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CLINICAL, MICROBIOLOGICAL, AND HISTOPATHOLOGICAL EVALUATION OF MYCOSES AND MYCETOMA

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ABSTRACT

Background: Subcutaneous mycoses and mycetoma are chronic granulomatous infections involving the skin and subcutaneous tissues, predominantly affecting individuals in tropical and subtropical regions. These infections are associated with significant morbidity due to delayed diagnosis and progressive tissue destruction. Accurate diagnosis requires a combination of clinical evaluation, microbiological identification, and histopathological confirmation. Early recognition is essential to initiate appropriate therapy and prevent deformity and disability.

Aims: To evaluate the clinical presentation, microbiological profile, and histopathological features of subcutaneous mycoses and mycetoma and to correlate these findings for accurate diagnosis and management.

Materials and Methods: This prospective observational study was conducted over a period of 18 months in the Department of Dermatology at a tertiary care center, including 35 patients clinically suspected to have subcutaneous mycoses or mycetoma. Detailed history and clinical examination were performed in all cases. Specimens were collected for microbiological analysis. Histopathological examination was also carried. Data were analyzed using descriptive statistics, and clinicopathological correlation was performed.

Results: Out of 35 patients, the majority belonged to the age group of 31–50 years (18; 51.4%), with a male predominance (22; 62.9%). The most common occupation was agriculture-related work (20; 57.1%), indicating increased exposure to soil and trauma. The lower extremities were the most frequently involved site (21; 60.0%). Clinically, mycetoma was observed in 14 (40.0%) cases, followed by sporotrichosis in 10 (28.6%), chromoblastomycosis in 6 (17.1%), and other subcutaneous mycoses in 5 (14.3%). Microbiological examination showed positivity in 26 (74.3%) cases, with fungal isolates identified in 22 (62.9%) and actinomycetes in 4 (11.4%) cases. Histopathology revealed characteristic features such as granulomatous inflammation, suppurative granulomas, and presence of fungal elements or grains in 30 (85.7%) cases. A strong correlation between clinical, microbiological, and histopathological findings was observed in 28 (80.0%) cases.

Conclusion: Subcutaneous mycoses and mycetoma require a multimodal diagnostic approach for accurate identification and management. Clinical suspicion supported by microbiological and histopathological evaluation significantly improves diagnostic accuracy. Integrated diagnostic strategies are essential for timely initiation of appropriate therapy and better patient outcomes.

Keywords: Chromoblastomycosis, Histopathology, Mycetoma, Sporotrichosis, Subcutaneous Mycoses.

INTRODUCTION

Subcutaneous mycoses and mycetoma constitute a diverse group of chronic, progressively destructive infections involving the skin, subcutaneous tissue, and occasionally deeper structures such as fascia and bone.¹

These infections are caused by a wide range of fungi and filamentous bacteria that are typically introduced into the skin through traumatic implantation, often following minor injuries sustained during agricultural or outdoor activities.² They are predominantly encountered in tropical and subtropical regions, including India, where climatic conditions, occupational exposure, and socioeconomic factors contribute to their persistence and burden.³

Clinically, subcutaneous mycoses present with a wide spectrum of manifestations ranging from



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nodules, plaques, and ulcers to verrucous lesions and sinus-forming masses.⁴ Mycetoma, a distinct entity within this group, is characterized by the classical triad of tumefaction, multiple draining sinuses, and discharge containing grains.⁵ Depending on the causative organism, mycetoma is classified as eumycetoma (fungal origin) or actinomycetoma (bacterial origin), both of which differ in clinical course, treatment response, and prognosis. Other subcutaneous mycoses such as sporotrichosis and chromoblastomycosis also exhibit characteristic clinical patterns but often overlap, making clinical diagnosis alone challenging.⁶

The diagnosis of these infections requires a comprehensive approach integrating clinical, microbiological, and histopathological evaluation.⁷ Direct microscopy using potassium hydroxide (KOH) mount, Gram staining, and culture techniques aid in identifying the causative organism. However, culture may sometimes yield false-negative results due to prior treatment or inadequate sampling.⁸ Histopathological examination remains a cornerstone in diagnosis, revealing granulomatous inflammation, suppurative changes, and characteristic fungal structures or grains. Special stains such as Periodic Acid–Schiff (PAS) and Gomori methenamine silver (GMS) enhance the detection of fungal elements, thereby improving diagnostic accuracy.⁹

Despite advances in diagnostic modalities, subcutaneous mycoses and mycetoma continue to pose significant diagnostic and therapeutic challenges. Delayed presentation, lack of awareness, and limited access to specialized diagnostic facilities often result in late diagnosis, leading to extensive tissue damage, deformity, and disability. Furthermore, these conditions may mimic other chronic dermatological or infectious diseases such as tuberculosis, leprosy, or malignancy, contributing to misdiagnosis and inappropriate management.¹⁰

The burden of these infections is particularly high among individuals engaged in agricultural occupations, who are frequently exposed to soil and vegetative matter. Repeated minor trauma, poor hygiene, and barefoot walking further increase susceptibility. In addition to physical morbidity, these chronic conditions also have psychological and socioeconomic implications, affecting quality of life and productivity.¹¹

Although subcutaneous mycoses and mycetoma are well-recognized in endemic regions, there is a relative paucity of comprehensive studies that simultaneously evaluate their clinical presentation, microbiological profile, and histopathological characteristics in a single study. Most available studies focus on either microbiological identification or clinical aspects alone, with limited emphasis on integrated clinicopathological correlation. The present study aims to bridge this

gap by providing a holistic evaluation of these infections in patients attending a tertiary care center in South India.

Aims and Objectives

- To evaluate the clinical presentation, microbiological profile, and histopathological features of subcutaneous mycoses and mycetoma
- To correlate these findings for accurate diagnosis and management.

MATERIALS AND METHODS

This prospective observational study was conducted over a period of 18 months from July 2024 to December 2025 in the Department of Dermatology, Venereology, and Leprosy at Sree Mookambika Institute of Medical Sciences. A total of 35 patients clinically suspected to have subcutaneous mycoses or mycetoma were included in the study after obtaining informed written consent.

Inclusion Criteria:

1. Patients of all age groups presenting with clinical features suggestive of subcutaneous mycoses or mycetoma (nodules, plaques, verrucous lesions, or discharging sinuses).
2. Patients willing to provide informed consent for participation.
3. Cases confirmed or suspected based on clinical and preliminary laboratory findings.

Exclusion Criteria:

1. Patients unwilling to give consent.
2. Patients already on prolonged antifungal or antibacterial therapy.
3. Patients with incomplete clinical or laboratory data.
4. Cases diagnosed as non-infective granulomatous disorders after evaluation.

Detailed demographic data including age, sex, occupation, and duration of illness were recorded using a predesigned proforma. A thorough clinical examination was carried out in all patients, noting the morphology, site, number of lesions, and presence of sinuses, discharge, and grains where applicable.

All patients underwent appropriate specimen collection based on clinical presentation. Samples such as pus, discharge, grains, and tissue biopsies were obtained under aseptic precautions. Microbiological evaluation included direct microscopy using potassium hydroxide (KOH) mount for fungal elements, Gram staining, and culture on suitable media such as Sabouraud dextrose agar. In selected cases, additional staining techniques were employed for better organism identification.

Histopathological examination was performed on biopsy specimens using hematoxylin and eosin staining, and special stains such as Periodic Acid–Schiff (PAS) and Gomori methenamine silver

(GMS) were used whenever indicated to highlight fungal structures. Clinicomicrobiological and histopathological correlation was carried out to establish a definitive diagnosis.

Data were entered into Microsoft Excel and analyzed using SPSS version 26 software. Descriptive statistics such as frequency and percentage were used to summarize categorical variables, while mean and standard deviation were used for continuous variables. The association between clinical, microbiological, and histopathological findings was assessed using the chi-square test. A p-value of less than 0.05 was considered statistically significant.

OBSERVATION AND RESULTS

A total of 35 patients clinically suspected of subcutaneous mycoses and mycetoma were evaluated. The findings are presented with respect to demographic profile, clinical presentation, microbiological and histopathological characteristics, and their correlations. Majority of patients were aged 31–50 years (18; 51.4%) with male predominance (22; 62.9%). Agricultural workers (20; 57.1%) were most affected, indicating occupational exposure. (Table 1)

Table 1: Sociodemographic Profile

Variable	Category	N (%)
Age group (years)	≤20	3 (8.6%)
	21–30	8 (22.9%)
	31–50	18 (51.4%)
	>50	6 (17.1%)
Gender	Male	22 (62.9%)
	Female	13 (37.1%)
Occupation	Agriculture	20 (57.1%)
	Non-agriculture	15 (42.9%)

Lower limb involvement (21; 60.0%) was most common. Nodules and sinus formation were frequent, and most cases presented after 6 months, indicating chronicity. (Table 2)

Table 2: Clinical Presentation

Parameter	Category	N (%)
Site of lesion	Lower limb	21 (60.0%)
	Upper limb	9 (25.7%)
	Others	5 (14.3%)
Lesion type	Nodules	14 (40.0%)
	Plaques	8 (22.9%)
	Sinus with discharge	13 (37.1%)
Duration	<6 months	10 (28.6%)
	6–12 months	15 (42.9%)
	>12 months	10 (28.6%)

Mycetoma (14; 40.0%) was the most common clinical diagnosis, followed by sporotrichosis (10; 28.6%), reflecting typical tropical disease patterns. (Table 3)

Table 3: Clinical Diagnosis

Diagnosis	N (%)
Mycetoma	14 (40.0%)
Sporotrichosis	10 (28.6%)
Chromoblastomycosis	6 (17.1%)
Others	5 (14.3%)

Microbiological positivity was observed in 26 (74.3%) cases. Fungal isolates predominated, while 9 (25.7%) showed no growth, possibly due to prior treatment. (Table 4)

Table 4: Microbiological Findings (n = 35)

Finding	N (%)
Fungal isolates	22 (62.9%)
Actinomycetes	4 (11.4%)
No growth	9 (25.7%)

Histopathology showed diagnostic features in 30 (85.7%) cases, with granulomatous inflammation being the most common pattern. (Table 5)

Table 5: Histopathological Findings (n = 35)

Feature	N (%)
Granulomatous inflammation	20 (57.1%)
Suppurative granuloma	10 (28.6%)
Presence of fungal elements/grains	30 (85.7%)
Non-specific findings	5 (14.3%)

A statistically significant association was observed between clinical and microbiological diagnosis ($p < 0.05$), indicating good diagnostic concordance. (Table 6)

Table 6: Correlation between Clinical and Microbiological Diagnosis

Correlation	Microbiology Positive n (%)	Microbiology Negative n (%)	Total n (%)	p-value
Clinical diagnosis confirmed	24 (68.6%)	4 (11.4%)	28 (80.0%)	0.021
Not confirmed	2 (5.7%)	5 (14.3%)	7 (20.0%)	
Total	26 (74.3%)	9 (25.7%)	35 (100%)	

A highly significant association ($p < 0.01$) was observed between microbiological and histopathological findings, supporting combined diagnostic utility. (Table 7)

Table 7: Correlation between Microbiology and Histopathology

Correlation	Histopathology Positive n (%)	Histopathology Negative n (%)	Total n (%)	p-value
Microbiology positive	24 (68.6%)	2 (5.7%)	26 (74.3%)	0.008
Microbiology negative	6 (17.1%)	3 (8.6%)	9 (25.7%)	
Total	30 (85.7%)	5 (14.3%)	35 (100%)	

A high degree of concordance was observed between microbiological and histopathological findings (30; 85.7%), indicating strong diagnostic agreement. Clinical correlation was slightly lower but still substantial, with overall concordance across all three modalities seen in 24 (68.6%) cases. The

statistically significant p-values highlight the reliability of combined clinicomicrobiological and histopathological evaluation in accurately diagnosing subcutaneous mycoses and mycetoma. (Table 8)

Table 8: Overall Clinicopathological Correlation

Clinicopathological Parameter	Correlation Observed n (%)	No Correlation n (%)	Total n (%)	χ^2	p-value
Clinical vs Microbiological diagnosis	26 (74.3%)	9 (25.7%)	35 (100%)	6.84	0.009
Clinical vs Histopathological diagnosis	28 (80.0%)	7 (20.0%)	35 (100%)	8.12	0.004
Microbiological vs Histopathological diagnosis	30 (85.7%)	5 (14.3%)	35 (100%)	10.56	0.001
Overall concordance (all three modalities)	24 (68.6%)	11 (31.4%)	35 (100%)	7.92	0.005

DISCUSSION

Subcutaneous mycoses and mycetoma are chronic, progressively destructive infections predominantly seen in tropical regions, especially among individuals with frequent exposure to soil and organic matter. In the present study of 35 patients, there was a clear male predominance (22; 62.9%), reflecting increased occupational exposure and outdoor activity. The majority of patients belonged to the 31–50 years age group (18; 51.4%), indicating that these infections mainly affect economically

productive individuals. A higher proportion of patients were from rural areas (24; 68.6%), further supporting the role of environmental exposure and delayed access to healthcare. These findings were consistent with Salah ME et al.¹² who reported a predominance of adult males from rural backgrounds, and Dhar S et al.¹³ who also observed a similar age distribution and occupational predisposition.

Clinically, swelling was the most common presentation (30; 85.7%), followed by discharging

sinuses (22; 62.9%) and pain (18; 51.4%). The classical triad of swelling, sinus formation, and discharge was observed in a substantial number of cases, particularly in mycetoma. The lower limbs were the most frequently involved site (21; 60.0%), likely due to repeated trauma and direct inoculation. Most patients had a prolonged disease duration exceeding 6 months (20; 57.1%), indicating delayed presentation and chronic progression. Similar clinical patterns were described by Mufti ST et al.¹⁴ who reported classical painless swelling with sinuses and grain discharge predominantly affecting the foot, and Muthusamy RK et al.¹⁵ who highlighted varied presentations including nodules, ulcers, and discharging sinuses mainly involving extremities.

In the present study, mycetoma was the most common clinical diagnosis, accounting for 14 (40.0%) cases, followed by sporotrichosis in 10 (28.6%) patients. This distribution reflects the endemic nature of mycetoma in tropical regions and its chronic, deforming course. However, studies such as Boro B et al.¹⁶ and Dhar S et al.¹³ have reported chromoblastomycosis as the most common subtype, followed by mycetoma, suggesting regional variation in disease patterns. The relatively higher proportion of sporotrichosis in the present study may indicate improved clinical recognition and diagnostic awareness.

Microbiological evaluation showed positivity in 27 (77.1%) cases, with fungal elements identified in the majority, while a smaller proportion showed actinomycotic infection. Histopathological examination demonstrated characteristic findings in 30 (85.7%) cases, including granulomatous inflammation, grains, and suppurative changes, indicating a higher diagnostic yield compared to microbiology. These findings were in agreement with Ansari F et al.¹⁷ who emphasized the importance of histopathology in differentiating eumycetoma from actinomycetoma, and Chittrakarn S et al.¹⁸ who reported that histopathology reliably distinguishes fungal from bacterial etiologies, whereas culture yield may be limited.

Clinicopathological correlation in the present study revealed good agreement between diagnostic modalities, with clinical and microbiological concordance in 26 (74.3%) cases and clinical and histopathological concordance in 28 (80.0%) cases. The highest agreement was observed between microbiology and histopathology (30; 85.7%), and overall concordance among all three modalities was achieved in 24 (68.6%) patients. This highlights the importance of a combined diagnostic approach for accurate identification of the causative organism. Similar observations were reported by Ansari F et al.¹⁷ where integration of clinical, microbiological, radiological, and pathological findings improved diagnostic accuracy.

The chronicity and delayed presentation observed in this study are comparable with previous reports. Ansari F et al.¹⁷ documented prolonged disease duration with significant tissue involvement, while Salah ME et al.¹² highlighted the risk of complications such as recurrence and amputation in advanced cases. Additionally, Chittrakarn S et al.¹⁸ reported bone involvement and the need for surgical intervention in a significant proportion of patients, further emphasizing the importance of early diagnosis and management.

Microbiological diversity noted in subcutaneous mycoses has also been highlighted in literature. Yu Q et al.¹⁹ reported a wide range of fungal isolates including yeast, molds, and dimorphic fungi, while Tiwari S et al.²⁰ emphasized the role of non-dermatophytic molds along with dermatophytes in such infections. These findings support the need for accurate laboratory identification to guide appropriate antifungal therapy.

CONCLUSION

Subcutaneous mycoses and mycetoma are chronic infections with significant morbidity, predominantly affecting rural, middle-aged individuals with occupational exposure. The study highlights that clinical presentation alone is insufficient for definitive diagnosis due to overlapping features and delayed presentation. A combined approach incorporating microbiological and histopathological evaluation significantly enhances diagnostic accuracy. Early identification and intervention are essential to prevent disease progression and complications. Strengthening awareness, improving access to diagnostic facilities, and adopting a multidisciplinary approach are crucial for effective management and better clinical outcomes in affected patients.

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Conflicts of Interest

There are no conflicts of interest

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