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Evaluation of factors responsible and mycological profile of intertrigo of foot

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Abstract
The term foot intertrigo covers diverse disorders with different clinical manifestations. It may present as a chronic erythematous desquamative eruption or as a more acute exudative, macerated, inflammatory eruption. Associated symptoms may range in severity and may be disabling in some cases. The etiology is variable, and a differential diagnosis based on clinical grounds is difficult because the initial phase commonly presents as an infection such as interdigital tinea pedis, candidiasis, or bacterial intertrigo.
The present study was planned in the Department of Microbiology, Nalanda Medical College and Hospital, Patna, Bihar from March 2018 to November 2018. Total 50 Samples were collected from the patients with clinical suspicion of intertrigo of foot. Detailed histories such as age, sex, demographic and socioeconomic status of the patients were collected prior to sample collection.
The data generated from the present study suggest that Candida albicans is the most common agents of intertrigo of foot. The diagnosis cannot only be based on the clinical aspect of the lesions. The place of mycological examination is very important in confirming the diagnosis, identifying the fungal agent and guiding the treatment. By characterizing the spectrum of pathogens usually involved, the results of this study could contribute to improve the management of intertrigo.

Keywords: intertrigo, candida albicans, fusarium, dermatophytes, etc

Introduction
Intertrigo refers to a type of inflammatory rash (dermatitis) of the superficial skin that occurs within a person's body folds. These areas are more susceptible to irritation and subsequent infection due to factors that promote skin breakdown such as moisture, friction, and exposure to body secretions such as sweat, urine or faeces. Areas of the body which are more likely to be affected by intertrigo include the inframammary fold, intergluteal cleft, armpits, and spaces between the fingers or toes. Skin affected by intertrigo is more prone to infection than intact skin. The term "intertrigo" commonly refers to a secondary infection with bacteria (such as Corynebacterium minutissimum), fungi (such as Candida albicans), or viruses. A frequent manifestation is candidal intertrigo.
Intertrigo occurs more often in warm and humid conditions. Generally, intertrigo is more common in people with a weakened immune system including children, the elderly, and immunocompromised people. The condition is also more common in people who experience urinary incontinence and decreased ability to move [1].
An intertrigo usually develops from the chafing of warm, moist skin in the areas of the inner thighs and genitalia, the armpits, under the breasts, the underside of the belly, behind the ears, and the web spaces between the toes and fingers. An intertrigo usually appears red and raw-looking, and may also itch, ooze, and be sore. Intertrigos occur more often among overweight individuals, those with diabetes, those restricted to bed rest or diaper use, and those who use medical devices, like artificial limbs, that trap moisture against the skin. Also, there are several skin diseases that can cause an intertrigo to develop, such as dermatitis or inverse psoriasis.
Intertrigo can be diagnosed clinically by a medical professional after taking a thorough history and performing a detailed physical examination. Many other skin conditions can mimic intertrigo's appearance including erythrasma, inverse psoriasis, scabies, pyoderma, atopic dermatitis, candidiasis, seborrheic dermatitis, and fungal infections of the superficial skin caused by Tinea versicolor or Tinea corporis [1].
Intertrigo is treated by addressing associated infections, by removing moisture from the site, and by using substances at the site to help maintain skin integrity. If the individual is overweight, losing weight may also help. Relapses of intertrigo are common. Keeping the area of the intertrigo dry and exposed to the air can help prevent recurrences, as can removing moisture from the area using absorbent fabrics or body powders, including plain cornstarch and judiciously used antiperspirants. Greases, oils, and barrier ointments, may help by protecting skin from moisture and from friction. Antifungal powders, most commonly clotrimazole 1%, may also be used in conjunction with a barrier ointment. Diaper rash ointment can also help. Fungal infections associated with intertrigo may be treated with antifungals applied directly to the skin (in most cases) or systemic antifungals, including fluconazole, nystatin, and griseofulvin. Intertrigo is also a known symptom of vitamin B6 deficiency [2].
The appearance of intertrigo is dependent on the skin area

involved and the duration of inflammation. Intertrigo initially presents as mild erythematous patches on both sides of the skinfold. The erythematous lesions may progress to weeping, erosions, fissures, maceration, or crusting. Worsening erythema or inflammation could suggest the development of a secondary cutaneous infection [3, 4]. Pustules or vesicles may herald infection. In the perineum, depths of the skin folds are involved compared with purely irritant diaper dermatitis in which only convex surfaces are involved. Bluish-green staining of the diaper or underclothing may indicate pseudomonal intertrigo, which can be treated with vinegar soaks [5, 6]. Intertrigo infected by candidal species often presents with satellite lesions.

Any skin fold may be involved with intertrigo. In adults or infants who are obese, skin folds are accentuated, and inflammation may occur under pendulous abdominal folds, in neck creases, or in popliteal or antecubital fossae.

Since intertrigo frequently is colonized or secondarily infected, secondary cutaneous infections and acute cellulitis are threats to occur [7]. These secondary cutaneous infections can be caused by a variety of gram-positive or gram-negative bacteria or fungi, including various yeasts and dermatophytes [8]. An infectious intertrigo may result in serious cellulitis, especially in patients who are diabetic. Additionally, skin fissuring and ulceration can occur, possibly hidden in the deep skin folds of persons who are obese, which can lead to pain, disability, and, potentially, sepsis.

Correcting the causative factors of intertrigo is critical. Take steps to eliminate friction, heat, and maceration by keeping folds cool and dry. These steps can be accomplished by using air conditioning and absorbent powders, wearing moisture-wicking polyester underwear and socks (eg, Orlon) and by exposing skin folds to the air. Compresses with Burow solution 1:40, dilute vinegar, or wet tea bags often are effective, especially if followed by fanning or cool blow-drying. Skin surfaces in deep folds can be kept separated with cotton or linen cloth; however, be sure to avoid tight, occlusive, or chafing clothing or dressings.

Simple intertrigo may be treated with drying agents (eg, talc, cornstarch).

Where appropriate, antimycotic agents (miconazole, clotrimazole) are helpful, especially if used with a mild- to mid-potency (class III-VI) steroid for a short duration. Avoid using stronger topical steroids because the occlusive effect of skin folds can accelerate the development of skin atrophy and striae. Castellani paint (carbol-fuchsin paint) also can be helpful, especially in the toe web spaces.

Formulations combining protective agents, antimicrobials, and topical steroids may be helpful, including the following [9, 10].

- Triple Paste contains petrolatum, zinc oxide paste, and aluminum acetate (Burow) solution applied qs ad (ie, in a sufficient quantity).
- Greer goo is composed of nystatin (Mycostatin) powder 4 million U, hydrocortisone powder 1.2 g, and zinc oxide paste 4 oz applied qs ad (ie, in a sufficient quantity).

A thick coat of these protective barrier creams should be applied. Commercially available barrier pastes sold for diaper dermatitis (eg, Desitin) can be helpful, as can absorbent diapers. Tetrix, a prescription dimethicone barrier cream, may be more protective and less greasy than traditional petrolatum-based barrier products such as zinc oxide ointment.

Intertrigo infected by bacteria should be treated with topical (eg, mupirocin) or oral antibiotics (eg, penicillin) along with low-potency topical steroids. Intertrigo infected by yeasts or dermatophytes should be treated with antifungal agents. Intertrigo complicated by erythrasma should be treated with topical or oral erythromycin [11].

Intertrigo most often involves persons who are helpless or dependent on others (eg, older persons, infants). Since intertrigo in the perineum often is complicated by incontinence, new breakthroughs in absorbent diapers have made diaper dermatitis easier to avoid. However, contact dermatitis in reaction to these diapers, whether irritant or allergic, can occur; therefore, monitor waistlines and leg openings for intertrigo. Open-toed shoes or sandals may help reduce toe web-space moisture. Monitor patients closely for the development of striae or a hidden infection if topical steroids are needed to control an inflammatory intertrigo.

The term foot intertrigo covers diverse disorders with different clinical manifestations. It may present as a chronic erythematous desquamative eruption or as a more acute exudative, macerated, inflammatory eruption. Associated symptoms may range in severity and may be disabling in some cases. The etiology is variable, and a differential diagnosis based on clinical grounds is difficult because the initial phase commonly presents as an infection such as interdigital tinea pedis, candidiasis, or bacterial intertrigo [12, 15].

Methodology

The present study was planned in the Department of Microbiology, Nalanda Medical College and Hospital, Patna, Bihar from March 2018 to November 2018. Total 50 Samples were collected from the patients with clinical suspicion of intertrigo of foot. Detailed histories such as age, sex, demographic and socioeconomic status of the patients were collected prior to sample collection.

Skin scrapings were collected under the supervision of the professionals in the department of Dermatology by following standard precautions. Specimens were wrapped in clean black coloured paper and labelled with the patient's details including the site from where the samples have been collected. The same were transported to the department of Microbiology for laboratory investigations. The samples were divided into two portions: one for microscopic examination and one for culture.

Samples that are received in the Microbiology department were processed for direct microscopy using 10% and 20% potassium hydroxide (KOH) wet-mount examination, and screened for the presence of fungal elements, Simultaneously the other portion of the sample were inoculated on to Potato dextrose agar (PDA), Sabouraud dextrose agar (SDA), Sabouraud dextrose agar with antibiotics (SDAac) and incubated at room temperature for 2-4 weeks and observed for the growth. Isolated fungi were identified by macroscopic appearance and microscopic morphology using gram stain for yeasts and Lacotophenol Cotton Blue (LPCB) stain and slide culture for moulds. Germ tube test was performed to differentiate between Candida albicans and Non-albicans species.

All the patients were informed consents. The aim and the objective of the present study were conveyed to them.

Approval of the institutional ethical committee was taken prior to conduct of this study.

Results & Discussion

Intertrigo is primarily caused by friction of opposing skin surfaces, and it is characterized by an initial mild erythema that may progress to a more intense inflammation with erosions, oozing, exudation, maceration, and crusting [16]. Intertrigo is facilitated by moisture trapped in deep skin folds, where air circulation and natural evaporative drying are limited. Foot intertrigo may be associated with closed-toe or tight-fitting shoes, and it commonly affects persons participating in athletic, occupational, or recreational activities [17].

The interdigital presentation can be subdivided into two categories: dermatophytosis simplex and dermatophytosis complex [18]. Interdigital tinea pedis has been treated in the past mostly with antifungal agents; however, in dermatophytosis complex, there is bacterial involvement, and the agent of choice should exhibit antifungal and antibacterial properties [19]. Bacterial proliferation may be associated with keratinocyte necrosis. Staphylococcus aureus may present alone or with group A β-hemolytic streptococcus. Pseudomonas aeruginosa, P mirabilis, and Proteus vulgaris also may occur alone or simultaneously.

Table 1: Socio demographic characteristics

Characteristic	No. of Cases
Age	
Below 20 years	3
21- 30 years	15
31- 40 years	12
Above 40 years	20
Gender	
Male	36
Female	14
Season	
Dry	25
Rainy	25

Table 2: Comparison of both KOH microscopy

	KOH Positive Cases	KOH Negative Cases
Culture Positive	25	3
Culture Negative	1	21
Total	26	24

Table 3

Isolates	No. of Cases
Candida albicans	22
Non-albicans	8
Dermatophytes	6
Fusarium species	14
Total	50

Intertrigo is one of the chronic condition commonly observed in housewives even though it can be affect both sexes at any age. In the present study 4th and 5th toe web space being more commonly involved and caused by Candida albicans, Fusarium followed by Candida non-albicans and Dermatophytes. Therefore it is necessary to accurately identify causative agent of intertrigo to select appropriate antimicrobial agent which helps in prevention of complications.

Conclusion

The data generated from the present study suggest that Candida albicans is the most common agents of intertrigo of foot. The diagnostic cannot only be based on the clinical aspect of the lesions. The place of mycological exams is very important in confirming the diagnostic, identifying the fungal agent and guiding the treatment. By characterizing the spectrum of pathogens usually involved, the results of this study could contribute to improve the management of intertrigo.

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