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Original Article

KOH Preparation – A Diagnostic Tool for Intertrigo

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Author`s Contribution

[1-3]Substantial contributions to the conception or design of the work; or the acquisition, final approval of the study to be published, drafting the work or revising it critically for important intellectual content, analysis, or interpretation of data for the work

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A B S T R A C T

Objective: To evaluate diagnostic efficacy of microscopic examination of KOH preparation in intertrigo.

Methodology: This Retrospective study was conducted in the Dermatology Department of Tertiary care Hospital Gujranwala, from April 2022 to March 2023. The 150 patients with intertrigo, registered in the clinic and diagnosed through KOH preparation were included in this study. The questionnaire was filled for demographic details after taking their consents. A glass slide and cover glass, 20% KOH, and gauze and a microscope that has both 10 mm and 40 mm objectives requires. The existence of a fungal infection can be confirmed by doing a culture, which is the gold standard diagnostic procedure. The statistical analysis was done by using SPSS version 20.

Results: The median age of patients diagnosed with intertrigo was twenty-seven years old, with a range of 10 to 66 years. The ages of presenting patients in men were 25.07 ± 12.13 and 31.73 ± 10.76 in females. There was statistically significant difference in age of male and female patients (p=0.02). Candida albicans was found in larger no of patients 46%.

Conclusion: In conclusion, potassium hydroxide (KOH) preparation emerges as a valuable and efficient diagnostic tool for identifying fungal infections underlying intertrigo. Its simplicity, rapidity, and high sensitivity make it an indispensable asset in dermatological practice, facilitating prompt diagnosis and appropriate management strategies for patients with this common yet challenging condition.

Keywords: KOH preparation, intertrigo, candida albicans, intertriginous dermatitis.

Introduction

The word "intertrigo" comes from Latin *inter* (between) and *terere* (to rub) that reflects the rubbing together of two opposing skin surfaces leading to friction dermatitis. Intertrigo is a common skin disorder that causes inflammation of skin because of friction, humidity, maceration, or occlusion.[1,2] This condition can affect small areas of skin or can involve larger area. The most common affected sites are the neck, axilla, groin, sub-mammary folds, and perineum; however, lesions may appear anywhere on the body such as interdigital spaces, abdominal folds, the eyelids, and retro auricular area.[3] It can be exacerbated by body secretions such as sweat, urine and feaces. Friction of skin, manifests as erythema in f lexures, a primary contributor in the progression of the lesion.

It starts with mild erythematous papillae or plaques on opposing sides of skin fold, like a mirror image, then develop into an exudative erosions, fissures, macerations and crusts.[4,5] Incidence of intertrigo is more with diabetes mellitus, obesity, hyperhidrosis, urinary/fecal incontinence, poor hygiene, immunocompromise (HIV, chemotherapy, systemic steroids) and tight clothing and occlusive footwear.[6,7]

Intertrigo can result into serious systemic infections and lead to significant morbidity and mortality. Studies shown that toe web intertrigo leads to 60% of leg cellulitis.[8] Common organisms associated with intertrigo are *candida* species, *dermatophyte* species, *fusarium* species and bacteria including *beta hemolytic streptococcus*, *Staphylococcus aureus*, *Pseudomonas*, *Corynebacterium minutissimum*, *E.coli, proteus, Enterococcus faecalis, Klebsiella*.[9] Superinfection with *candida* is common in most cases of intertrigo.[10,11] Microscopic evidence of pseudo-hyphae/yeasts with KOH, calcofluor white staining, f luorescent microscopy and tryptophan blue preparation, are diagnostic tools. In non-responding cases, a biopsy is necessary to rule out

other skin conditions.[12] Dif ferential diagnosis includes infectious and noninfectious skin diseases and skin neoplasms. Infectious diseases include candidiasis, dermatophytosis, erythrasma, pyoderma, scabies, seborrheic dermatitis. Non-infectious diseases include atopic dermatitis, pemphigus vulgaris, psoriasis, acanthosis nigricans, hidradenitis suppurativa, lichen sclerosis. Skin neoplasms include Bowen disease, Paget's disease and superficial BCC.[13] Simple intertrigo can be managed by gentle cleansing, preventing excess moisture and by proper drying after bath/shower or physical activity, with soft towel and by using antiperspirants including triple paste i.e; aluminium acetate solution, zinc oxide and petrolatum, and by adding appropriate antimicrobials/antifungals in case of infective etiology.[14,15]

Intertrigo is diagnosed clinically with lesion morphology, KOH wet mounts can guide treatment. The present study focused on the importance of KOH preparation in the diagnosis and the intertrigo in different age groups of patients and their predominant sites.

Methodology

This retrospective study was conducted at the Dermatology Department of Tertiary care Hospital, Gujranwala, from April 2022 to March 2023. This study was approved by the Ethical review committee with ERB (No:20-2023). The demographic details were recorded on a questionnaire. A data collecting sheet was made to describe the demographic variables (age, gender, and ethnicity), BMI was calculated according to WHO recommendations, Clinical aspects, investigations, and therapy given for each patient.[16]

The patients with intertrigo, registered in the clinic, diagnosed through microscopic examination of KOH preparation were included. Other skin diseases caused by bacteria or viruses are not included in the study. By using WHO sample size calculator[17], a total of 150 subjects were chosen in this study based on a prevalence of 16.1% intertrigo prevalence with 95% confidence interval and margin of error was 5%.

A glass slide and cover glass, 20% KOH, gauze and a microscope that has both 10 mm and 40 mm objectives were required. A skin scraping taken with a tiny scalpel blade. The existence of a fungal infection is confirmed by doing a culture, which is the gold standard diagnostic procedure.

Set up a clean glass slide for the specimen. Scrape off the skin with surgical blade and place scrapping particles on glass slide. Put in 1 ml of 20% KOH. Second, position the cover glass over the slide and push down lightly to expel any trapped air. After preparing the slides, use the gauze to soak up any remaining solution. Third, place the slide on the microscope's stage, and examine it at low magnification (10X).

Dim the lights so that the epithelial cells become visible and look for yeast or hyphae. Use the 40 setting (high-dry objective) to look for hyphae or budding yeasts as telltale signs of fungus. The data analysis for this study was carried out using version 20.0 of the IBM-SPSS. Descriptive analysis was performed on demographic factors. The Chi square test was used to determine the outcome variables. P-value of <0.05, was considered statistically significant.

Results

The demographic details including BMI, gender, marital status, socioeconomic status, and ethnicity has been shown in Table I.

Table I: Demographic details of the intertrigo patients.

Grouping	N	%
BMI		
Normal Weight	19	12.7
Overweight	34	22.7
Obese	97	64.7
Gender		
Male	87	58
Female	63	42
Marital Status		
Married	26	17.3
Unmarried	124	82.7
Socioeconomic Status		
Very Low-Income Status	54	36
Low Income status	48	32
Middle Income Status	38	25.3
High Income Status	10	6.7
Ethnicity		
Sindhi	29	19.3
Punjabi	36	24
Urdu Speaking	30	20
Baloch	27	18

Pathan	28	18.7

Intertrigo cases were observed in the following body sites: Axilla, 25(16.7%); Groin 40(26.7%); Abdominal Folds, 20(13.3%); Intergluteal Cleft 15(10.0%); Inframammary Folds, 25(16.7%); and Interdigital Spaces, 25(16.7%) as shown in Figure 1&2, and Table II.

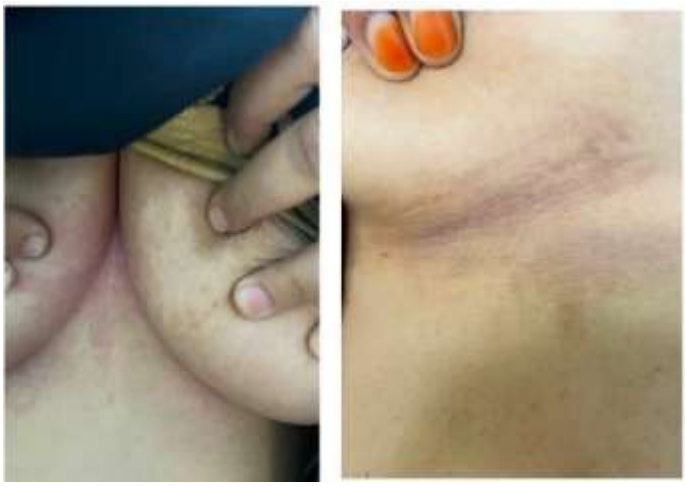

Figure 1. Intertrigo in inframammary region.

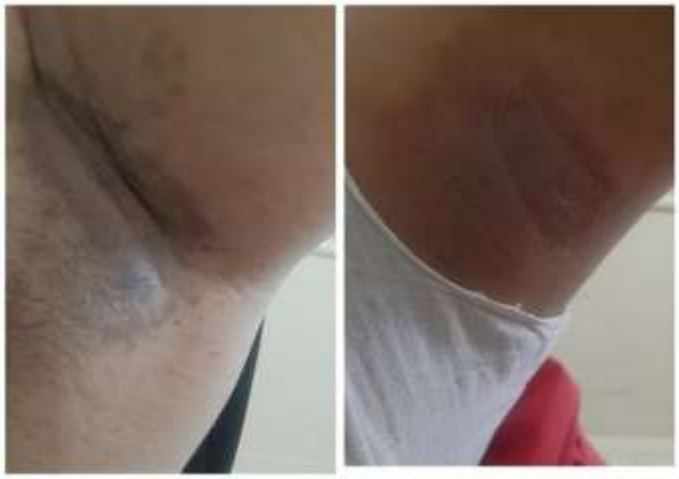

Figure 2.: intertrigo in axilla.

Intertrigo prevalence and fungal species distribution were compared across different age groups. Significant differences were observed in intertrigo occurrence at various sites like axilla, groin, abdominal folds, intergluteal cleft, inframammary folds, and interdigital spaces ($p < 0.001$). The prevalence of specific fungal species also varied significantly among age groups ($p < 0.05$). For instance, Candida albicans was more prevalent in the 26-50 years age group compared to the other age groups, followed by Trichophyton as second most common organism as given in Table II, Table III, and Table IV.

Table III: Comparison of intertrigo on different body sites for different age groups.

Site of Intertrigo	Age groups			P Value
	10-25 Years	26 -50 Years	>50 Years	
Axilla	4 (2.66%)	25 (16.6%)	0 (0%)	<0.001
Groin	17 (11.33%)	20 (13.33%)	5 (3.33%)	
Abdominal Folds	4 (2.66%)	15 (10%)	2 (1.33%)	
Intergluteal Cleft	0 (0%)	15 (10%)	1 (0.66%)	
Inframam mary Folds	18 (12%)	10 (6.66%)	2 (1.33%)	
Interdigital Spaces	9 (6%)	3 (2%)	0 (0%)	

Table IV: KOH interpretation for different age groups

KOH Interpretation	Age groups			P Value
	10-25 Years	26 -50 Years	>50 Years	
Epidermophyton	14 (9.33%)	16 (10.66%)	0 (0%)	<0.05
Trichophyton	7 (4.66%)	20 (13.33%)	5 (3.33%)	
Candida albicans	27 (18%)	39 (26%)	3 (2%)	
Microsporum	4 (2.66%)	13 (8.66%)	2 (1.33%)	

Discussion

A total of 150 individuals clinically diagnosed with intertrigo were included. The current study's focused on the importance of KOH preparation in the early diagnosis of intertrigo. When there is a doubt regarding diagnosis, laboratory confirmation is considered as gold standard before starting antifungals because of their potential side effects as demonstrated by Ruocco et al, who emphasized the role of KOH preparation on skin scrapings and examination under microscope, to confirm the diagnosis of intertrigo.[18]. Present study demonstrated that majority of patients belonged to age group of 26-50 years, which correlates with Krishna S. et al., with majority of cases belonged to age group of 21-60 years.[19] Whereas Keita et al., found common

Table II: Frequency of intertrigo site and KOH interpretation.

Site	N	%	KOH interpretation	N	%
Axilla	25	16.7	Epidermo-phyton	30	20.0
Groin	40	26.7	Trichophyton	32	21.3
Abdominal Folds	20	13.3	Candida albicans	69	46.0
Intergluteal Cleft	15	10.0	Microsporum	19	12.7
Inframammary Folds	25	16.7			
Interdigital Spaces	25	16.7			

age group for intertrigo was 12-48 years and Arnoldlong et al, found that intertrigo is most common in old age 65 years and above.[20-21] This age variation highlights that intertrigo is a common disorder and can affect people of all ages. Present study found that patients with high BMI and obese were mostly effected as in Kottner et al., and Everink et al., who highlighted the strong association between intertrigo and obesity.[22-23] The slight male predominance was seen, similar to Wickramanayake et al., and contrary to Gabriel et al., demonstrated intertrigo with female predominance.[24,25]

Most common effected site was groin in present study, compatible with Volzer et al., concluded groin as commonest site for intertrigo,[26] whereas Ahmad S. et al., found toe web space as commonest site and Gray et al., found inframammary spaces as commonest effected site.[27,28] This variation suggested that all body folds have the equal risk to develop intertrigo and person to person variation depends on person's anatomy, skin microenvironment, humidity, sweating, f lexural occlusion and occupation. The commonest organism found was candida albicans, similar to Nenoff et al., who found candida albicans as commonest secondary fungal infection to complicate intertrigo.[29] People with low socioeconomic status were predominantly affected with intertrigo, which correlates with Black et al., who concluded low socioeconomic status, poor hygiene, self -neglect and overcrowding as contributing factors to develop intertrigo.[30]

Intertrigo is a common yet challenging dermatological disorder, leading to serious complications if early diagnosis and appropriate management is not done. Overall, this analysis shows that intertrigo is a dermatological topic that has received surprisingly little attention. This implies that the new guidelines regarding its etiology, predisposing factors, early diagnosis, prevention and management strategies for which the research must be conducted on large sample size to rely on expert opinion rather than empirical data to inform its recommendations.

The study focuses solely on depression, leaving its efficacy for other mental health conditions untested. Participants may feel compelled to report positive outcomes due to the religious nature of the therapy.

Conclusion

In conclusion, potassium hydroxide (KOH) preparation emerges as a valuable and efficient diagnostic tool for identifying fungal infections underlying intertrigo. Its simplicity, rapidity, accessibility and high sensitivity make it an indispensable asset in dermatological practice, facilitating prompt diagnosis and appropriate early management strategies for patients with this common yet challenging condition to prevent its complications.

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