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Original Research Article

Bacteriological and antibiotic susceptibility study of pyodermas at a tertiary care center in central Karnataka

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ABSTRACT

Background: Pyoderma is defined as a skin infection mainly caused by *Staphylococcus aureus*, *Streptococcus pyogenes* or both. Pyoderma is a common skin infection in India and constitutes major portion of patients in dermatological clinics. Many cases nowadays do not respond to the antibiotics that were previously sensitive. In order to successfully treat cases of pyodermas, sound knowledge is necessary regarding the etiology and their sensitivity patterns. Objectives of this study were to determine clinico-epidemiological and etiological factors associated in patients with pyoderma and to find sensitivity pattern of isolated organisms to various antibiotics commonly used.
Methods: A hospital based cross sectional study was performed on 100 patients presenting with bacterial skin infections to the Dermatology out-patient department of a tertiary care centre in Central Karnataka. Clinical and epidemiological features were recorded on a predefined proforma. Sterile swabs were used to collect the pus from the lesions under aseptic precaution. Antimicrobial susceptibility testing of the isolated strains to different groups of drugs was tested on Muller Hinton agar by the Kirby Bauer disc diffusion method.
Results: Primary pyodermas was seen more in the age group of 21-30 years (21%), followed by 31-40 years (19%). Folliculitis (32%) was the commonest clinical type followed by furuncles (28%). Among the gram positive isolates, Vancomycin (88.24%), Linezolid (86.67%) and Cefoxitin (71%) were the most susceptible drugs, whereas Amoxicillin (92.86%) and penicillin G (88.37%) were the most resistant drugs.
Conclusions: Pyodermas have been the major cause of morbidity since long. Even though pyoderma is a common condition, emerging multidrug resistant strains is of major concern to treat these conditions. Suitable and judicious selection of antibiotics by using antibiotic sensitivity data would limit the emerging drug resistant strains in the future to treat these clinical conditions successfully.

Keywords: Pyoderma, *Staphylococcus aureus*, Antibiotic susceptibility, Antibiotic resistance

INTRODUCTION

Pyoderma is defined as a skin infection with formation of pus and caused by *Staphylococcus aureus*, *Streptococcus pyogenes* or both in majority of patients. Pyoderma is a common skin infection in India and constitutes major portion of patients in dermatological clinics.[1]

Pyodermas can be either primary or secondary, former being the pyogenic infection on a normal skin and later as infection over a pre-existing skin disease. Most pyodermas are more common during summer and rainy seasons.[2]

Various factors like overcrowding, poverty, malnutrition, poor hygiene, illiteracy, customs, low immunity, habits and people who are prone to various traumas like insect

bites, thorn prick have been implicated in the formation of pyoderma.[3]

Many cases nowadays do not respond to the antibiotics that were previously very effective. In such cases, indiscriminate use of topical and systemic antibiotics might have contributed to this situation. In order to successfully treat cases of pyodermas, sound knowledge is necessary regarding the various causative organisms and their sensitivity patterns.[4]

Objectives

1. To describe clinico-epidemiological and etiological factors associated in patients with pyoderma.
2. To determine sensitivity pattern of isolated organisms to various antibiotics commonly used.

METHODS

A hospital based cross sectional study was conducted at a tertiary care centre in central Karnataka from November 2014 to July 2016 after ethical clearance from Institute's ethical board. A consecutive 100 clinically diagnosed pyoderma patients of both sex and all age group and who consented for necessary investigations attending the Out Patient Department of Dermatology of a tertiary care centre in central Karnataka were included in the study. A detailed history regarding the age, sex, occupation, socio-economic status, nature of lesion, duration of illness, onset and progression of the disease, ingestion of any drugs and associated metabolic disorders were recorded and thorough clinical examination of those selected patients was done. Sterile swabs were used to aseptically collect exudates or pus from the lesions. Two samples were collected before the start of antibiotic therapy and transported to the microbiology laboratory as early as possible for culture and sensitivity examination. In case of intact pustular lesions, the pustule was ruptured with a sterile needle and material was collected on two sterile swabs. One of the swabs was used to make a thin smear on a clean glass slide for gram staining and the other swab was transferred to sterile culture tubes; it was sealed, labelled and sent to microbiology laboratory for culture and susceptibility studies for culture and susceptibility studies.

All specimens were inoculated on blood and Mac-Conkey agar. *Staphylococcus aureus* colonies were identified using catalase test, coagulase test, oxidation Fermentation (OF) test by Hugh Leifson's method, mannitol fermentation test and urease test. Gram positive cocci arranged in clusters with catalase positivity were further tested by coagulase test, urease test and mannitol fermentation. Those found positive for the above tests were recognized as *Staphylococcus aureus*.

RESULTS

Table 1: Socio-demographic variables of the study subjects.

Characteristics	No of patients	Percent (%)
Age (in years)		
1-10	14	14.0
11-20	17	17.0
21-30	21	21.0
31-40	19	19.0
41-50	13	13.0
51-60	8	8.0
61-70	5	5.0
71-80	3	3.0
Sex		
Male	58	58.0
Female	42	42.0
Socio Economic Status*		
Upper Class	5	5
Middle	39	39
Lower Class	56	56
Total	100	100

*Modified BG Prasad's classification, January 2014.

Table 2: Clinical presentation of pyoderma.

Clinical presentation	Number of patients	Percentage (%)
Site of lesion		
Head & neck	20	20.00
Upper limb	14	14.00
Lower limb	33	33.00
Trunk	15	15.00
Genitalia	1	1.00
Multiple	17	17.00
Type of lesion		
Pustule	65	65
Nodule	08	8
Crusting & erosion	13	13
Oedema	11	11
Abscess	02	2
Ulcer	01	1
Associated Symptoms		
Pain	90	90
Itching	15	15
Fever	47	47
Discharge	10	10
Swelling	12	12
Pain and fever	57	57
Pain and discharge	5	5
Total	100	100

Most of the pyoderma cases belonged to the age group 21-30 years (21%), Male patients (58%) were more compared to female gender (42%). Majority of them belonged to class III socio-economic status according to Modified BG Prasad's classification (Table 1). The clinical presentation of pyoderma is represented in table 2. Pustule was the commonest type of lesion detected in 65% cases and pain was the predominant associating symptom seen in 90% patients. Folliculitis was the most common diagnosis accounting for 32% followed by Furunculosis and Impetigo Contagiosa with 28% and 13% cases respectively (Figure 1).

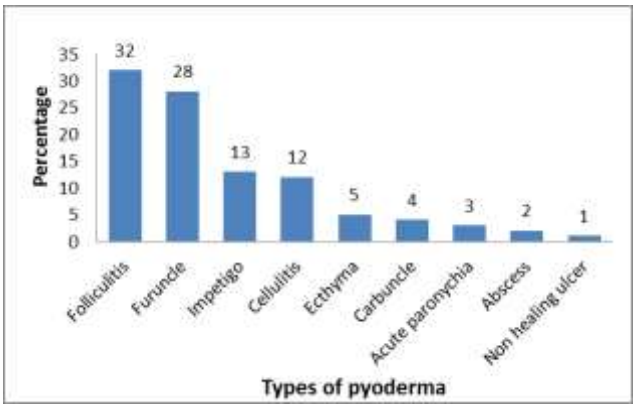

Figure 1: Types of pyoderma.

On bacterial analysis, Bacterial growth was reported in 92% cases and no growth of organisms was reported in 8% cases. *Staphylococci* were the most common organisms isolated in a total of 86% patients. Of the 86 cases of *Staphylococci*, *Staphylococcus aureus* was isolated in 82% cases and Coagulase negative *Staphylococci* was reported in 4% of cases.

In the present study, organisms were isolated in 92 (92%) of cases and all the 92 isolates were of single organism type. Of the 82 isolates of coagulase positive *Staphylococcus aureus*, majority i.e., 27 isolates (32.9%) belonged to folliculitis followed by 19 (23.17%) to furunculosis. Of the 4 isolates of coagulase negative *Staphylococci*, 3 (75%) isolates belonged to furuncles and 1 (25%) to impetigo. In 8 cases of no growths, 3 cases of folliculitis, 3 cases of furunculosis and 2 cases of cellulitis showed no growth of organisms.

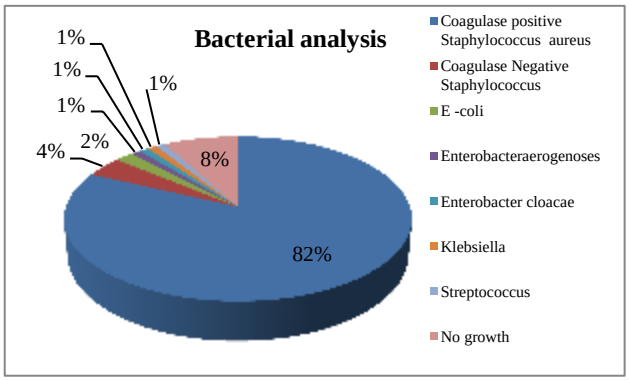

Figure 2: Bacterial analysis of the sample collected.

Table 4 and 5 shows the antibiotic susceptibility pattern. Majority of the organisms isolated were susceptible to Vancomyin (88.24%). Isolated organisms were resistant to Amoxicillin in 92.86%, Penicillin G in 88.37% and Ampicillin in 80.77%. In our study, the strains of coagulase positive staphylococci were susceptible to Doxycyclin (43 cases- 100%), Ofloxacin (7 cases-100%), Cefoxitin (53 cases-100%), Ampicillin (4 cases-100%) and Amoxicillin (1 case- 100%).

Table 3: Bacteriological analysis of 100 cases of pyoderma.

Type of Primary Pyoderma	Total number of patients	No growth	Number of Organisms isolated	*Staphylococcus aureus*	Streptococcus	Klebseilla	CONS	Enterobacter	E-coli
Folliculitis	32	3	29	27	0	1	0	1	0
Furunculosis	28	3	25	19	1	0	3	0	2
Impetigo	13	0	13	12	0	0	1	0	0
Cellulitis	12	2	10	10	0	0	0	0	0
Ecthyma	5	0	5	5	0	0	0	0	0
Carbuncle	4	0	4	4	0	0	0	0	0
Ac paronychia	3	0	3	3	0	0	0	0	0
Abscess	2	0	2	2	0	0	0	0	0
Non-healing ulcer	1	0	1	0	0	0	0	1	0
Total	**100**	**8**	**92**	**82**	**1**	**1**	**4**	**2**	**2**

Table 4: Antibiotic susceptibility I.

Drug	Sensitive		Moderately Sensitive		Resistant	
	No.	%	No.	%	No.	%
Penicillin_G	10	11.63	0	0.00	76	88.37
Ampicillin	4	15.38	1	3.85	21	80.77
Amoxicillin	1	7.14	0	0.00	13	92.86
Amikacin	13	59.09	0	0.00	9	40.91
Ciprofloxacin	12	31.58	5	13.16	21	55.26
Cotrimoxazole	28	56.00	1	2.00	21	42.00
Clindamycin	44	62.86	2	2.86	24	34.29
Doxycycline	43	65.15	3	4.55	20	30.30
Tetracycline	8	66.67	2	16.67	2	16.66
Erythromycin	28	34.57	1	1.23	52	64.20
Gentamicin	17	38.64	1	2.27	26	59.09
Moxifloxacin	31	57.41	5	9.26	18	33.33
Ofloxacin	7	31.82	15	68.18	0	0.00
Linezolid	65	86.67	1	1.33	9	12.00
Cefoxitin	53	71.00	0	0.00	29	29.00
Vancomycin	45	88.24	3	5.88	3	5.88

Table 5: Antibiotic susceptibility II.

Drug	Coaglase positive *STAPH. AUREUS*		CONS		Enterobacter aerogenoses		Enterobacter cloacae		Klebsiella		Streptococcus	
	No.	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**
Penicillin_G	9	90.00	NT	0.00	0	0.00	0	0.00	0	0.00	1	10.00
Ampicillin	4	100.00	NT	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Amoxicillin	1	100.00	NT	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Amikacin	11	84.62	NT	0.00	1	7.69	1	7.69	0	0.00	0	0.00
Ciprofloxacin	10	83.33	NT	0.00	1	8.33	1	8.33	0	0.00	0	0.00
Cotrimoxazole	27	96.43	NT	0.00	0	0.00	1	3.57	0	0.00	0	0.00
Clindamycin	42	95.45	1	2.27	0	0.00	0	0.00	1	2.27	NT	0.00
Doxycycline	43	100.00	0	0.00	0	0.00	0	0.00	0	0.00	NT	0.00
Tetracycline	6	75.00	0	0.00	2	8.33	2	8.33	2	8.33	NT	0.00
Erythromycin	26	92.86	2	7.14	0	0.00	0	0.00	0	0.00	NT	0.00
Gentamicin	15	88.24	1	5.88	NT	0.00	1	5.88	0	0.00	NT	0.00
Moxifloxacin	29	93.55	1	3.23	NT	0.00	0	0.00	1	3.23	NT	0.00
Ofloxacin	7	100.00	0	0.00	NT	0.00	0	0.00	NT	0.00	0	0.00
Linezolid	62	95.38	2	3.08	NT	0.00	0	0.00	NT	0.00	1	1.54
Cefoxitin	53	100.00	0	0.00	NT	0.00	0	0.00	NT	0.00	0	0.00
Vancomycin	43	95.56	2	4.44	NT	0.00	0	0.00	NT	0.00	0	0.00

NT- Not Tested

DISCUSSION

In our study, majority of the pyoderma cases were reported in the age group of 21-30 years (21%) followed by 19% in 31-40 years age group. Our study correlated with most of the studies, with majority of cases occurring in first three decades of life.[5-7] Male patients (58%) were more than females (42%). Similar finding of male preponderance was observed in other studies.[8,9]

The present study reported high prevalence among lower socio-economic status with 56%. Nagmoti et al and Gandhi et al also found the same in their studies with high number of cases belonging to lower SES.[10,11]

Lower limb was the most common location of the lesions which is attributed to exposure of the extremities to trauma in adults in their work and in children while playing. In the present study the common site of involvement was lower limbs in 33% followed by head and neck in 20%. This presentation correlates with other studies.[6,10]

Majority of the studies have presented with impetigo as the commonest clinical type but in our study folliculitis (32%) was the most common clinical type followed by furunculosis (28%) and impetigo (13%) as our study population consisted mainly of adults.[6,9]

Isolation of organisms reported single organisms in 92% of cases and no growth of organisms from 8% of cases. Similar results were reported in many studies.[8,12] The main organism isolated in our study was staphylococci in 86% of cases; of which 82 strains were *staphylococcus aureus* and 4 were coagulase negative staphylococcus. Ghadge et al, also reported isolation of *Staphylococcus aureus* in 67.35% of cases, of which coagulase positive staphylococcus was isolated in 43.7%, coagulase negative staphylococcus in 23.6% and beta hemolytic strepto-coccus in 21.7% of cases.[7] Of the 100 cases of primary pyodermas, 29 (29%) cases were methicillin resistant (MRSA). A similar high value of MRSA has been reported in the study done by Jayaraj et al, (38.95%).[6] National Staphylococcal Phage Typing Centre, New Delhi, reported that there is an increase in the occurrence of methicillin-resistant *Staphylococcus aureus* strains of *S. aureus* from 9.83% in 1992 to 45.44% in 1998.[13]

With respect to drug sensitivity, in the present study the isolated organisms were susceptible to Vancomyin in 88.24% of the patients followed by Linezolid in 86.67%, Cefoxitin in 71%, Tetracycline in 66.67% etc (Table 4). The strains of coagulase positive staphylococci were susceptible to Doxycyclin, Ofloxacin, Cefoxitin, Ampicillin and Amoxicillin. (Table 5) Baslas *et al* reported that both *Staphylococcus aureus* and beta hemolytic streptococci were highly susceptible to Cephaloridine and Gentamicin. The lowest susceptibility was seen with Penicillin and Ampicillin. Susceptibility of both organisms to Erythromycin was moderate.[12] Patil et al in their study found the highest susceptibility to Vancomycin (100%), Methicillin (69%), Gentamicin (69%) and Ciprofloxacin (58%).[9] Jayaraj et al reported the highest antibiotic sensitivity to Linezolid (100%), Vancomycin (86.32%), Amikacin (85.26%), Co-trimoxazole (70.53%) and Clindamycin (69.47%).[6] Majority of the above mentioned earlier studies showed greater susceptibility to Gentamicin, Erythromycin, Cephaloridine, while the recent studies have reported highest antibiotic susceptibility to Vancomycin, Linezolid, Amikacin and Gentamicin. Our study showed highest susceptibility to Vancomycin (88.24%), Linezolid (86.67%) and Cefoxitin (71%) and is in correlation with the recent studies

In the present study, resistance was highest to Amoxicillin (92.86%), Penicillin G (88.37%) and Ampicillin (80.77%). The present study is in correlation with other studies with highest resistance to Amoxicillin, Penicillin G, and Ampicillin.[6,9-12]

CONCLUSION

Pyodermas have been the major cause of morbidity since long. Even though pyoderma is a common condition, emerging multidrug resistant strains are of the major concern to treat these conditions. Suitable and judicious selection of antibiotic by using antibiotic sensitivity data would limit the emerging drug resistant strains in the future to treat these clinical conditions successfully.

Our study there by will guide the clinician in choosing appropriate antibiotics which not only contribute to better treatment but their judicious use will also help in preventing emergence of resistance to the drugs which are still sensitive.

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Conflict of interest: None declared
Ethical approval: The study was approved by the institutional ethics committee

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