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Bacteriological profile and antimicrobial susceptibility pattern of pyoderma in a tertiary care hospital

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ABSTRACT

Background: Pyoderma is a common dermatological disorder mainly affecting children but can also affect adults. Its prevalence, causative organism, and antibiotic sensitivity pattern may vary from place to place. Therefore, clinical and bacteriological profile of pyoderma in tertiary care hospital of North India was studied. **Methods:** A retrospective analysis was conducted from pus samples obtained in the microbiology department over 1 year from patients attending the dermatology outpatient department/inpatient department seeking treatment for pyoderma. Pus swabs were cultured and organisms were identified, and their sensitivity was tested according to the standard laboratory methods. **Results:** Out of 100 cases diagnosed with pyoderma, males (61%) outnumbered females (39%). 72% of the cases were diagnosed with primary pyoderma while 28% with secondary pyoderma. 54% of the total samples received were infected with *Staphylococcus aureus*. Methicillin-resistant *S. aureus* was isolated in 7.4% of the all *S. aureus* isolates obtained. Gram-negative bacilli were detected in 16% of total samples with predominance of *Klebsiella pneumoniae* (6%). 8% of the samples yielded sterile culture. None of the isolates were ESBL producers. **Conclusion:** The study gives an indication of changing trends of antibiotic susceptibility patterns in the pathogenic isolates obtained from pyodermas which in turn prevents the development of multidrug resistance.

Key words: Antimicrobial susceptibility, Gram-negative *bacilli,* Gram-positive cocci, pyoderma

INTRODUCTION

Pyoderma is one of the most common clinical condition encountered in dermatological practices occurring, especially, in pediatric age group.[1] Pyodermas are the purulent skin conditions caused by bacterial infections. They range in size from a tiny spot to entire body surface and may be harmless or life threatening.[2] They have been characterized into two types - primary pyoderma and secondary pyoderma. Primary pyoderma is the infections of the normal skin and its appendages. It includes impetigo, folliculitis, carbuncle, and sycosis barbae. Of all the cases of primary pyodermas, impetigo is the most common of all infections because of the proximity to the common carrier site, i.e., nares, so that organisms get easily disseminated by fingers.[3] The secondary pyoderma is bacterial infection of preexisting skin disease such as eczema, scabies, dermatophytosis, and bullous disorders.[4] They are triggered by prior lesions, insect bite, trauma, and secondary infections.

Community-acquired cases are usually primary pyodermas mostly occurring in male patients of around 10 years of age who are never hospitalized. The reason behind high prevalence in this age group may be because of the increased susceptibility to infections due to the immature immune system. Hospital-acquired cases usually occur in cases diagnosed with secondary pyoderma in middle-aged people characterized by a large surface area of involvement.[5]

High incidence of pyodermas is reported in the lower socioeconomic strata where poverty, poor hygiene, malnourishment, and overcrowding are prevalent. Climatic conditions such as hot and humid climate are also associated with pyodermas.[6]

Primary pyodermas are primarily caused by Gram-positive organisms such as *Staphylococcus aureus* and *Streptococcus pyogenes*. They are occasionally caused by Gram-negative organisms such as *Pseudomonas* and *Klebsiella*. Secondary pyodermas mainly involve members of the family Enterobacteriaceae such as *Escherichia coli, Klebsiella, Enterobacter,* and *Citrobacter* and also *Pseudomonas* spp. and *Acinetobacter* spp. They less commonly involve Gram-positive organisms.[4] Pyodermas caused by *S. aureus* accounts for up to 17% of all clinical visits on dermatological practices. *S. aureus* often colonizes hospitalized as well as healthy people without any signs of infection. The preferential sites of colonization are anterior nares, perineum, axilla, and web spaces.[5]

Changing trends in antimicrobial susceptibility is being noted in etiologic agents of pyodermas due to indiscriminate and inappropriate use of antibiotics. Most strains encountered now are resistant to penicillin due to the ability of pathogen to produce penicillinase.[3,5]

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One such emerging multidrug-resistant strain is Methicillin-resistant *S. aureus* (MRSA) which was initially a nosocomial pathogen but is now being increasingly reported in healthy individuals.[7] As the mainstay of treatment continues to be antimicrobial therapy, the treatment of common superficial pyodermas has to be rationalized based on current epidemiological trends and changing sensitivity patterns of the pathogens.

Hence, this study was undertaken to analyze the clinical and bacteriological aspects of pyodermas along with their antimicrobial profile to guide for the selection of appropriate antibiotics while treating these cases, thus preventing the emergence of resistant organisms.

Table 1: Age- and sex-wise distribution of patients with pyodermas

Age group (in years)	Male	Female	Total
Up to 20	18	6	24
21-40	26	22	48
Above 40	17	11	28
Total (%)	61 (61)	39 (39)	100

Table 2: Patients enrolled in OPD/IPD of the department of dermatology

Patients enrolled	Number of patients (%)
OPD	76 (76)
IPD	24 (24)
Total	100 (100.0)

OPD: Outpatient department, IPD: Inpatient department

MATERIALS AND METHODS

A retrospective study was conducted on pus samples obtained from 100 patients in the Department of Microbiology, Government Medical College, Amritsar, from 1st January 2016 to 31st December 2016.The patients included were all the cases attending the dermatology department with primary or secondary pyodermas for the first time for treatment during that period. All the samples obtained were subjected to Gram staining and microscopy, culture, and sensitivity. For culture, the sample was inoculated on both Blood agar and MacConkey agar followed by incubation at 37°C for 18-24 h. After overnight incubation, if culture growth was obtained, those isolated colonies were identified by standard microbiological methods based on staining, morphological, and biochemical properties. The antibiotic sensitivity testing was done using standard disc diffusion method by Kirby-Bauer technique on Mueller-Hinton Agar according to the Clinical and Laboratory Standards Institute guidelines. Methicillin resistance was detected by Cefoxitin (30 µg) disc diffusion method. ESBL production was tested using phenotypic confirmatory tests. All the antibiotic susceptibility testing pattern was performed and identified according to the Clinical Laboratory Standards criteria 2017.[8]

The following antibiotics were tested: ceftriaxone (30 µg), cefoxitin (30 µg), amoxicillin-clavulanic acid (20/10 µg), amikacin (30 µg), gentamicin (10 µg), trimethoprim sulfamethoxazole (1.25/23.5 µg), imipenem (10 µg), penicillin (10 units), erythromycin (15 µg), vancomycin (30 µg), linezolid (30 µg), and ceftazidime (30 µg).

Table 3: Distribution of types of pyoderma with respect to the microbiological isolates

Organism	Primary pyoderma (%)	Secondary pyoderma (%)	Total (%)
S. aureus	41 (41)	13 (13)	54 (54)
Coagulase-negative *Staphylococcus*	12 (12)	10 (10)	22 (22)
Citrobacter spp.	4 (4)	0	4 (4)
K. pneumoniae	4 (4)	2 (2)	6 (6)
E. coli	1 (1)	1 (1)	2 (2)
P. aeruginosa	1 (1)	1 (1)	2 (2)
Acinetobacter spp.	1 (1)	1 (1)	2 (2)
Sterile	8 (8)	0	8 (8)
Total	72 (72)	28 (28)	100 (100.0)

S. aureus: Staphylococcus aureus, K. pneumoniae: Klebsiella pneumonia, P. aeruginosa: Pseudomonas aeruginosa, E. coli: Escherichia coli

Table 4: Antimicrobial susceptibility pattern of Gram-positive cocci

Antibiotic tested	*S. aureus*	*n*=54	Coagulase-negative *Staphylococcus*	*n*=22
	Sensitive	Resistant	Sensitive	Resistant
Ampicillin (%)	10 (18.5)	44 (81.5)	6 (27.3)	16 (72.7)
Amikacin (%)	53 (98.14)	1 (1.8)	21 (95.5)	1 (4.5)
Gentamicin (%)	50 (92.6)	4 (7.4)	16 (72.7)	6 (27.3)
Ciprofloxacin (%)	15 (27.8)	39 (72.2)	17 (77.3)	5 (22.7)
Cephalexin (%)	25 (46.3)	29 (53.7)	12 (54.5)	10 (45.5)
Cefoxitin (%)	50 (92.6)	4 (7.4)	22 (100)	0
Cotrimoxazole (%)	14 (26)	40 (74)	8 (36.4)	14 (63.6)
Erythromycin (%)	49 (90.8)	5 (9.2)	21 (95.5)	1 (4.5)
Amoxicillin-clavulanate (%)	49 (90.8)	5 (9.2)	19 (86.4)	3 (13.6)
Linezolid (%)	54 (100.0)	0	22 (100.0)	0
Vancomycin (%)	54 (100.0)	0	22 (100.0)	0

S. aureus: Staphylococcus aureus

RESULTS

The age- and sex-wise distribution of patients enrolled in the study is shown in Table 1. Out of 100 cases, 61% were males and 39% were females. 48% of the cases belonged to 20-40 years of age group. Majority of the cases were diagnosed with primary pyoderma (72%) while secondary pyoderma was diagnosed in only 28% of patients. Of all the samples, 92% were culture positive and 8% were sterile. On Gram staining, 76% were Gram-positive cocci, and 24% were Gram-negative bacilli. *S. aureus* was the predominant Gram-positive isolate (54%) and *Klebsiella* (6%) was reported as predominant Gram-negative isolate as shown in Table 2. The antibiotic sensitivity pattern of Gram-positive cocci and Gram-negative bacilli is shown in Tables 3 and 4, respectively. Maximum sensitivity of *S. aureus* was detected to vancomycin and linezolid, followed by amikacin and gentamicin. Majority of Gram-negative bacilli were sensitive to imipenem and amikacin, followed by ceftazidime and gentamicin.

DISCUSSION

Pyodermas constitute a considerable proportion of cases in dermatological practices worldwide. The spectrum of causative organisms changes over time and varies from region to region. These organisms have also developed resistance over the past two decades. Therefore, knowledge of the pattern of bacterial isolates and their antimicrobial susceptibility pattern is useful for the prompt treatment of patients.

In the present study, males (61%) were affected more than females (39%). In a similar study conducted by Nagmoti *et al.*,[9] it was found that 62% of males and 38% of females were affected. Similar results have been reported in a study conducted by Malhotra *et al*.[10] with 67.21% of prevalence in males and 32.79% in females. In our study, primary pyoderma cases comprised of 72%, whereas secondary pyoderma accounted for 28%. This rate was comparable with a study conducted by Kalshetti *et al*.[11] where they found 69% of cases of primary and 31% of cases of secondary pyoderma. This may be due to the known fact that a number of patients attending the dermatology outpatient department (OPD) (76%) outnumbered the inpatient department (24%) patients as shown in Table 2. In the present study, Gram-positive cocci were predominantly isolated comprising of 76% which was comparable to the study conducted by Ahmed *et al.*[12] where they found Gram-positive cocci in 68.3% of the isolates as shown in Tables 4 and 5. Our study detected *S. aureus* in 54% of the total samples received. Ahmed *et al*. conducted a similar study and found *S. aureus* in 52.6% of the cases while Chopra *et al*.[13] noted 73.73% of *S. aureus* isolates. *S. aureus* is known to induce purulent superinfection as well as to enhance the inflammatory process by superantigen-mediated T-cell activation.[14] In the present study, 16% of the cases were infected with Gram-negative bacilli. Out of which, 12 isolates were from Enterobacteriaceae family, and 4 were non-fermenter Gram-negative bacilli. In a similar study conducted by Janardhan *et al.*,[15] 17 Enterobacteriaceae and 9 non-fermenter isolates were found. Malhotra *et al*. in their study reported 9 isolates of Enterobacteriaceae from cases of pyoderma. Culture-negative cases in our study were 8%, while Baslas *et al*.[16] obtained 14.9% of sterile cultures and Malhotra *et al.* obtained 14.75% of culture-negative cases. All Gram-positive cocci were found to be sensitive to vancomycin and linezolid with similar

Table 5: Antimicrobial susceptibility pattern of Gram-negative bacilli

Gram negative bacilli	Type of strain	Amikacin (%)	Gentamicin (%)	Ciprofloxacin (%)	Ceftazidime (%)	Piperacillin-tazobactam (%)	Sulbactam-ceftazidime (%)	Imipenem (%)
Klebsiella	S	6 (100.0)	5 (83.3)	5 (83.3)	6 (100.0)	5 (83.3)	6 (100.0)	6 (100.0)
n=6	R	0	1 (16.7)	1 (16.7)	0	1 (16.7)	0	0
E. coli	S	2 (100.0)	1 (50)	2 (100.0)	2 (100.0)	1 (50)	2 (100.0)	2 (100.0)
n=2	R	0	1 (50)	0	0	1 (50)	0	0
P. aeruginosa	S	2 (100)	1 (50)	1 (50)	1 (50)	1 (50)	1 (50)	2 (100.0)
n=2	R	0	1 (50)	1 (50)	1 (50)	1 (50)	1 (50)	0
A. baumannii	S	1 (50%)	1 (50)	2 (100.0)	2 (100.0)	1 (50)	1 (50)	2 (100.0)
n=2	R	1 (50%)	1 (50)	0	0	1 (50)	1 (50)	0

P. aeruginosa: Pseudomonas aeruginosa, A. baumannii: Acinetobacter baumannii, E. coli: Escherichia coli

findings being reported by Ramana *et al*.[17] Gram-positive cocci were largely susceptible to amikacin (98.14%) and gentamicin (92.6%). Poor sensitivity was detected for ampicillin (18.5%) and cotrimoxazole (26%). Furtado *et al*. in their study reported slight higher rate of sensitivity to *S. aureus* against cotrimoxazole (52%). In the present study, 7.4% of *S. aureus* isolates were methicillin-resistant. Kalshetti *et al*. found MRSA in 15% of pyoderma cases while Gupta *et al*.[18] found comparable results with 10% MRSA strains. Gandhi *et al*.[3] reported an isolation rate of methicillin-susceptible *S. aureus* and MRSA in 80% and 20% of cases. In the present study, 16 isolated Gram-negative bacilli were found to be sensitive to most of the antibiotics. Imipenem showed excellent activity against all Gram-negative bacilli.

CONCLUSION

One of the most common skin problems observed in patients attending the dermatology OPD is pyoderma. In the present study, primary pyoderma was predominant among males in the age group of 20-40 years. *S. aureus* was the most common organism isolated. In this study, antibiotic sensitivity pattern showed vancomycin and linezolid as most effective for Gram-positive cocci, and imipenem showed excellent activity against Gram-negative bacilli. However, efforts must be made toward the prudent use of antibiotics based on the type of causative organisms and their antibiotic sensitivity pattern. Every hospital should have their in-house antibiotic policy for effective treatment and to prevent from the emergence of drug resistance.

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