

## Case Report

# Decoding chronic subcutaneous mysteries

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## ABSTRACT

Phaeohyphomycosis, a fungal infection caused by dematiaceous fungi, presents diagnostic challenges due to clinical similarity with other conditions. Advanced imaging, especially magnetic resonance imaging, is crucial for assessing tissue involvement. This report highlights a case of subcutaneous phaeohyphomycosis, emphasizing the importance of multimodal diagnostics including histopathology and culture. In this case report, we wish to highlight the features of this rare entity in a 41-year-old male who presented with the left knee swelling with multiple draining sinuses and nodules for the past 6 months.

**Keywords:** Subcutaneous abscess, Phaeohyphomycosis, Dematiaceous fungi

## INTRODUCTION

Phaeohyphomycosis is a rare infection caused by dematiaceous fungi, involving the skin and subcutaneous tissue, paranasal sinuses, eyes, bones, or central nervous system. Skin and subcutaneous tissue involvement is termed subcutaneous phaeohyphomycosis and is characterized by papulonodules, verrucous, hyperkeratotic or ulcerated plaques, cysts, abscesses, pyogranuloma, non-healing ulcers, or sinuses.<sup>[1]</sup> Subcutaneous infections typically occur over the exposed areas of the body especially the extremities fingers, wrist, knees, or ankles resulting from traumatic inoculation.

## CASE REPORT

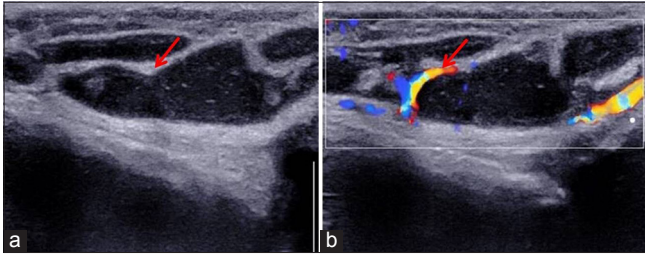
A 41-year-old male presented with complaints of the left knee swelling with multiple draining sinuses and nodules around left knee for the past 6 months. No history of trauma or any other complaints were reported. The patient was evaluated with ultrasound and magnetic resonance imaging (MRI) of the left lower extremity (MRI).

Ultrasonography of knee revealed [Figure 1] multiloculated hypoechoic collection with mobile internal echoes, increased posterior acoustic enhancement and increased vascularity in the walls.

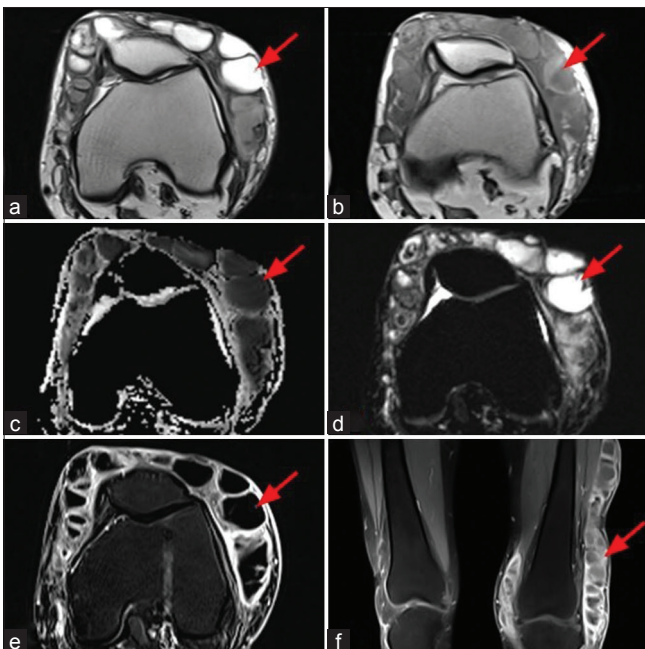
MRI of knee revealed [Figure 2] an extensive multiloculated collection in the subcutaneous plane of lower-half of thigh and knee regions. It appears predominantly hyperintense in T2 and hypointense on T2-weighted images and shows significant diffusion restriction on diffusion weighted image (DWI). Post-contrast subtracted images revealed smooth enhancement of the walls. No evidence of deeper extension to bone or joint space was seen. No imaging features of myositis/osteomyelitis/infective arthritis.

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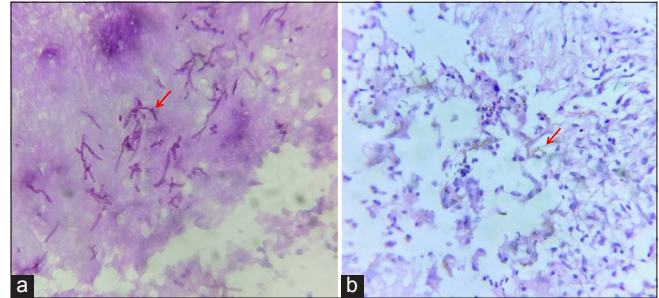


**Figure 1:** A 41-year-old male with complaints of the left knee swelling with multiple draining sinuses and nodules for the past 6 months. Ultrasonography of the left knee. (a) Transverse sonogram of the knee showing multiloculated hypoechoic collection with mobile internal echoes and increased posterior acoustic enhancement (red arrow). (b) Color Doppler image showing appreciable vascularity in the walls (red arrow).



**Figure 2:** A 41-year-old male with complaints of the left knee swelling with multiple draining sinuses and nodules for the past 6 months, (a and b) T2-weighted axial and T1-weighted axial MR images show an extensive T2 hyperintense/hypointense and T1 hypointense multiloculated collections in subcutaneous plane of lower thigh and knee regions (red arrows), (c and d) Apparent diffusion coefficient and diffusion-weighted image shows significant diffusion restriction (red arrows) (e and f) subtracted and post contrast T1 fat-saturated images show smooth thin peripheral enhancement (red arrows).

Based on these imaging features, chronic infective etiology with differential diagnosis of cutaneous actinomycosis/nocardiosis/tuberculosis was made. The patient was evaluated further with excision biopsy from the skin and knee lesion. Histopathological examination (HPE) images [Figure 3] revealed features of subcutaneous abscess cavity



**Figure 3:** Histopathology image (a) periodic acid Schiff stain shows thin septate fungal hyphae (red arrow) and (b) high-power view shows brown pigmented thin septate fungal hyphae (red arrow).

lined by granulation tissue, special stain for fungus showed thin septate fungal hyphae consistent with subcutaneous mycosis - phaeohyphomycosis.

The patient was treated with extensive debridement of the left thigh and knee.

## DISCUSSION

Phaeohyphomycosis is caused by dematiaceous (pigmented) fungi which contain melanin in their cell walls and grows in tissues in the form of dark-walled septate mycelium. Melanin is the virulence factor in these fungi, it acts by inhibiting phagocytosis.<sup>[2]</sup> The infections due to dematiaceous fungi are classified into two groups based on the morphology in tissues, chromoblastomycosis (which present as muriform bodies in tissues), and phaeohyphomycosis (which present as hyphae or yeast cells or both without any muriform body in tissues).<sup>[3]</sup> They are sometimes indistinguishable from a condition called mycetoma also known as “Madura foot.” Mycetoma is a localized chronic, suppurative infection affecting skin, subcutaneous tissue, and bones caused by either bacteria (actinomycetoma) or fungi (eumycetoma).

The etiological agents of phaeohyphomycosis include various dematiaceous hyphomycetes belonging to different orders such as *Chaetothyriales* (*Exophiala*, *Phialophora*, and *Cladophialophora*) and *Pleosporales* (*Bipolaris*, *Exserohilum*, *Curvularia*, and *Alternaria*).<sup>[4]</sup> Identifying the specific agent has therapeutic importance as different species may have tropism for different organs with varying response to antifungals.

The clinical presentation ranges from solitary cutaneous nodules to deep subcutaneous abscess. The subcutaneous infections typically occur on the exposed areas of the body, especially the extremities, fingers, wrists, knees, or ankles, resulting from traumatic inoculation.<sup>[5]</sup>

It is essential to distinguish this from conditions such as chromoblastomycosis, mycetoma, ganglion cysts, epidermal inclusion cysts, Baker's cysts, erythema nodosum, and lipomas. This distinction can be achieved through evaluating

**Table 1:** Differential diagnosis for subcutaneous mycosis.

Synovial cysts	<ul style="list-style-type: none"> <li>• Well-defined unilocular or multilocular cystic masses.</li> <li>• Located posteromedially arising between the tendon of the semimembranosus and the medial head of gastrocnemius.</li> <li>• Fluid signal intensity is seen in all sequences.</li> <li>• Increased signal intensity within the cyst on T1-weighted images may appear in an infected or hemorrhagic cyst.</li> </ul>
Mycetoma (Maduramycosis)	<ul style="list-style-type: none"> <li>• USG - Numerous sharp bright hyper reflective echoes produced by the grain cement, observed in Eumycetoma.</li> <li>• MRI - Dot-in-circle sign is a characteristic sign of mycetoma, well-defined small round hyperintensity (represents granulation tissue), surrounded by a low-signal intensity rim (represents fibrous septa) with a hypointense dot (represents fungal elements) in the center.</li> </ul>
Chromoblastomycosis	<ul style="list-style-type: none"> <li>• Characteristic histological finding of epithelioid granulomas containing microlonies and grains.</li> <li>• Chronic slow growing non-tender nodular lesion which originates from deeper tissues particularly involving foot.</li> <li>• Non-specific imaging findings - May involve the underlying bone in long standing conditions.</li> <li>• Characteristic histological finding of granulomatous inflammation, muriform cells, and Medlar bodies (copper pennies)</li> </ul>
Cutaneous nocardiosis	<ul style="list-style-type: none"> <li>• Non-specific imaging findings - multiple, complex lesions and fluid collections</li> <li>• Peripheral ring enhancement on T1-weighted images after contrast administration</li> <li>• Characteristic morphology of branching, filamentous, gram positive rod observed under microscope.</li> </ul>
MRI: Magnetic resonance imaging, USG: Ultrasonography	

clinical presentation, followed by histopathology and culture sensitivity.<sup>[6]</sup>

Subcutaneous abscess are usually diagnosed clinically and do not routinely require any imaging. In complex cases where possible radical surgical treatment is being considered, imaging may be undertaken to determine the extent of soft-tissue involvement. MRI is the preferred modality for the evaluation of more deep soft-tissue abscesses.

Ultrasound is useful for differentiating cellulitis with cutaneous and subcutaneous swelling from a true abscess. Predominantly hypoechoic fluid collection with mobile internal echoes on sonopalpation, echogenic capsule, and increased posterior through-transmission are characteristic findings of an abscess on ultrasound. However, ultrasound cannot assess the deeper extension of the abscess into the joint space or bone.

MRI is the preferred modality for soft-tissue abscess. On MRI, subcutaneous abscess demonstrate single or multiloculated well-circumscribed area of T1-weighted (T1W) isointense or hypointense signal, hyperintense (fluid-like) signal on fluid-sensitive sequences, with T1W post-contrast rim enhancement. However, subacute, chronic, or acute on chronic abscesses may demonstrate a peripheral rim of hyperintense signal relative to the low-signal abscess cavity on T1W pre-contrast images, referred to as the “penumbra sign,” with sensitivity and specificity of 54% and 98%, respectively, for differentiation of soft-tissue infection from neoplasm.<sup>[7]</sup> Like cerebral fungal abscess, on DWI, subcutaneous fungal abscess may show low apparent-diffusion-coefficient (ADC) of the walls and high ADC of the central contents. The center or periphery of the abscess may show susceptibility artifacts

in susceptibility-weighted imaging, indicating toward its fungal composition. Characteristic magnetic resonance spectroscopy includes multiple signals between 3.6 and 3.8 ppm assigned to Trehalose, a fungal wall disaccharide.

Although MRI results lack specificity, imaging plays a crucial role in determining the extent of the infectious process, involvement of bone, and guiding surgical drainage of purulent collections.

HPE and culture plays the most important role in the diagnosis of phaeohyphomycosis.

The treatment of choice is surgical excision, but additional antifungal therapy is recommended for recurrent cases and immunocompromised patients. Itraconazole, voriconazole, posaconazole, and caspofungin have shown good results.<sup>[8]</sup> A number of other treatment modalities including amphotericin B, flucytosine, terbinafine, and griseofulvin, as well as physical treatment methods such as heat and cryosurgery have been utilized in patients with cutaneous phaeohyphomycosis.<sup>[9]</sup>

## DIFFERENTIAL DIAGNOSIS

Common differential diagnosis of subcutaneous mycosis includes synovial cysts, mycetoma, chromoblastomycosis, and cutaneous nocardiosis [Table 1].

## CONCLUSION

The diagnosis of subcutaneous phaeohyphomycosis is difficult due to the clinical polymorphism of the lesion. Clinical presentation along with the findings from multimodal diagnostic tools including radiological,

microbiological, and histological should direct toward diagnosis of phaeohyphomycosis. Since these fungal infections are subclinical in presentation, the importance of imaging and histology should be emphasized to achieve appropriate treatment, prevent recurrence, and avoid functional and mutilating sequelae.

## TEACHING POINTS

1. Our case report highlights the fact that a subcutaneous abscess must also be considered under differential diagnosis for fungal infections even in immunocompetent individuals.
2. Although MRI findings of subcutaneous mycosis may be nonspecific and mimic many other conditions, it is not only helpful in delineating soft tissues and bone involvement but also differentiating it from deeper neoplastic growth.

## MCQs

1. Which one of the following sentences is false regarding phaeohyphomycosis?
  - a. It is caused by dematiaceous fungi.
  - b. Melanin is the virulence factor.
  - c. Phaeohyphomycosis affects only skin and subcutaneous tissue.
  - d. Subcutaneous infections typically occur over the exposed areas of the body.

Answer Key: c

2. What is the standard modality for diagnosis of phaeohyphomycosis?
  - a. Ultrasound
  - b. Histopathology and culture
  - c. Gram stain
  - d. MRI

Answer Key: b

3. Which one of the following is false regarding subcutaneous phaeohyphomycosis?
  - a. Mycetoma is one of the close differential diagnoses.
  - b. HPE and culture plays an important role in the diagnosis.
  - c. Subcutaneous abscesses are treated with surgical excision.
  - d. Dot-in-circle sign is a characteristic MRI sign of phaeohyphomycosis

Answer Key: d

## Ethical approval

Institutional Review Board approval is not required.

## Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent.

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Nil.

## Conflicts of interest

There are no conflicts of interest.

## Use of artificial intelligence (AI)-assisted technology for manuscript preparation

The authors confirm that there was no use of artificial intelligence (AI)-assisted technology for assisting in the writing or editing of the manuscript and no images were manipulated using AI.

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