

RESEARCH ARTICLE

A Bacteriological Study of Intertrigo

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Abstract

The study was taken up to identify the various bacterial agents causing intertrigo of feet and to determine the antimicrobial sensitivity pattern of the isolated bacterial agents. A total of 75 pus samples were collected from infected toe, web space infection by using sterile swabs. Samples were inoculated into Blood agar and MacConkey agar for the bacterial isolation and antibiotic susceptibility testing was performed as per CLSI Guidelines. Out of 75 samples examined 38 were from male patients and 37 were collected from female patients. 101 different types of bacteria were grown in the present study. Among them 38 Gram-Positive Cocci (GPC) and 63 Gram-Negative Bacilli (GNB). Of 38 Gram positive cocci isolated, *Staphylococcus aureus* were 19 (18.81%), followed by Coagulase negative staphylococcus (CONS) 12 (11.88%) and *Streptococcus spp* 7 (6.93%). Of 63 Gram negative bacilli isolated *Pseudomonas* were 19 (18.81%), followed by *Proteus* 16 (15.84%) and *Klebsiella* 13 (12.87%). 25.8% *Staphylococcus spp* are Methicillin Resistant (MR) strains. Among the Gram negative bacteria 9.25% of the strains were showing resistance to Colistin or Tigecycline. It is known fact that different microbes and factors play very important role in lesions of toe web space. In the present study 25.8% of *Staphylococcus* species and 9.25% of Gram negative bacteria were multi drug resistant. Therefore, clinical and microbiologic studies are needed to help in the selection of appropriate treatment, prevention of important complications and emergence of drug resistance pathogens.

Keywords: Intertrigo, *Staphylococcus aureus*, *Streptococcus species*, *Pseudomonas*, Multi drug resistant.

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INTRODUCTION

Intertrigo is the clinical condition resulting from cutaneous inflammatory process due to opposing skin surfaces., Axillae, inframammary folds and groin are the most common sites affected. It can also affect other areas like neck creases, interdigital areas, antecubital fossae, umbilical, perineal, and folds of the eyelids¹. Diabetes patients in particular are more susceptible. Environmental factors play an important role which includes the hot and humid weather.

Foot intertrigo is the inflammation of toe web spaces. It often occurs in the 4th interdigital space extending to the dorsal and plantar aspects, which is characterized primarily by mild erythema². Patients with intertrigo can suffer from this disorder throughout life. It may present as a chronic erythematous exfoliative lesions. This condition often misdiagnosed as tinea pedis or eczematous dermatitis. However, macerated eruption in some patients, do not respond to treatment with anti-inflammatory agents³.

Intertrigo is a fertile breeding site for various microbes due to damaged skin and moisture associated with it resulting in secondary cutaneous infections . Bacterial multiplication may be associated with keratinocytic necrosis. *Staphylococcus aureus* alone or in combination with Group A β-haemolytic *streptococcus* can be the cause for this condition. Gram negative bacilli like *Pseudomonas aeruginosa*, *Proteus mirabilis* and *Proteus vulgaris* may also cause alone or simultaneously. In the begin it may starts as a bacterial infection, which can further damage the stratum corneum and facilitate the proliferation

of other drug resistant microbes. Gram negative bacteria like *P. aeruginosa* combined with other gram- negative bacteria such as *Moraxella*, *Alcaligenes*, *Acinetobacter*, and *Erwinia* are often reported as agents associated with toe web intertrigo ⁴.

Damaged stratum corneum produces natural substances with antibiotic properties that change the composition of commensal bacterial flora, encouraging the proliferation of drug resistant bacteria⁵. Hence the study was undertaken to know the bacterial etiological agents of intertrigo of feet which helps in selection of appropriate treatment.

MATERIALS AND METHODS

All the samples were collected from the patients with Intertrigo of foot attending the outpatient/In patient Department at tertiary care hospital in Mysore, South India.

Table 1. Showing the antibiotics used in the study

Gram positive (µg)	Gram negative (µg)
Erythromycin (15µg)	Ampicillin(10µg)
Clindamycin (10µg)	Gentamicin(10µg)
Tetracycline (30µg)	Co-Trimoxazole(25µg)
ciprofloxacin (5µg)	Ciprofloxacin (5µg)
linezolid (30µg)	Tigecycline (15µg)
Gentamycin (10µg)	Colistin(10µg)
Vancomycin (30µg)	Imipenem(10µg)
Co-Trimoxazole (25µg)	Amikacin (30µg)
Chloramphenicol(30µg)	Piperacillin/ Tazobactam (10µg)
Penicillin (10 units)	
Cefoxitin (30µg)	

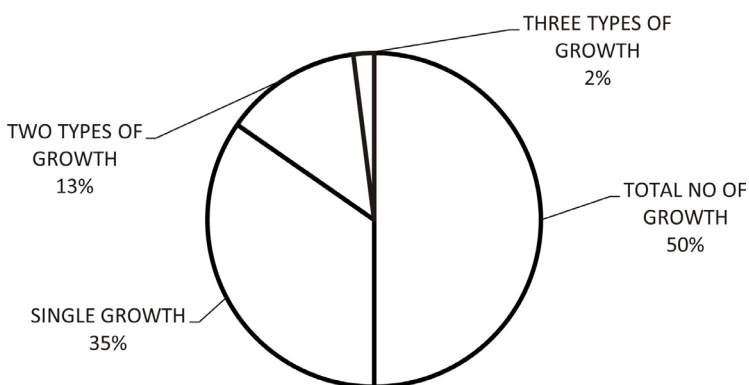


Fig. 1. Growth pattern from 75 samples

Bacterial culture examination:

Pus samples were collected from infected toe, web space infection by using sterile swabs. Pus samples were inoculated into Blood agar and MacConkey agar and incubated at 37°C for 24-48 hours for bacterial isolation. The isolated organisms were identified by using standard biochemical reactions such as Indole, Urease, Citrate, Triple Sugar Iron, Catalase, Oxidase, Coagulase and Antimicrobial Susceptibility Testing (ABDD) by Kirby-Bauer disc diffusion method were performed as per CLSI guidelines for following antibiotics.

RESULTS

Out of 75 samples 38 [50.67%] samples were collected from male patients and 37 [49.33%] samples were collected from female patients. Majority of the samples isolated in this study were from patients in the age group of 41-50(28%) years and 31-40(26%) years.

All the suspected cases of infected foot included in the study yielded growth (100%), in which 52 samples yielded single growth (69%), 20 samples yielded Two types of growth (27%) and 3 samples yielded Three types of growth (4%). Out

Sensitivity pattern of the Gram positive isolates

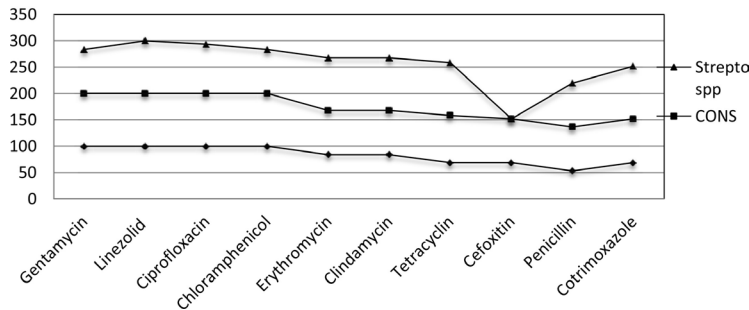


Fig. 2. Showing the Antibiotic Susceptibility pattern of the Gram Positive Bacteria

Sensitivity pattern of the Non-fermentors

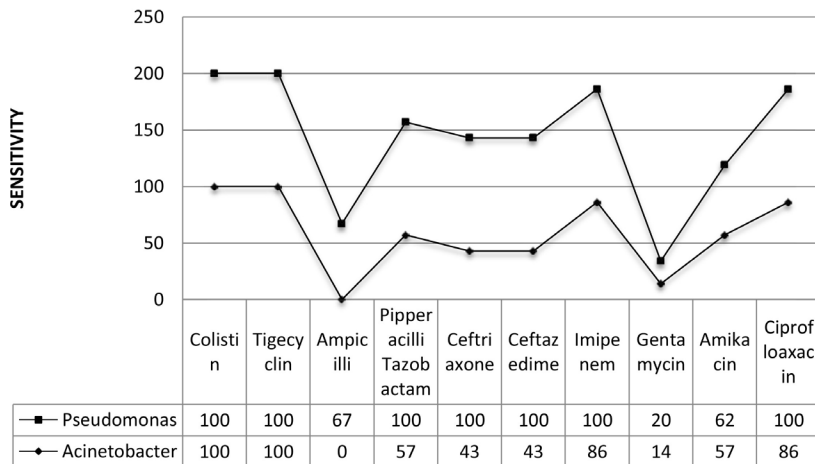


Fig. 3. Antibiotic susceptibility pattern of Non-fermentors- *Acinetobacter*, *Pseudomonas*

of 52 which yielded single organism, 24 were Gram Positive cocci and 28 were Gram Negative bacilli.

Out of 75 samples 101 different types of bacteria were grown in the present study. Among them 38 Gram-Positive Cocci (GPC) and 63 Gram-

Negative Bacilli (GNB). Of 38 Gram positive cocci isolated, *Staphylococcus aureus* were 19 (18.81%), followed by Coagulase negative staphylococcus (CONS) 12 (11.88%) and *Streptococcus species* 7 (6.93%). Of 63 Gram negative bacilli isolated

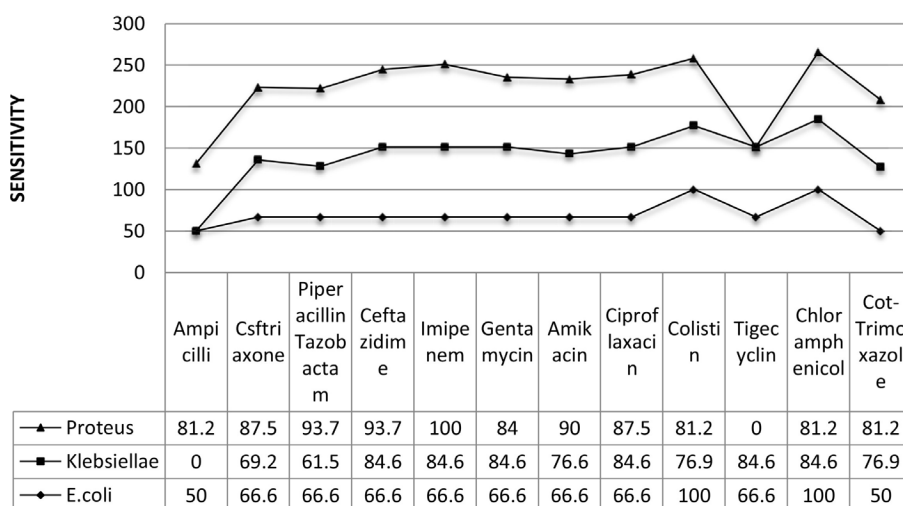


Fig. 4. Antibiotic susceptibility pattern of Enterobacteriaceae (*E.coli*, *Klebsiellae*, *Proteus*)

Pseudomonas were 19 (18.81%), followed by *Proteus* 16 (15.84%), *Klebsiella* 13 (12.87%), *Acinetobacter* 8 (7.92%), *E. coli* 6 (5.94%) and *Citrobacter* 1 (1.00%)

31.58% of *S. aureus* and 16.7% of CONS were Methicillin Resistant (MR) organisms. That

means a total of 25.8% *Staphylococcus species* are Methicillin Resistant (MR) strains.

Among the isolates of *Acinetobacter baumannii* all the isolates were 100% sensitive to Colistin, Tigecycline and 100% resistance was seen to Ampicillin.

Table 2. Table showing the different types of Bacterial growth

GPC	Total (%)	GNB(Enterobacteriaceae, Non-fermentors)	TOTAL (%)
<i>S. aureus</i>	19(18.81%)	<i>Acinetobacter</i>	8(7.92%)
CONS	12 (11.88%)	<i>P.aeruginosa.</i>	19 (18.81%)
<i>Streptococci</i> (β)	7 (6.93%)	<i>E. coli</i>	6 (5.94%)
		<i>Klebsiella</i>	13 (12.87%)
		<i>Proteus</i>	16 (15.84%)
		<i>Citrobacter</i>	1 (1.00%)

Table 3. Showing the Antibiotic Susceptibility pattern of the Gram Positive Bacteria

Organisms	Drugs										
	GEN	LZ	CIP	C	E	CD	TE	CX	P	COT	VAN
<i>S.aureus</i> (19)	100	100	100	100	84.21	84.21	68.42	68.42	53	68.42	-
CONS(12)	100	100	100	100	83.3	83.3	90	83.3	83.3	83.3	-
<i>Streptococci</i> (β)(7)	83.3	100	93.6	83.3	100	100	100	-	83.3	100	100

GEN- Gentamicin, LZ-Linezolid, CIP-Ciprofloxacin, C-Chloramphenicol, E-Erythromycin, CD-Clindamycin, TE-Tetracyclin, CX-Cefoxitin, P-Penicillin, COT-Cotrimoxazole, VA-Vancomycin.

Among the isolates of *Pseudomonas* spp all the isolates were 100% sensitive to Colistin, Piperacillin-tazobactam, Ceftriaxone, Ceftazidime, Imipenem and Ciprofloxacin.

3 strains of *Klebsiella* (23.1%), 3 strains of *Proteus* (18.8%) were Resistance to Colistin and among the *E.coli* 100% Sensitivity was observed to Colistin.

2 strains of *E.coli* and 2 strains of *Klebsiella* were Resistance to Tigecycline.

Among the Gram negative bacteria 9.25% of the strains were showing resistance to Colistin or Tigecycline.

DISCUSSION

Obese patients with diabetes are more vulnerable for foot intertrigo in high heat and humid conditions, but it can occur in anyone. Urinary and fecal incontinence, hyperhidrosis, poor hygiene, and malnutrition are other conditions associated with foot intertrigo. Toe inter web intertrigo may be associated with closed-toe or tight-fitting shoes and commonly affects persons participating in athletic, occupational, or recreational activities. Flexed posture, short necks, drooping and relative chubbiness seen in infants make them more susceptible for intertrigo^{6,7}. Individuals with prominent skinfolds on either side of the chin are also vulnerable for intertrigo⁸.

Foot intertrigo may present as a chronic erythematous exfoliative lesions. This condition often misdiagnosed as tinea pedis or eczematous dermatitis. In some patients, the macerated eruption is unresponsive to treatment with antibacterial agents, antifungals or anti-inflammatory agents⁹. Therefore, clinical and microbiological studies are suggested to assist in the selection of appropriate treatment and prevention of important complications¹⁰.

In the present study a total of 75 pus samples from clinically suspected cases of Intertrigo of foot were included for bacteriological study. Out of 75 clinical samples 65 (86.67%) samples had only provisional diagnosis of bilateral intertrigo, remaining 10 (13.33%) samples had provisional diagnosis of intertrigo associated with other conditions.

The majority of patients belong to the age group of 41-50 (28%) and 31-40 years (26%) which correlates with the study of (21-50 years) Ahmad,

Set al¹¹. Whereas Aste et al., 2001¹² found that foot intertrigo was common in the age group of 36-81 years. These findings suggest that intertrigo is a common disorder that can affect any stage of life.

Out of 75 pus samples 38 [50.67%] samples were collected from male patients and 37 [49.33%] samples were collected from female patients. In accordance Ahmad et al., 2003¹¹ in Pakistan reported higher rate in males (56.7%).

In the present study 101 organisms were grown, which includes 38 Gram-Positive Cocci (GPC) and 63 Gram-Negative Bacilli (GNB). Out of 38 GPC isolated, *Staphylococcus aureus* was most common 19 (18.81%), followed by CONS 12 (11.88%) and *Streptococcus* 7 (6.93%). Out of 63 GNB and 63 Gram-Negative Bacilli (GNB) are isolated that are *Pseudomonas* was most common 19 (18.81%), followed by *Proteus* 16 (15.84%), *Klebsiella* 13 (12.87%), *Acinetobacter* 8 (7.92%), *E. coli* 6 (5.94%) and *Citrobacter*.

The predominant organism isolated was *Staphylococcus* spp (*Staph. aureus* and CONS) which accounted for 37.62%; this is in accordance by the study conducted by Lin et al.,¹³ and Aste et al.,¹⁴ who isolated in 55% and 46.4% cases respectively.

31.58% of *S. aureus* and 16.7% of CONS were Methicillin Resistant (MR) organisms. 25.8% of the total staphylococcus species are Methicillin Resistant (MR) strains. In a study by Krishna, et al,¹⁵ all isolates of Staphylococci (100%) were sensitive to amoxicillin-clavulanic acid and gentamicin, 85.7% isolates were cefoxitin sensitive that means 14.3% of isolates were Methicillin Resistant (MR) organisms.

Second most predominant organism isolated was *Pseudomonas* spp 18.81%. This correlates with the studies of Ahmad et al¹¹. who isolated in 10% of cases. All the isolates were 100% sensitive to Colistin, Piperacillin-tazobactam, Ceftriaxone, Ceftazidime, Imipenem and Ciprofloxacin. In Krishna et al¹⁵ study 29 (93.55%) *Pseudomonas* spp were sensitive to piperacillin-tazobactam followed by 27 (87.09%) to amikacin, and 21 (67.74%) to ciprofloxacin. These variations could be due to variations in the study populations.

3 strains of *Klebsiella* (23.1%), 3 strains of *Proteus* (18.8%) were Resistance to Colistin. 2 strains of *E.coli* and 2 strains of *Klebsiella* were

Resistance to Tigecycline. Resistance to these broad spectrum antibiotics may be as result of self-medication by patients or inappropriate selection of antibiotics.

CONCLUSION

It is well known fact that different microbes and factors play very important role in lesions of toe web space. Although fungal foot infection is common, patients who do not respond to topical and/or systemic antifungal therapy should be re examined for another primary or secondary dermatologic condition that may resemble pedal fungal intertrigo. In the present study 23.1% of *Klebsiella*, 18.8% of *Proteus* species were resistant to Colistin and 2 strains *E.coli* and *Klebsiella* were Resistance to Tigecycline. These findings suggest that intertrigo is caused by drug resistant pathogens which may not respond to regular antimicrobial agents. Therefore, clinical and microbiologic studies are needed to help in the selection of appropriate treatment, prevention of important complications and emergence of drug resistance pathogens.

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