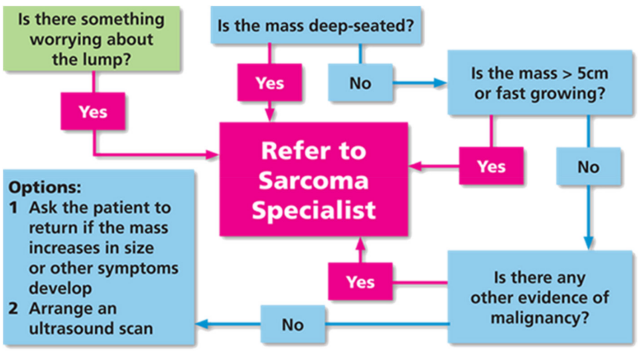

FIGURE 4 East Midlands Sarcoma Service referral (East Midlands Sarcoma Service)[35]

4 | SURGICAL PROCEDURE

A local anesthetic (ropivacaine HCL 0.75%) ankle block was performed under ultrasound guidance. Ropivacaine HCL is identified to have prolonged duration of anesthesia, profound sensory with less motor blockade and reduced risk of cardiotoxicity.[36,37] The foot was prepped in standard fashion, and the procedure undertaken with an ankle tourniquet with patient positioned supine. A 5 cm curvilinear lazy "S" incision of the skin was performed on the plantar aspect of the foot over the mass respecting cutaneous angiosomes. The incision choice was for appropriate surgical exposure and to avoid scar contracture. The incision was deepened, and vessels encountered were cauterized with bipolar diathermy. Blunt dissection was performed to separate the subcutaneous layer until the body of the mass was identified.

A dense uniform mass was identified on subcutaneous reflection with unvarying colouration with no direct vascular supply (Figures 5 and 6). The mass was invasive and enveloped the medial plantar nerve requiring blunt separation (Figure 5) and once resected whole it was sent for histopathological analysis (Figure 7). The evacuated site was examined to ensure no remaining tissue of the mass was present and once satisfied copious irrigation was performed with saline. The deep fascia closure was performed to reduce evacuated mass space that was a potential for seroma or hematoma formation. Deep fascia layer closure was achieved in layers with interrupted 4.0 Vicryl® sutures. An external vacuum drain was not deemed necessary based on our judgment. Skin closure was completed with simple interrupted suture technique using 4.0 Prolene® (Figure 8). Tourniquet deflation was performed to appreciate digital cutaneous reperfusion and to ensure inadvertent vascular damage had not occurred. A postoperative standard sterile dressing was applied. The patient was advised to be non-weight bearing with crutches and supplied with postoperative analgesia and instructions as service protocol.

The dressing was changed at 14 days, as per our routine, plantar sutures were removed at 28 days. The histopathology report noted: "*A piece of multilobular fatty tissue 60 × 30 × 20 millimetres. On slicing specimen appears to consist of unremarkable fat. Sections show mature adipose tissue with mature fibrous bands within. No atypia necrosis or mitosis is seen – lipoma.*"

A minor seroma noted at week four was treated empirically based on our departmental policy with flucloxacillin 500 mg QDS and metronidazole 400 mg TDS, both for 7 days (Figure 9). A deep wound swab demonstrated normal skin flora only, and the wound was fully healed 6 weeks. Patient follow-up was undertaken at 2 weeks, 4 weeks, 6 months, and 24 months postoperatively.

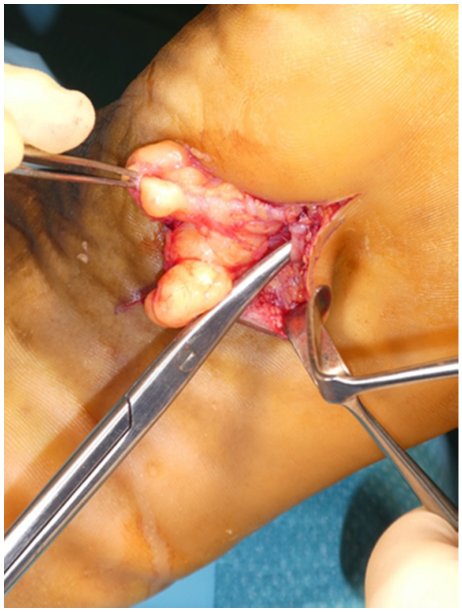

FIGURE 5 Surgical excision (intra-operative)

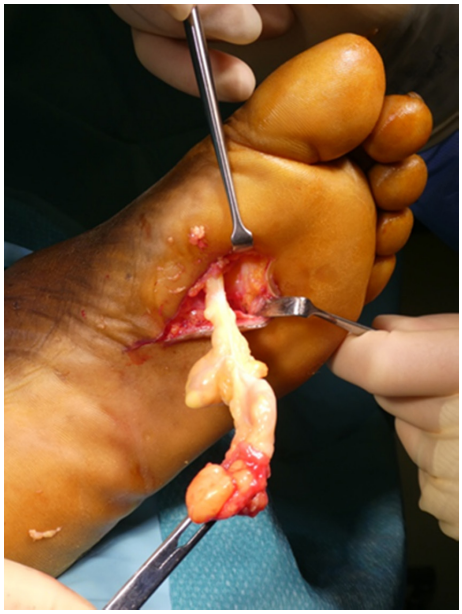

FIGURE 6 Surgical excision (intra-operative)

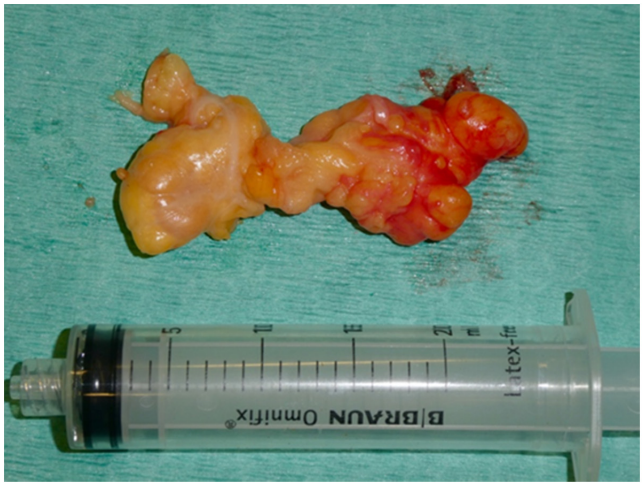

FIGURE 7 Excised mass

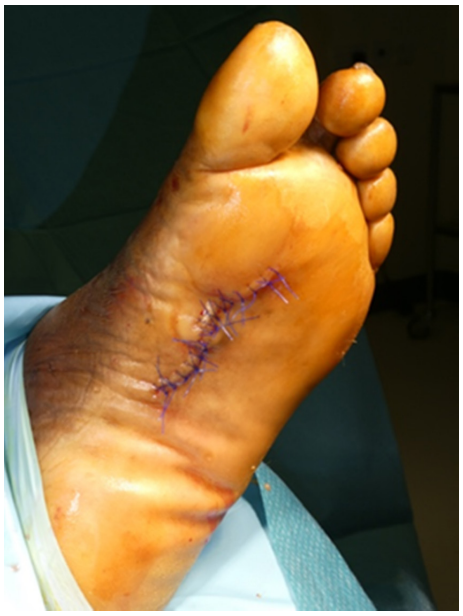

FIGURE 8 Wound closure

5 | OUTCOME

Clinically, no sign of recurrence has been documented to date. Patient-reported outcome measures were determined preoperatively and at 24 months postoperatively. A patient satisfaction questionnaire was completed; at 24 months postoperatively, the patient noted their foot was "much better" with no discomfort. A 10-point visual analogue scale was used to rate pain, this reduced from 9/10 preoperatively to 0/10 at 24 months post-intervention. The Manchester Oxford Foot Questionnaire[38] (MOxFQ) showed a significant reduction in all 3 domains. In the walking/standing (WS) domain, the average pre-treatment score was 39, the post-treatment score reduced to 14. For social interaction (SI), scores reduced from 56 to 0 and in the pain (P) category 30 and 0, respectively.

6 | DISCUSSION

Tumors of the foot and ankle account for 4–5% of all musculoskeletal tumors.[39] The majority of the soft tissue tumors of the foot and ankle are benign.[23,31] Lipomas account for 50% and are most common benign soft tissue

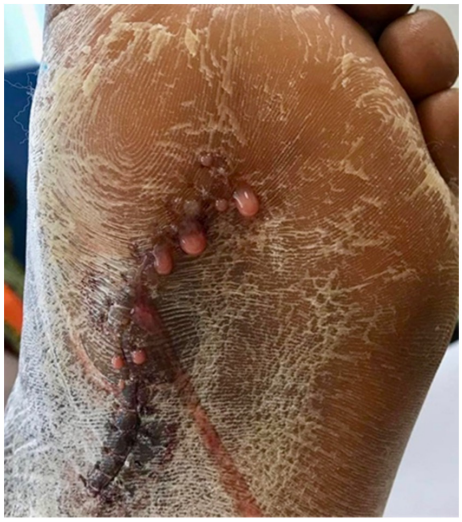

FIGURE 9 4 weeks post-surgery: aseptic seroma

tumors.[1,4,5,10,11] Sarcomas of the lower extremity are uncommon and believed to be less malignant than those that arise in other sites.[40] The occurrence of lipoma to the plantar aspect of the foot is rare,[14] and it is important to differentiate the benign lesion from an aggressive benign or malignant tumor.[2,21] The infrequency of soft tissue sarcoma may lead to a lack of consideration when soft tissue masses present.[41] Although less common, malignant tumors of the lower extremity remain a threat and must be studied by diagnostic imaging and biopsies performed as necessary.[40] Histopathology, however, remains the gold standard in the diagnosis of lipoma.[9] A lesion lacking features of a benign entity should be considered malignant until proven otherwise.[23] Deep-seated tumors >5 cm are identified to be more likely to be sarcomas,[1] contrary to small superficial masses <30 mm having been reported to be malignant tumors from the hand and foot.[42] In the human foot and hand, a mass less than 15 mm is considered to be significant whereas <50 mm is generally considered body-wide.[19]

When assessing tumors of the foot, plain radiograph shows soft tissue masses in the form of increased density with or without calcification or osseous involvement[18,19,21] Radiographs may also demonstrate expansile fatty masses or effacement of usual fat planes[43] but none were required for this case. USS evaluation of soft tissue lesions is useful in the initial triaging of soft tissue masses.[23] It is a useful diagnostic tool of superficial lipomas with good sensitivity and even better specificity and should remain the first-line imaging investigation.[44] Furthermore, it helps determine the size, shape, and outlines of the expansile tissue process and internal structure and homogeneity.[11] USS examination, however, requires sufficient operator and radiologist expertise to assist with diagnosis.[43] Furthermore, the mass is only appreciated in one plane, and deeper structures are not well appreciated due to reduced resolution. Rahmani et al.[44] conducted a systematic review on the diagnostic accuracy of ultrasonography for lipomas. The sensitivity and specificity were 86.87% and 95.95%, respectively, therefore supporting this imaging modality to be the first-line imaging investigation.

The USS report of this case study confirmed a mass with mixed reflectivity that was predominantly echogenic measuring 16 mm × 13 mm × 12 mm. On clinical correlation and history taking, the mass had rapidly expanded since the USS was performed. The report confirmed the mass to be located within the superficial soft tissues with extension of the mass into the deeper plantar soft tissue layers which were not visible on USS. Therefore, as an atypical lipoma was suggested as a probable diagnosis, we requested an urgent MRI.

MRI evaluation should follow on from US examination where there is reasonable chance of malignancy.[23] MRI should comprise at least T1, T2, and T1 fat-saturated sequences.[19] Advanced techniques such as spectroscopy, perfusion, and diffusion-weighted imaging may provide enhanced soft tissue characterization.[23] Lipomatous tumors can be characterized with MRI because of their predominant T1 signal intensity that is similar to subcutaneous fat on all pulse sequences.[8] Intravenous contrast allows for distinction between cystic lesions and dense masses.[43] On T1-weighted images, lipomas demonstrate high signal uniform intensity with low signal intensity appreciated on T2 weighted images.[4,5] However, some lipomas contain mesenchymal non-fatty elements and therefore differ from this typical homogeneous MRI appearance.[45] On Short-Tau Inversion Recovery (STIR images), the fat signal of lipomas is nulled.[8] Furthermore, MRI allows cross-sectional nodular components to be appreciated and large size lesions with septations thicker than 2 mm direct toward liposarcoma over lipoma.[21] However, some lipomas can contain septa thicker than expected; therefore, this parameter although useful is less reliable.[45]

Our request for MRI was to appreciate the nature of the mass and tissue matrix composition for diagnostic purposes and exact anatomical location and establish the extent of neighboring anatomy involvement to assist with surgical planning. If the patient was contraindicated for MRI, we would have requested a computed tomography (CT) scan with contrast. Contrast-enhanced CT scans can help distinguish masses from surrounding soft tissues and reveal vascular involvement.[43] On CT scans lipomas present as homogeneous hypo attenuated lesions.[4]

Open or image-guided biopsies are recommended if a soft tissue mass of the foot or ankle cannot be further distinguished by diagnostic imaging.[46] Percutaneous needle biopsies are extremely effective and safe in the diagnosis of soft tissue masses.[47] The biopsy should be performed in a sarcoma center, involving multidisciplinary input including

the oncologic surgeon.[19,23,48] This is due to the technical considerations that are required when taking a biopsy for histological diagnosis and without further spreading of the tumor.[20,48] The referral for biopsy is indicated when a superficial lesion is >50 mm, any deep lesion regardless of size and in atypical presentation cases.[11,23] In the human foot, the threshold is reported 15 mm and 50 mm for the rest of the body.[19] Fine-needle aspiration (FNA) has the advantage of enabling the aspiration of various parts of the same tumor which is important in large heterogeneous neoplasms.[49] FNA allows aspiration of material for pathological examination of the cells.[48] Immediate evaluation of FNA specimen is advantageous due to its fast and simple technique.[50] Incisional biopsies carry a risk of hematoma which may delay treatment as well as increasing the risk of local dissemination of the tumor.[48] Core needle biopsy (CNB) is a technique to achieve histological diagnosis but can also help grade a tumor and allows immunohistochemical or molecular analysis.[20]

The function of the foot is important and must be considered when resecting tumors and surgery must be performed to avoid nerve or muscle.[13] The functional outcome in limb salvage surgery for soft tissue tumors was prospectively evaluated in 36 patients using the modified Enneking functional rating scale.[51] This study reported on the Musculoskeletal Tumor Society (MSTS) functional rating scale with 85% of patients reporting good to excellent outcomes at 12 months postoperatively. The study highlighted the importance to place emphasis on functional issues and managing the tumor. Latt et al[41] similarly reported using the MSTS scale but also conducted postoperative functional measures using the Toronto Extremity Salvage Score (TESS). The findings from this study are difficult to compare to others as patients were treated in other centers initially by unplanned excision which led to worse oncological outcomes. Our case study although assessed the functional outcome with the MOXFQ cannot be compared to functional outcome scores from these studies although the TESS is a patient completed tool.

Multiple and large subcutaneous lipomas may create challenges in surgical planning[2] which may require free muscle flap reconstruction and split thickness skin grafts.[51] The functional demands of the foot and related structures, the limitations of soft tissue coverage as well as underlying vital anatomy must be taken into consideration before planning limb salvage surgery.[51] The plantar incision performed for this case study ensured cutaneous angiosome perfusion was not affected, and satisfactory anatomical exposure and visualization of key neurovascular structures was achieved through meticulous surgical resection. The functional demands of the foot were considered when planning the surgery and intraoperatively no inadvertent complication occurred.

7 | CONCLUSION

Although the incidence of non-benign lesions found in the human foot and ankle is low, atypical masses should be not treated by simple resection without wider consideration. MRI should be the imaging modality of choice and in cases where it is contraindicated, an alternative modality such as contrast CT scan may be considered. An X-ray should be considered to rule out osseous involvement. Surgeons should additionally interpret diagnostic imaging themselves rather than relying on a radiologist's report alone. If a mass is of suspicious nature, deep seated, greater than 15 mm, rapidly expanding and there are red flag symptoms—the case must be referred to the regional sarcoma service. To meet the recommendations of NICE,[33,34] every surgery unit should ensure that they follow set pathways for referral and diagnosis for patients with suspected sarcoma. Once a decision to refer has been made, this must be done within one working day.[34] Furthermore, M&M meetings jointly attended by Podiatric Surgeons, Orthopedic Surgeons, Podiatrists, and Radiologists should be welcomed for clinical governance, multidisciplinary working, reflective, and safe surgical practice.

AUTHOR CONTRIBUTIONS

All authors made substantial contributions to the work enclosed. Akram Uddin prpared the manuscript.

ACKNOWLEDGMENTS

None.

CONFLICT OF INTEREST

All authors have no competing interests to declare. Further data are available from the authors on reasonable request.

DATA AVAILABILITY STATEMENT

The data that support the findings of this study are available on reasonable request from the corresponding author. The data are not publicly available due to privacy and ethical restrictions.

ETHICAL APPROVAL

Organization ethical approval was not required but written consent from the patient for publication was obtained.

CONSENT

Written informed consent was obtained from the patient to publish this report in accordance with the journal's patient consent policy.

ORCID

Ian Reilly https://orcid.org/0000-0002-2786-5739

REFERENCES

1. Azam A, Rajagopalan S, Niezywinski WA. A rapidly expanding massive lipoma of the toe. *J Foot Ankle Surg*. 2007;46(6):499-501. doi:10.1053/j.jfas.2007.06.001
2. Sitarz R, Skierucha M, Jazienicki M, et al. Lipomas - a health condition that cannot be ignored. *Fam Med Prim Care Rev*. 2016;4(4):473-476. doi:10.5114/fmpcr.2016.63704
3. Swarnkar M, Jain SC. Web space lipoma causing separation of toes - a rare case report with review of literature. *J Krishna Inst Med Sci Univ*. 2017;6(2):107-110.
4. Derin AT, Yaprak N. Lipomas: review and evaluation of the literature. *Clin Surg*. 2015;2(1615):1-2.
5. Su CH, Hung JK, Chang IL. Surgical treatment of intramuscular, infiltrating lipoma. *Int Surg*. 2011;96(1):56-59. doi:10.9738/1396.1
6. Fletcher CDM, Bridge JA, Hogendoorn PCW, Mertens F. WHO classification of tumours of soft tissue and bone; 2013.
7. Vilanova JC. WHO classification of soft tissue tumors. *Imaging Soft Tissue Tumors*. 2017;187-196. doi:10.1007/978-3-319-46679-8_11
8. Drevelegas A, Pilavaki M, Chourmouzi D. Lipomatous tumors of soft tissue: MR appearance with histological correlation. *Eur J Radiol*. 2004;50(3):257-267. doi:10.1016/j.ejrad.2004.01.022
9. Kaur R, Kler S, Bhullar A. Intraoral lipoma: report of 3 cases. *Dent Res J (Isfahan)*. 2011;8(1):48-51.
10. Curca V, Culiuc V, Bzovil F. Atypical giant lipomas. *Curierul Med*. 2014;57(2):102-105.
11. Loubignac F, Bourtoul C, Chapel F. Myxoid liposarcoma: a rare soft-tissue tumor with a misleading benign appearance. *World J Surg Oncol*. 2009;7:42. doi:10.1186/1477-7819-7-42
12. Fan KY, Lui TH. Lipoma of the sinus tarsi. *BMJ Case Rep*. 2013;2013:bcr2013200904. doi:10.1136/bcr-2013-200904
13. Yasumura K, Satake T, Shibuya M, et al. A case of recurrent lipoma in the sole with long-term follow-up. *JPRAS Open*. 2016;8:19-22. doi:10.1016/j.jpra.2016.03.001
14. Chowdhary K, Zaman M, Kaur G, et al. Lipoma over plantar aspect of foot: an uncommon site for a common lump. *Int J Med Rev Case Rep*. 2018;2:103-104. doi:10.5455/ijmrcr.lipoma-over-plantar-aspect-of-foot
15. Kaoutar M, Gallouj S, Nassiri A, Mernissi FZ. A rare case of plantar lipoma. *J Dermatology Cosmetol*. 2018;2:126-127. doi:10.15406/jdc.2018.02.00060
16. Chou LB, Ho YY, Malawer MM. Tumors of the foot and ankle: experience with 153 cases. *Foot Ankle Int*. 2009;30(9):836-841. doi:10.3113/FAI.2009.0836
17. Riva G, Sensini M, Corvino A, Garzaro M, Pecorari G. Liposarcoma of hypopharynx and esophagus: a unique entity? *J Gastrointest Cancer*. 2016;47(2):135-142. doi:10.1007/s12029-016-9808-6
18. Kure S, Naito Z, Peng W-X, Kudo M, Matsubara M, Tsunoda T. A rare case of myxoid liposarcoma of the adult foot diagnosed using fine needle aspiration cytology (FNAC). *Pathol Lab Med Int*. 2014;2015:1-5. doi:10.2147/plmi.s72042
19. Mascard E, Gaspar N, Brugières L, Glorion C, Pannier S, Gomez-Brouchet A. Malignant tumours of the foot and ankle. *EFORT Open Rev*. 2017;2:261-271. doi:10.1302/2058-5241.2.160078
20. Errani C, Traina F, Perna F, Calamelli C, Faldini C. Current concepts in the biopsy of musculoskeletal tumors. *Sci World J*. 2013;2013:538152. doi:10.1155/2013/538152
21. Singer AD, Datir A, Tresley J, et al. Benign and malignant tumors of the foot and ankle. *Skeletal Radiol*. 2016;45:287-305. doi:10.1007/s00256-015-2278-2
22. Nishio J, Isayama T, Yoshimura I, Ohjimi H, Iwasaki H, Naito M. Myxoid liposarcoma of the ankle: a case report. *J Foot Ankle Surg*. 2012;51(1):76-79. doi:10.1053/j.jfas.2011.09.005
23. Hughes P, Miranda R, Doyle AJ. MRI imaging of soft tissue tumours of the foot and ankle. *Insights Imaging*. 2019;10:60. doi:10.1186/s13244-019-0749-z
24. Salti G, Ghersetich I, Tantussi F, Bovani B, Lotti T. Phosphatidylcholine and sodium deoxycholate in the treatment of localized fat: a double-blind, randomized study. *Dermatol Surg*. 2008;34:60-66. doi:10.1111/j.1524-4725.2007.34009.x
25. Nanda S. Treatment of lipoma by injection lipolysis. *J Cutan Aesthet Surg*. 2011;4(2):135-137. doi:10.4103/0974-2077.85040
26. Scarpa C, Vindigni V, Bassetto F. Extracorporeal acoustic wave therapy and multiple symmetric lipomatosis. *Plast Reconstr Surg Glob Open*. 2015;3(6):e430. doi:10.1097/GOX.0000000000000407
27. Stebbins WG, Hanke CW, Petersen J. Novel method of minimally invasive removal of large lipoma after laser lipolysis with 980 nm diode laser. *Dermatol Ther*. 2011;24(1):125-130. doi:10.1111/j.1529-8019.2010.01385.x
28. Shemer A, Brawer S, Amichi B, Azhari H. Noninvasive lipoma size reduction using high-intensity focused ultrasound. *Dermatologic Surg*. 2013;39:1446-1451. doi:10.1111/dsu.12269
29. Kässner F, Sauer T, Penke M, et al. Simvastatin induces apoptosis in PTEN-haploinsufficient lipoma cells. *Int J Mol Med*. 2018;41:3691-3698. doi:10.3892/ijmm.2018.3568
30. Han HH, Choi JY, Seo BF, et al. Treatment for intramuscular lipoma frequently confused with sarcoma: a 6-year restrospective study and literature review. *Biomed Res Int*. 2014;41(6):3691-3698. doi:10.1155/2014/867689
31. Kinoshita G, Matsumoto M, Maruoka T, et al. Bone and soft tissue tumours of the foot: review of 83 cases. *J Orthop Surg*. 2002;10(2):173-178. doi:10.1177/230949900201000212
32. Hurwitz EE, Simon M, Vinta SR, et al. Adding examples to the ASA-physical status classification improves correct assignment to patients. *Anesthesiology*. 2017;126(4):614-622. doi:10.1097/ALN.0000000000001541
33. NICE Sarcoma Quality Standards. 2017. https://www.nice.org.uk/guidance/qs78. Accessed January 2022.
34. NICE. Suspected cancer: recognition and referral. *NICE Guidel*. 2015;1-378. http://www.ncbi.nlm.nih.gov/pubmed/26180880%5Cnhttps://www.nice.org.uk/guidance/ng12/evidence/full-guidance-74333341
35. East Midlands Sarcoma Service. Published 2020. https://www.eastmidlandssarcoma.org.uk/making-a-referral/. Accessed September 20, 2020.
36. Uddin A, Reilly I. Ropivacaine and levobupivacaine: new drugs for podiatric medicine and surgery. *Pod Now*. 2008;11:22-28.
37. Kuthiala G, Chaudhary G. Ropivacaine: a review of its pharmacology and clinical use. *Indian J Anaesth*. 2011;55(2):104-110. doi:10.4103/0019-5049.79875
38. Dawson J, Coffey J, Doll H, et al. A patient-based questionnaire to assess outcomes of foot surgery: validation in the context of surgery for hallux valgus. *Qual Life Res*. 2006;15(7):1211-1222. doi:10.1007/s11136-006-0061-5

39. Rammelt S, Fritzsche H, Hofbauer C, Schaser KD. Malignant tumours of the foot and ankle. *Foot Ankle Surg*. 2020;26(4):363-370. doi:10.1016/j.fas.2019.05.005
40. Zeytoonjian T, Mankin HJ, Gebhardt MC, Hornicek FJ. Distal lower extremity sarcomas: frequency of occurrence and patient survival rate. *Foot Ankle Int*. 2004;25(5):325-330. doi:10.1177/107110070402500509
41. Latt LD, Turcotte RE, Isler MH, Wong C. Case series. Soft-tissue sarcoma of the foot. *Can J Surg*. 2010;53:424-431.
42. Khoo M, Pressney I, Hargunani R, Saifuddin A. Small, superficial, indeterminate soft-tissue lesions as suspected sarcomas: is primary excision biopsy suitable? *Skeletal Radiol*. 2017;46(7):919-924. doi:10.1007/s00256-017-2635-4
43. Hochman MG, Wu JS. MR imaging of common soft tissue masses in the foot and ankle. *Magn Reson Imaging Clin N Am*. 2017;25:159-181. doi:10.1016/j.mric.2016.08.013
44. Rahmani G, McCarthy P, Bergin D. The diagnostic accuracy of ultrasonography for soft tissue lipomas: a systematic review. *Acta Radiol Open*. 2017;6:2058460117716704. doi:10.1177/2058460117716704
45. Galant J, Martí-Bonmatí L, Sáez F, Soler R, Alcalá-Santaella R, Navarro M. The value of fat-suppressed T2 or STIR sequences in distinguishing lipoma from well-differentiated liposarcoma. *Eur Radiol*. 2003;13(2):337-343. doi:10.1007/s00330-002-1463-6
46. Toepfer A. Tumors of the foot and ankle – a review of the principles of diagnostics and treatment. *Fuß Sprunggelenk*. 2017;15:82-96. doi:10.1016/j.fuspru.2017.03.004
47. Welker JA, Henshaw RM, Jelinek J, Shmookler BM, Malawer MM. The percutaneous needle biopsy is safe and recommended in the diagnosis of musculoskeletal masses. *Cancer*. 2000;89:2677-2686. doi:10.1002/1097-0142(20001215)89:12<2677::aid-cncr22>3.0.co;2-l
48. Exner GU, Kurrer MO, Mamisch-Saupe N, Cannon SR. The tactics and technique of musculoskeletal biopsy. *EFORT Open Rev*. 2017;89(12):2677-2686. doi:10.1302/2058-5241.2.160065
49. Cardoso P, Rosa J, Esteves J, Oliveira V, Rodrigues-Pinto R. Fine needle aspiration for the diagnosis and treatment of musculoskeletal tumours. *Acta Orthop Traumatol Turc*. 2017;51(4):278-283. doi:10.1016/j.aott.2017.06.001
50. Yang YJ, Damron TA. Comparison of needle core biopsy and fine-needle aspiration for diagnostic accuracy in musculoskeletal lesions. *Arch Pathol Lab Med*. 2004;128:759-764. doi:10.5858/2004-128-759-concba
51. Colterjohn NR, Davis AM, O'Sullivan B, Catton CN, Wunder JS, Bell RS. Functional outcome in limb-salvage surgery for soft tissue tumours of the foot and ankle. *Sarcoma*. 1997;1(2):67-74. doi:10.1080/13577149778326

How to cite this article: Uddin A, Flanagan G, Reilly I. Surgical excision of complex lipoma from the foot: A case report. *Clin Case Rep*. 2022;10:e05953. doi: 10.1002/ccr3.5953