# DIAGNOSTIC ACCURACY OF PLAIN POTASSIUM HYDROXIDE MOUNT AND CULTURE IN TINEA PEDIS

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## ABSTRACT

***Objectives:*** To determine the diagnostic accuracy of direct microscopy in clinically diagnosed cases of tinea pedis by keeping culture as gold standard.

***Study design:*** validation study

***Place and duration of study:*** Department of Dermatology Military Hospital and Armed Forces Institute of Pathology Rawalpindi from January 2008 to July 2008.

***Patients and methods:*** One hundred clinically diagnosed cases of tinea pedis were subjected to direct microscopy with 10% KOH and fungal culture.

***Results:*** Direct microscopic examination was positive in 34% and culture in 60% of the cases. The sensitivity and specificity of direct microscopy were 38.33% and 72.5%, respectively keeping culture as gold standard. Direct microscopy had a positive predictive value of 67.65% and negative predictive value of 43.94%.

***Conclusion:*** Direct microscopy with 10% KOH may not be sufficient alone therefore cultures should be used for a definitive diagnosis.

**Keywords:** Dermatophytes, Fungal Culture, Tinea Pedis

## INTRODUCTION

Tinea pedis is the term used for dermatophytes infection of the toes or feet. It is one of the commonest forms of superficial fungal infection seen in the outpatient departments[1]. Three Anthropophilic species *Trichophyton rubrum, T. mentagrophytes* and *E. floccosum* are responsible for the majority of cases world wide[2,3]. Chronic infections are common in patients with atopy and immunosupression[4]. Tinea pedis may clinically present as intertriginal, moccasin or vesiculobullous type. When the lesions are acutely vesicular, an ide reaction develops on the uninfected hand. However these clinical forms, especially the first two, are not always caused by dermatophytes; dyshidrotic eczema, atopic dermatitis, contact dermatitis, juvenile plantar dermatosis, and erythrasma can cause diagnostic difficulty.

Diagnosis of tinea pedis is based on history, clinical examination, direct microscopy of skin scrapings and or fungal culture or skin biopsy. Isolating dermatophytes by fungal culture gives more reliable proof of infection and has the advantage of identifying the causative organism[5]. *Trichophyton rubrum* is the most common isolate found in cases of Tinea pedis[6-9]. This study determined the diagnostic accuracy of direct microscopy with culture in clinically diagnosed cases of Tinea pedis.

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## PATIENTS AND METHODS

After obtaining institutional ethical board approval, this validation study was conducted in the department of dermatology at Military Hospital Rawalpindi and at Microbiology Department of Armed Forces Institute of Pathology Rawalpindi. The study was carried out from January 2008 to July 2008. A total of 100 patients of tinea pedis were enrolled through non probability convenience sampling after their informed consent. Patients who had received topical anti fungals in past two weeks or oral antifungals in past one month, or had comorbid conditions i.e. diabetes mellitus, erythrasma, eczema, psoriasis, corns, atopic dermatitis and dyshidrosis were excluded. Patients name, age, gender and occupation were recorded on a pre-designed proforma. Cutaneous examination for the clinical type of tinea pedis i.e. interdigital, vesiculobullous or moccasin was recorded. Skin scrapings were taken from the active border of the lesion.

When blisters were present scissors were used to cutoff blister roof for microscopic examination and culture. Skin scrapings were placed on a glass slide, a drop of 10% KOH was added and the slide was kept in a moist environment of Petri dish for 30 to 35 minutes. It was then examined for septate hyphae in low (10x) and then high (40x) power of microscope. The findings were reviewed by another consultant in the department. Samples from these cases were also transported in folded paper for culture at microbiology department of Armed Forces Institute of Pathology. Cultures were done on three plates of Sabourads agar, one on plain Sabourads agar, the other ones with addition of chloremphenicol, and cyclohexamide. They were incubated at 28 °C and checked twice weekly for growth. Cultures were documented negative if no fungal growth occurred in four weeks[10]. The identification of dermatophytes and non dermatophytes were done at microbiology department on the basis of colonial and microscopic features. Data was analyzed using SPSS version 10. Descriptive statistics were used to describe the data. Sensitivity, specificity, positive and negative predictive values were calculated to assess the accuracy of microscopy by comparing it with gold standard of culture. For determining any existing association between socio demographic variables i.e. age, gender and occupation Chi square test was applied. P-value <0.05 was considered as significant.

## RESULTS

Demographic data of our 100 patients is shown in Table I, II and III. We found that there was insignificant association between clinical type of Tinea pedis and gender (p=0.442), age (p=0.976) and occupation (p=0.280).

Intertriginal tinea pedis was seen in 74% of patients, vesicobullous in 19% and moccasin type in 7% of patients. The culture was positive in 60 cases and direct microscopy in 34 cases (Fig 1).

The sensitivity and specificity of direct microscopy was calculated by using culture as the gold standard. The sensitivity of direct microscopy was calculated as 38.33% and specificity as 72.5%. The positive predictive value of microscopy was 67.65% and negative predictive value was 43.94%. The breakup of culture yield was that dermatophytes were isolated in 35 cases, nondermatophytes in 25 cases, whereas in 40 cases there was no fungal growth. The most commonly isolated dermatophytes species in cultures was *T. mentagrophytes* which was seen in 15 cases, followed by *T. interdigitale* (12), *T. rubrum* (6), *Trichophyton species* (1) and *Microsporum gypseum* (1) case respectively. Non dermatophytes species isolated on cultures were *Fusarium solani* in 5 cases, *Fusarium dimarum* in 3, *Alternaria alternata* in 6, *Scytilidium dimidiatum* in 3, *Scytilidium hyalinum* in 4, *Candida tropicalis* in 2, *Cladophialophora carrionii* in 1 and *Ulocaldium chartarum* in 1 case. Fungal hyphae on direct microscopy were seen in 20 patients of dermatophytes, 3 cases of non dermatophytes and in 11 cases of no growth. Break up of microscopy in dermatophytes was *T. mentagrophytes* in 11 cases, *T.interdigitale* in 8 and *T. rubrum* in 1 case. Among non dermatophytes microscopy was positive in 1 case of candida and 2 cases of *Scytilidium hyalinum*.

## DISCUSSION

Cutaneous fungal infections are common and causative organisms include dermatophytes, yeasts and non dermatophytes molds. Among cutaneous fungal infections tinea pedis is the most frequent fungal infection[11-12]. Since the study was done in a military hospital, larger numbers of our patients were soldiers (53%). This could be attributed to their foot wear pattern, nature of duty and living conditions[13]. Papulosquamous pattern was seen as the commonest followed by intertriginal type where as vesicobullous as the least common in a study[14]. The commonest isolate in our study was *T. mentagrophytes* which differs from the culture results of the study conducted at Peshawar among children which documented *T. rubrum* as the commonest isolate[9]. In different parts of the world *Trichophyton rubrum* had been documented as the most common isolate[15-16].

**Table 1: Frequency of Gender in Clinical Types of Tinea Pedis**

| Gender | Clinical Types of Tinea Pedis | | | Total |
|---|---|---|---|---|
| | Intertriginal | Moccasin | Vesicobullous | |
| Male | 62 | 7 | 17 | 86 |
| Female | 12 | - | 2 | 14 |
| Total | 74 | 7 | 19 | 100 |

**Table 2: Frequency of Age in Clinical Types of Tinea Pedis**

| S No. | Tinea Pedis Type | Mean | N | SD |
|---|---|---|---|---|
| 1 | Intertriginal | 40.96 | 74 | 13.32 |
| 2 | Moccasin | 40.14 | 7 | 11.42 |
| 3 | Vesicobullous | 40.84 | 19 | 10.86 |
| | **Total** | **40.88** | **100** | **12.66** |

**Table 3: Frequency of Occupation in Clinical Types of Tinea Pedis**

| Occupation | Clinical Type of Tinea Pedis | | | Total |
|---|---|---|---|---|
| | Intertriginal | Moccasin | Vesicobullous | |
| **Soldier** | 39 | 3 | 11 | **53** |
| **Office Worker** | 7 | - | - | **7** |
| **House Wife** | 12 | - | 2 | **14** |
| **Others** | 16 | 4 | 6 | **26** |
| **Total** | **74** | **7** | **19** | **100** |

**Table 4: Result of Direct Microscopy and Growth in Culture**

| Direct Microscopy | Growth in Culture | | |
|---|---|---|---|
| | Positive | Negative | Total |
| **Positive** | 23 | 11 | **34** |
| **Negative** | 37 | 29 | **66** |
| **Total** | **60** | **40** | **100** |

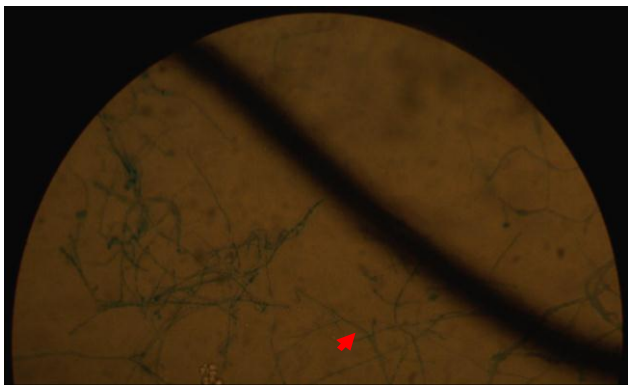

**Figure 1: A KOH preparation exhibits septate hyphae in direct microscopy of a patient. (10x)**

Perea S et al documented *T. rubrum* and *T. mentagrophytes* isolates as (44.8%) each, followed by *E. floccosum* (7%) and T. tonsurans (3.4%)[17].

The results of our study showed that dermatophytes were culture positive in only 35% of the cases having clinical diagnosis of tinea pedis. This ratio is quite close to the 36.6% that was calculated by Ecemis and his colleagues in a study conducted at Turkey[10]. Fuchs et al in their study documented the yield of positive cultures in 32% of patients with clinical diagnosis of tinea pedis[18]. In our study non dermatophytes were isolated in 25% of cases with clinical diagnosis of Tinea pedis. Gupta AK documented non dermatophytes molds as uncommon cause of cutaneous infection, as Scytalidium hyalinum may cause interdigitale Tinea pedis, and less frequently "moccasin foot" [19].

False negative direct examinations of our study were high as compared to other studies. As Singh KA et al documented 15.69% false negative KOH result in 51 cases of clinical tinea pedis[20]. Das S et al worked on the laboratory based epidemiology of superficial fungal infection and reported 2.7% false negative and 10.6% false positive cases[6].

The variations in false negative and false positive cases might be explained on the basis of subjectivity. The more the experienced operator, higher will be the yield. Many advocate that in experienced hands KOH preparation is one of the most useful and inexpensive diagnostic procedures in medical mycology[21]. The non dermatophytes mould i.e. *Scytalidium hyalinum* and *S. dimidiatum* fungal

foot infections are clinically indistinguishable from dermatophytes and may lead to treatment failure. Without proper culture identification, clinically diagnosed cases would be treated with standard antifungal treatment leading to minimum response and be interpreted as drug resistant cases[22]. The non dermatophytes molds as found in our study also, invade the epidermis due to structural or biochemical abnormality of keratin as a result of trauma or pre-existing disease[23]. The recognition of the changing prevalence in the causative dermatophytes should help the treatment approach and potential for implementation of control measures. In a study by Dilnawaz M et al the accuracy of 10% potassium hydroxide mount was calculated as 39% in relation to culture[24].

Our study has few limitations. The availability of greater number of specimens might have increased the chances to compare the differences between microscopy and culture.

The major disadvantage of culture is the time duration. It requires minimum of 3 weeks duration to be interpreted. Treatment however can be initiated in patients with direct positive examination but culture is necessary for definitive mycological diagnosis[25]. In a broader aspect, we may consider that cost of the culture should not be considered as financial burden to the patient, since the cost of inappropriate treatment would exceed the cost of culture, and results in wastage of time and also disappointment to the patients.

## CONCLUSION

Direct microscopy with 10% KOH may not be sufficient alone for the diagnosis of Tinea pedis therefore skin scraping for fungal culture remain the gold standard for definitive diagnosis.

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