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Radiological diagnostic and treatment challenges of rare cases of adult fibrosarcoma: A case report

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Case Report

ABSTRACT

Fibrosarcoma in adults is a rare malignant tumor originating from fibroblasts, accounting for 3% of all sarcomas in adults. We report the case of a 22-year-old man with a large, solitary, persistent mass on the right sole, accompanied by swelling and pain, as well as a mixture of blood and necrotic tissue. There was no history of trauma. Initial X-ray examination showed a soft tissue mass without periosteal reaction or bone damage. Ultrasonography confirmed the presence of a solid, slightly heterogeneous mass within the plantar fascia of the foot. Subsequently, Magnetic Resonance Imaging (MRI) showed an irregularly shaped solid mass with irregular margins, without a capsule, containing small areas of necrotic tissue, measuring approximately 7.4 x 4.4 x 4.3 cm in the right plantar fascia. The mass appeared to spread to the surrounding muscles without damaging the adjacent bones, with no evidence of neurovascular compression. Histopathological examination revealed highly proliferative fibroblastic cells arranged in a herringbone pattern. Fibroblastic cells with spindle-shaped nuclei, enlarged, coarse chromatin, and eosinophilic cytoplasm were present within the collagenous mass. The patient underwent tumor resection with clean margins of 1–2 cm, followed by chemotherapy, and is scheduled for radiotherapy. It is essential to perform appropriate radiological examinations and to correlate clinical, laboratory, and histopathological findings to diagnose fibrosarcoma and plan the best course of treatment.

INTRODUCTION

Fibrosarcoma is a subtype of soft tissue sarcoma originating from mesenchymal fibroblasts.[1–3] Although rare, fibrosarcoma is known for its local aggressiveness, resistance to chemoradiation, and high recurrence rate.[4–6] Early and accurate diagnosis, supported by advanced imaging and histopathological confirmation, is essential to optimize clinical outcomes.[3,7,8] Adult fibrosarcoma typically affects individuals aged 40 to 55 years, with a slight male predominance.[1,9,10] It most often arises in the deep soft tissues of the extremities but may also occur in the trunk, head, or neck.[11,12] The MRI plays a pivotal role in preoperative assessment, tumor localization, and surgical planning.[13–15] Histopathological evaluation remains the gold standard for diagnosis.[7,16,17]

Radiological assessment is crucial for diagnosing an adult fibrosarcoma.[13,14] An initial radiographic and ultrasonographic evaluation is usually recommended,[1] but MRI is considered the gold standard for evaluating tumor extent and peritumoral edema.[13,15] MRI provides important details such as bone remodeling, invasion, and calcification or ossification within soft tissue, all of which are crucial for surgical planning—especially given that positive surgical margins are a strong predictor of local recurrence.[13,18] Definitive diagnosis requires

histopathological and immunohistochemical (IHC) evaluation.[16,17,19] Standard treatment involves surgical resection, with radiotherapy recommended in cases of residual tumor or positive margins.[12,19,20] Chemotherapy may be indicated for high-grade tumors.[21] However, fibrosarcoma often mimics the other soft tissue neoplasms.[1,11,20,22] Appropriate radiological examination is essential for diagnosing fibrosarcoma, supported by histopathological findings, including IHC, and clinical findings. Both clinicians and radiologists must be aware of the risk of misdiagnosis when these essential data are not evaluated.[7,15,19]

CASE DESCRIPTION

A 22-year-old male presented with a rapidly enlarging lump on the sole of the right foot over the past month. He also experienced significant weight loss and reported no history of trauma. Physical examination revealed a solitary, firm, immobile mass on the plantar aspect of the right foot, associated with swelling, pain, hemorrhagic discharge, and areas of necrosis. Vital signs were within normal limits. Laboratory investigations revealed anemia (hemoglobin: 9 g/dL), leukocytosis (12,000/mm^3), and elevated ESR (erythrocyte sedimentation rate), CEA (carcinoembryonic antigen) 1.9 ng/ml, and CA-125 (cancer antigen-125) 21.3 units/ml.

Initial X-ray evaluation (Figure 2.a) revealed soft tissue swelling extending from the plantar region to the medial superior part of the foot, with minimal lucent areas indicating the presence of a necrotic component. It is important to note that there were no signs of bone destruction in the tarsal or metatarsal bones. Further assessment using ultrasound (Figure 2.b) revealed a hypoechoic mass, slightly heterogeneous with a well-defined border and irregular edges, located within the plantar fascia. Color Doppler imaging demonstrated significant vascularization within the lesion, raising suspicion of a malignant soft-tissue process. The MRI examination conducted without gadolinium contrast was performed due to an allergic reaction during the contrast sensitivity test (Figure 3). The MRI findings showed an irregular, heterogeneous solid mass with minimal internal necrosis and irregular contours. The lesion was confined to the soft tissue of the plantar fascia without bone infiltration, periosteal reaction, and neurovascular involvement. Based on these findings, we suspected that the mass is a stage I soft-tissue fibrosarcoma.

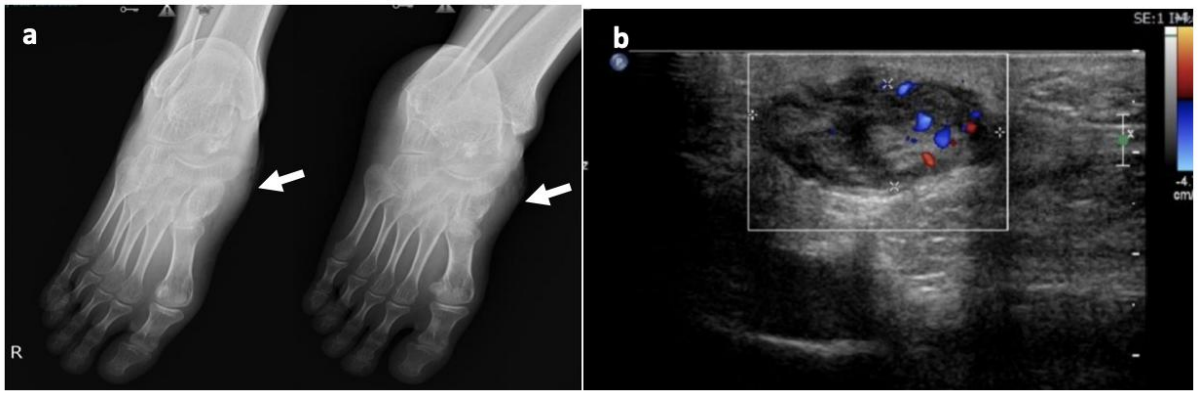

Figure 2. a) X-ray examination of the right ankle with AP/Oblique projection revealed a soft tissue swelling with minimal erosion of the surrounding tarsal bones and no apparent bone destruction or periosteal reaction (arrow), concluded as a soft tissue tumor, b) Ultrasonography of the plantar pedis confirmed a hypoechoic and heterogeneous mass at the thickness of the plantar fascia with significant vascularization in Doppler.

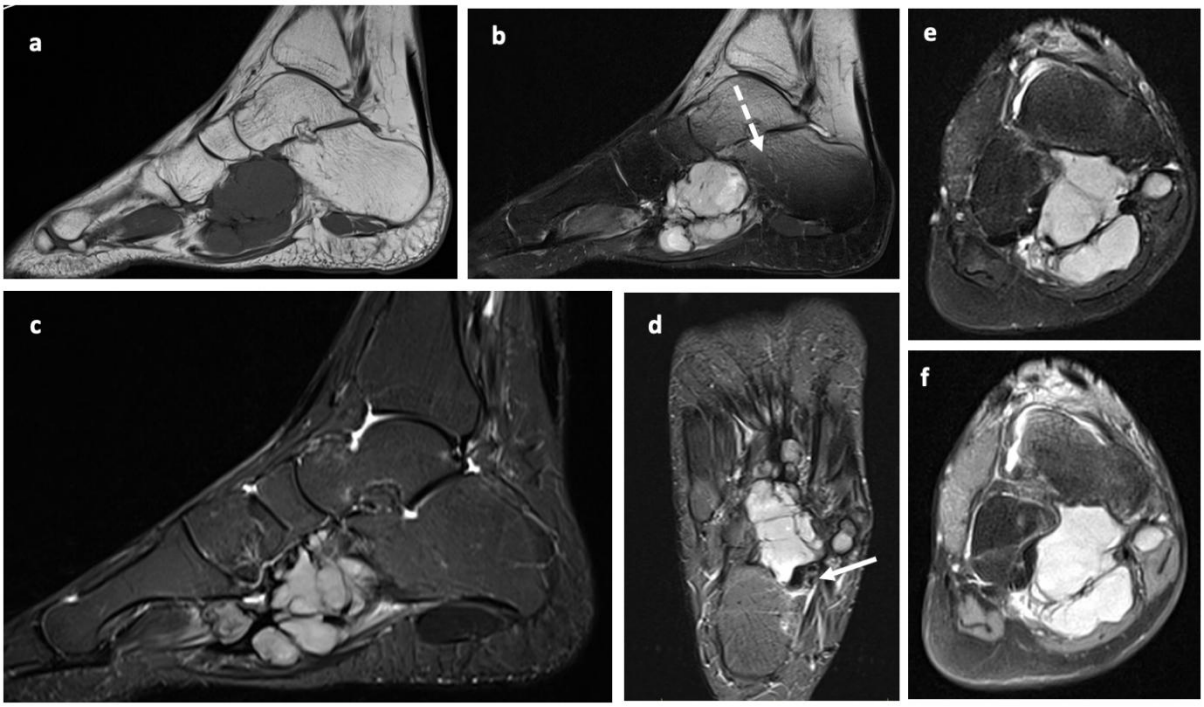

Figure 3. Non-contrast MRI showed a hypointense solid lesion on a) T1WI and b) heterogeneous intensity on T2WI and c) T2 TIRM sagittal view, with partially indistinct borders, lobulated edge on the right plantar pedis, no fat suppression was seen on T2 Fatsat coronal view (f). On T2 TIRM coronal view (d & e), the lesion is a soft tissue origin with no lesion infiltrating into the calcaneal bone (*dashed arrow*) or other tarsal and metatarsal bones without periosteal reaction. No evidence of neurovascular encasement (*arrow*). These results indicated the plantar fascia mass was most likely a fibrosarcoma.

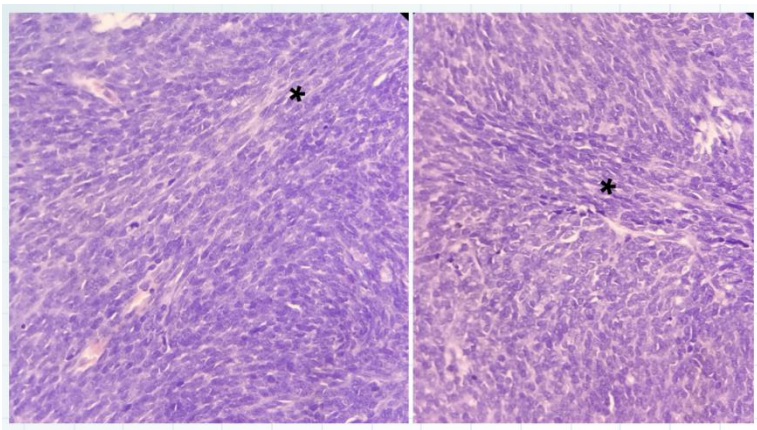

Figure 4. Hematoxylin-eosin (H&E) analysis at 200x magnification of the biopsy tissue revealed highly proliferative fibroblastic cells organized to form a “Herring Bone” pattern (*). The tumor cells showed fibroblastic cells with spindle-shaped nuclei, enlarged, coarse chromatin, and eosinophilic cytoplasm between collagen masses. These findings support the appearance of fibrosarcoma.

The tissue biopsy was performed for histopathological analysis by hematoxylin-eosin (H&E) staining (Figure. 4), which revealed a densely cellular lesion composed of proliferative fibroblastic cells arranged in a characteristic "herringbone" pattern. The tumor cells displayed spindle-shaped nuclei, coarse chromatin, and eosinophilic cytoplasm, embedded in a collagen-rich stroma, consistent with fibrosarcoma.

The patient underwent surgical excision of the tumor along with adjacent soft tissue to achieve clear margins. Postoperative systemic chemotherapy was initiated to control residual disease and delay recurrence. The patient received six cycles of chemotherapy using a combination regimen of cyclophosphamide (1500 mg/m^2), actinomycin D (0.75 mg/m^2), and

vincristine (1.5 mg/m^2), and was closely monitored to manage chemotherapy-related side effects. After completing the six cycles, a follow-up MRI with gadolinium contrast is scheduled to re-evaluate the tumor location. Adjuvant radiotherapy is also planned to target residual tumor tissue, depending on the patient's recovery and improvement in general condition.

DISCUSSION

Fibrosarcoma is a rare subtype of soft tissue sarcoma arising from mesenchymal cells and composed predominantly of pathologically transformed spindle-shaped fibroblasts with high mitotic activity.[2,3,11,23] It is classified into two main types based on age: infantile (congenital) fibrosarcoma, typically occurring in children under 10 years—often even before age two[21,22]—and adult-type fibrosarcoma, which generally manifests after age 10.[24,25] According to World Health Organization (WHO) classification, adult fibrosarcoma is categorized as *high-grade malignant*, whereas the infantile type is considered *intermediate-grade*.[11,25]

Fibrosarcoma falls under the broader category of spindle cell sarcomas, which are the most prevalent subtype of soft tissue sarcomas. Histologically, soft tissue sarcomas are grouped into five categories based on cell morphology: pleomorphic, epithelioid, myxoid, small round cell, and spindle cell types.[22] Microscopically, spindle cell tumors display oval to fusiform nuclei, uni- or bipolar cytoplasm, and tapered ends.[11,17,23] Fibrosarcoma specifically is characterized by uniform spindle fibroblasts arranged in parallel bundles, often forming intersecting angles that create a "herringbone" pattern.[7] Cellular pleomorphism is typically minimal, and nuclei tend to be prominent with coarse, granular chromatin and small cytoplasmic volume.[7,11,23]

The degree of necrosis, hemorrhage, interstitial collagen content, and mitotic activity are key indicators of tumor aggressiveness.[6,18,26] The Fédération Nationale des Centres de Lutte Contre le Cancer (FNCLCC) grading system evaluates fibrosarcoma malignancy based on tumor differentiation, mitotic count, and necrosis.[23] Well-differentiated fibrosarcomas tend to resemble normal fibroblastic tissue, whereas poorly differentiated forms may have a stroma that is keloid-like, loose, or myxoid in appearance.[11,18,23,26] Clinical symptoms are often vague in the early stages.[19,22] Tumors may remain asymptomatic until they exceed 5 cm or impinge on adjacent structures. Pain, weight loss, or neurological symptoms may develop as the lesion enlarges.[19,20,25]

Radiological imaging continues to play a crucial supporting role in identifying, describing, and planning the management.[11] Initial imaging often begins with ultrasound (US). According to the European Society of Musculoskeletal Radiology, ultrasound help to confirm the presence of a tumor, assess its depth relative to the fascia, size, and anatomical location, evaluate its relationship with surrounding structures (blood vessels, nerves, joints, bones), and characterize internal contents such as cystic areas, necrosis, hemorrhage, mineralization, or vascularity on color Doppler. [11,19,27,28] In this case, the US revealed a solid lesion with necrotic components adherent to the plantar fascia with hypervascularization. X-rays also remain a valuable tool as recommended by the American College of Radiology (ACR) appropriateness criteria.[12,24] to exclude bone involvement, detect periosteal reactions, or differentiate from primary bone tumors with secondary soft tissue extension.[1,11]

In this case, MRI was used as an advanced imaging modality. MRI is considered the most informative imaging technique for fibrosarcoma in adults.[18,29] In general, fibrosarcoma shows low signal intensity on T1-weighted images, heterogeneous high signal intensity on T2-weighted images, and restricted diffusion on DWI sequences.[18] Non-contrast MRI may also show fibrous septa with low signal intensity, appearing as band-like areas across the image sequences, supporting the diagnosis of fibrosarcoma in this case (Figure 3).[1,18] When contrast is used, particularly with gadolinium-based agents like Gd-DTPA (gadolinium-diethylenetriamine pentaacetic acid), characteristic enhancement patterns such as heterogeneous peripheral or spoke-wheel-like enhancement may appear—features considered highly suggestive of adult fibrosarcoma.[1,11] Unfortunately, the allergic reaction limited the MRI examination with contrast. On the other hand, CT scans are less reliable for soft-tissue sarcomas due to their limited soft-tissue resolution[1,18] Additionally, in infantile fibrosarcoma, CT scans may resemble vascular tumors due to prominent arterial vessels, complicating radiological interpretation.[28]

Histopathological features are definitive for the diagnosis of fibrosarcoma, particularly the presence of hyperchromatic spindle cells with moderate pleomorphism arranged in a characteristic fascicular or herringbone pattern,[11] which is clearly visible in the case under discussion. Additionally, variable amounts of interstitial collagen may be present, and diagnosis requires exclusion of similar entities such as myxofibrosarcoma, low-grade fibromyxoid sarcoma, sclerosing epithelioid fibrosarcoma, and fibrosarcoma associated with dermatofibrosarcoma protuberans.[23] Furthermore, IHC plays an important role, especially in distinguishing fibrosarcoma from other spindle cell neoplasms, as there are no specific histopathological markers.[27] IHC testing can identify vimentin expression and minimal SMA expression, consistent with a fibroblastic origin.[30] Vimentin, an intermediate filament protein commonly expressed in mesenchymal cells, is associated with epithelial-mesenchymal transition (EMT). Although its diagnostic specificity is limited, vimentin remains a potential therapeutic target in cancer.[17,30] Unfortunately, IHC testing was not performed in the case we present. Therefore, the clinical-radiological correlation in this case may be key to successful diagnosis and therapy.

The management of fibrosarcoma is based on tumor type, anatomical location, disease stage, and the patient's general condition.[21] Surgery remains the cornerstone of treatment, as fibrosarcomas exhibit limited sensitivity to both radiotherapy and chemotherapy.[27] However, due to their aggressive nature and high recurrence rate, a multimodal approach combining local and systemic therapies is often recommended.[20] The standard surgical technique involves wide excision of the tumor with at least 1–2 cm of clear margins to reduce the risk of local recurrence.[7,31] If postoperative margins are positive, further excision or adjuvant radiotherapy may be necessary.[27] In cases where wide resection is anatomically challenging—such as intra-abdominal tumors near vital organs—margin-negative resection may not always be feasible.[12,27] For intramuscular tumors, en bloc or compartmental resection is strongly advised.[7]

Neoadjuvant treatments, including chemotherapy or radiotherapy prior to surgery, may be considered for large, high-grade, or limb-threatening tumors, aiming to reduce tumor size and facilitate resection.[27,32] Postoperative radiotherapy is generally delayed by 4–6 weeks to allow surgical wound healing.[32] In cases where surgery is contraindicated, radiation may serve as the primary modality, especially for symptom control in metastatic disease (palliative intent).[5,33] Although chemotherapy can target rapidly proliferating tumor cells, its role in fibrosarcoma remains controversial.[4,32,34] Fibrosarcomas are relatively resistant to cytotoxic agents, and the benefits of adjuvant or systemic chemotherapy are not yet clearly established. Nonetheless, agents such as doxorubicin**,** vincristine**,** and actinomycin D have shown some efficacy and are used in select cases.[21,34,35]

Emerging interventional radiology techniques, such as transarterial chemoembolization (TACE), are being explored as potential neoadjuvant options. While promising, further studies are needed to validate their effectiveness in treating fibrosarcoma.[35,36] Ultimately, treatment should be individualized based on tumor behavior and patient factors, and managed by a multidisciplinary team.[7]

Multiple factors, including patient age, tumor size, depth, histologic grade, and anatomical involvement, influence the prognosis of fibrosarcoma.[29] Critical prognostic indicators include infiltration of neurovascular structures, bone involvement, collagen density, potential for metastasis, and likelihood of local recurrence.[8,19,27] Poor prognostic factors comprise high tumor grade, extensive necrosis (>50%), high mitotic index (>20 mitoses per 10 high-power fields), decreased stromal collagen with increased cellularity, deep-seated location, and tumor diameter exceeding 5 cm.[21,27,37] Among these, histopathological features remain the most significant determinants of clinical outcome.[2,3]

CONCLUSION

Adult fibrosarcoma is an uncommon yet aggressive malignant soft tissue tumor, characterized by a high propensity for local recurrence and potential for distant metastasis. A precise diagnosis requires an integrated, multimodal approach that combines radiologic imaging, histopathological examination, and immunohistochemical (IHC) profiling. The cornerstone of

treatment is wide surgical excision with histologically negative margins, as local recurrence is strongly associated with residual tumor presence. In cases where complete resection is not feasible or in high-grade tumors, adjuvant therapies such as radiotherapy and, in selected cases, chemotherapy are employed to reduce the risk of recurrence. Recent developments in interventional radiology and molecular-targeted therapies offer promising adjuncts to conventional treatment, potentially improving both local control and systemic outcomes.

LIMITATIONS

This case was limited by the inability to perform contrast-enhanced MRI due to an allergy and the lack of immunohistochemistry.

CONFLICT OF INTEREST

The authors declare no conflict of interest.

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Written informed consent was obtained from the patient's family for both treatment and publication.

DATA AVAILABILITY STATEMENT

The patient data presented can be obtained from the corresponding author upon reasonable request if needed.

SUPPLEMENTARY MATERIAL(S)

All relevant data has been presented in this manuscript, and there is no additional data provided separately.

AUTHOR CONTRIBUTIONS

TMY: Conceptualization, literature review, and writing; RAS: Data curation; MDA: Drafting and editing; NE: English editing; FDI: Histopathologic analysis. All authors contributed to the final manuscript and approved its content.

DECLARATION OF USING AI IN THE WRITING PROCESS

The authors declare the use of AI to assist in citation searching.

LIST OF ABBREVIATIONS

MRI: Magnetic Resonance Imaging; ESR: Erythrocyte Sedimentation Rate; CEA: Carcinoembryonic Antigen; CA-125: Cancer Antigen-125; AP: Anterior-Posterior T1WI: T1 Weighted Image; T2WI: T2 Weighted Image; TIRM: Turbo inversion recovery magnitude; EBR: En-bloc Resection; TACE: Transarterial Chemoembolization; DWI: Diffusion Weighted Imaging; ADC: Apparent Diffusion Coefficient; Gd-DTPA: Gadolinium-Diethylene Triamine Penta Acetic; CT: Computed Tomography; IHC: Immunohistochemical; EMA: Epithelial Membrane Antigen; SMA: Alpha Smooth Muscle Actin; EMT: Epithelial-Mesenchymal Transition.

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