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Clinico-bacteriological Study and Antibiotic Sensitivity Pattern in Pyodermas at a Tertiary Care Hospital of Kathmandu

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Abstract

Introduction: Pyodermas are common cutaneous bacterial infections caused mainly by Staphylococci. The causative organisms and their antibiotic sensitivity patterns are changing periodically.

Objective: The study's objectives were to determine the clinical and bacteriological profile in pyodermas and the antibiotic sensitivity pattern of isolated organisms.

Methods: It was a descriptive study conducted at the Department of Dermatology and Venereology and Department of Microbiology, Tribhuvan University Teaching Hospital, from October 2020 to September 2021, in patients with pyodermas. After history taking and examination, the swab was sent for culture and sensitivity. The details of isolated organisms and antibiotic sensitivity patterns were recorded.

Results: Eighty-five patients were included in this study, 55(64.7%) males and 30(35.3%) females. The typical age group affected was 15-24 years. Lower extremities were the most common sites involved. Primary pyodermas were more common than secondary pyodermas, 45(52.9%) vs 40(47.1%). Folliculitis was the most common diagnosis in 22(25.9%) patients. *Staphylococcus aureus* was the most common organism isolated in 46(54.1%) cases, among which 41 isolates were methicillin-sensitive while 5 isolates were methicillin-resistant. The second most common organism was coagulase-negative *Staphylococci in* 25(29.4%) cases. *Staphylococcus aureus* was most sensitive to cephalexin and cloxacillin in 41(89.1%) cases. Coagulase negative Staphylococci were most sensitive to gentamicin in 25(100%) and ciprofloxacin in 24(96.0%) isolates.

Conclusion: The change in the drug sensitivity pattern in the isolates of pyoderma warrants regular monitoring and judicious use of antibiotics to prevent the further disastrous development of drug-resistant strains of organisms.

Key words: Antibiotic sensitivity; Pyoderma; Staphylococci

Introduction

Pyodermas are pyogenic skin condition caused by bacterial infections of the skin and its appendages.[1] These are common clinical conditions encountered in dermatological practice. Prevalence of pyodermas in our country, as per a community-based study is 5.3%.[2] However, it may vary in different geographic regions.

Pyodermas are classified as primary and secondary. Primary pyodermas are the infections of the normal skin and its appendages. They include folliculitis, impetigo, furunculosis, carbuncle, and ecthyma. The secondary pyodermas are pyogenic infections of previously diseased skin including infected eczema, infected scabies, and infected wounds. Prior lesions, trauma, insect bite, and secondary infections might trigger.[3]

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Factors like poor hygiene, poverty, malnutrition, overcrowding, and climatic conditions like hot and rainy season are responsible for its high incidence in the lower socio-economic strata in the developing countries.[4]

In clinical practice, antibiotics are empirically used in pyodermas without knowing the causative organisms and their antibiotic susceptibility. At times, the isolated organisms and their antibiotic sensitivity patterns differ. The increasing resistance to the antibiotics seen in the microorganism poses a big problem to the treating clinician. Empirical and over-the-counter use of antibiotics for pyodermas has been the major cause of antibiotic resistance.[3]

There are few studies on clinical-bacterial profile and antibiotic sensitivity patterns in cutaneous bacterial infections. However, comparing the latest literature to the studies done a few years back, changes in trends in sensitivity patterns and isolation of unusual organisms in cultures is a matter of concern. Knowledge of the bacteriological profile and the current anti-microbial profile becomes necessary in selecting appropriate treatment. This study was carried out to evaluate the clinical and bacteriological profile of pyodermas and antibiotic sensitivity pattern of isolated organisms, which ultimately will guide us for better management of pyodermas.

Materials and Methods

This was a hospital-based descriptive cross-sectional study conducted at the outpatient Department of Dermatology and Venereology and Department of Microbiology in Tribhuvan University Teaching Hospital (TUTH), Kathmandu, from October 2020 to September 2021, in all clinically diagnosed cases of pyodermas. After obtaining ethical clearance from the institution review board (IRCNo:83(6-11) E2 077/078), written consent was taken from the new cases of pyodermas who had not taken any antibiotics within the last 7 days or who did not have any known immunosuppressive co-morbidities. Relevant history and clinical examination of the patients were done.

The lesion and the surrounding area were cleaned with 70% alcohol and washed with sterile normal saline. The intact pustule was ruptured with a sterile needle, and the pus was taken with a sterile cotton swab stick. The debris was removed in open wounds, and the lesion was cleaned thoroughly with sterile saline before swab collection. The crusted lesion was cleaned and partly lifted with sterile forceps. The specimen was collected from underneath with a sterile cotton swab. All the samples were collected under aseptic technique with two sterile cotton swabs for each sample from the lesion.

The collected sample was transported to the microbiology laboratory within 1 hour. The specimen was inoculated in Blood agar and MacConkey medium and incubated at 37˚C for 24 hours.If there was no bacterial growth within 24 hours, incubation was extended to 48 hours. The identification of isolates was done using standard microbiological techniques. All isolated organisms were tested for antibiotic susceptibility patterns on the Mueller Hinton agar plate using the Kirby Bauer disc diffusion method. Antibiotic discs were placed on the surface of the agar plate according to the organisms isolated. Antibiotics disc used were penicillin (10 units), co-trimoxazole (1.25/23.75 mcg), ciprofloxacin (5 mcg), gentamicin (10 mcg), cephalexin (30 mcg), cloxacillin (30 mcg),erythromycin (15 mcg), ampicillin (10 mcg), amoxicillin(20mcg), vancomycin (30mcg), teicoplanin (30 mcg), cefixime (5 mcg), amoxicillin+clavulinicacid (20/10 mcg), pipercillin+tazobactum (100/10 mcg). After overnight incubation of the agar plate, the diameter of the zone of inhibition was measured. This was compared with the standard to interpret the result as 'Susceptible', 'intermediate susceptible', and 'resistant'. Statistical analysis was done using a computer-based statistical analysis program, Microsoft Excel 2016 and SPSS 26.

Results

Out of 85 study participants, 55 (64.7%) were males and 30 (35.3%) were females. The age of patients varied from 7 years to 71 years, with a median age of 28 years. Most common age group was 15-24 years, with 28 (32.9%) patients followed by 25-34 years, with 17 (20%) patients. The duration of lesions varied from 3 days to 90 days, with a mean of 15.86 days (SD 13.92). Predisposing factors were not noted in most cases (n=45,52.9%). There were triggering factors like other skin lesions in 33 (38.8%) patients, insect bites in 4 (4.7%) patients and trauma in 3 (3.5%) patients. Only 6 (7.1%) cases gave a positive family history of similar skin lesions, and a history of similar problems was seen in 22 (25.9%) patients.

Lower extremities were the most common site affected in 22 (25.9%) patients followed by multiple sites in 18 (21.2%), trunk in 16 (18.8%), scalp in 12 (14.1%), upper extremities in 9(10.6%) and face in 8 (9.4%) patients. Primary pyodermas were seen in 45(52.9%) patients, while 40 (47.1%) had secondary pyodermas. Primary pyodermas consisted of 22 (25.9%) cases of folliculitis, 12 (14.1%) cases of furunculosis, 4 (4.7%) cases of paronychia, 3 (3.5%) cases of impetigo, 2 (2.4%) cases of carbuncle, and 2 (2.4%) cases of ecthyma. Folliculitis was the most common diagnosis in primary pyodermas and the overall diagnosis. Different types of eczemas with secondary bacterial infections were common among secondary pyodermas, accounting for 20 (23.5%) cases.

Diagnosis	n (%)
Primary pyodermas	
• Folliculitis	22(26%)
• Furunculosis	12(14%)
• Paronychia	4(4.7%)
• Impetigo	3(3.5%)
• Ecthyma	2(2.4%)
• Carbuncle	2(2.4%)
Secondary pyodermas	
• Eczemas with secondary infection	20(23.5%)
• Insect bites with secondary infection	4(4.7%)
• Scabies with secondary infection	3(3.5%)
• Traumatic wounds with secondary infection	3(3.5%)
• Others	10(12%)

Table 1: Types of pyodermas

The most common organism isolated in swab culture was *Staphylococcus aureus* alone in 43 (50.6%) cases. Among *Staphylococcus aureus,* 39 (45.9%) were methicillin-sensitive *Staphylococcus aureus* (MSSA), and 4 (4.7%) were methicillin-resistant *Staphylococcus aureus* (MRSA). Coagulase-negative Staphylococcus was isolated in 25 (29.4%) cases. Other isolated organisms were Escherichia coli, *Enterococcus faecalis,* and Proteus mirabilis. There was no growth in 9 (10.6%) cases.

Out of 46 *Staphylococcus aureus* isolates, 37 (80.4%) were resistant to penicillin. The sensitivity to co-trimoxazole was seen in 31 (67.4%) isolates, ciprofloxacin in 25 (54.3%), gentamicin in 33 (71.7%) isolates. The most sensitive antibiotics were cephalexin and cloxacillin in 41 (89.1%) isolates each.

Antibiotics	Sensitivity n (%)	Resistant n (%)
Penicillin	9 (19.6)	37 (80.4)
Co-trimoxazole	31 (67.4)	15 (32.6)
Ciprofloxacin	25 (54.3)	21 (45.7)
Gentamicin	33 (71.7)	13 (28.3)
Cephalexin	**41 (89.1)**	5 (10.9)
Cloxacillin	**41 (89.1)**	5 (10.9)
Erythromycin	22 (47.8)	24 (52.2)
Clindamycin	32 (69.6)	14 (30.4)

Table 2: Antibiotics sensitivity pattern of *Staphylococcus aureus*

Out of 25 isolates of coagulase-negative Staphylococci, all were sensitive to gentamicin, followed by ciprofloxacin in 24 (96.0%), cephalexin in 23 (92.0%), cloxacillin in 23 (92.0%), clindamycin in 22(88.0%) and co-trimoxazole in 14 (56.0%) isolates. Erythromycin and penicillin were the least sensitive in 7 (28.0%) isolates.

Antibiotics	Sensitivity n (%)	Resistant n (%)
Penicillin	7(28.0)	18(72.0)
Cotrimoxazole	14 (56.0)	11 (44.0)
Ciprofloxacin	24 (96.0)	1 (4.0)
Gentamicin	25 (100)	0 (0)
Cephalexin	23 (92.0)	2 (8.0)
Cloxacillin	23 (92.0)	2 (8.0)
Erythromycin	7 (28.0)	18 (72.0)
Clindamycin	22 (88.0)	3 (12.0)

Table 3: Antibiotics sensitivity pattern of Coagulase-negative Staphylococci

Out of 5 isolates of *Enterococcus fecalis,* all were sensitive to vancomycin and teicoplanin, followed by 4(80%) isolates to ampicillin, ciprofloxacin, amoxicillin+clavulanic acid, and erythromycin each.

Out of 2 isolates of *Escherichia coli,* both were sensitive to cefixime, pipercillin+tazobactum and cotrimoxazole. One isolate was resistant to ciprofloxacin, gentamicin and amoxicillin+clavulanic acid. Both isolates were resistant to ampicillin. *Proteus mirabilis* was isolated from a single sample and was sensitive to cefixime, ciprofloxacin, gentamicin, pipercillin+tazobactum, amoxicillin+clavulanic acid, and co-trimoxazole. It was resistant to ampicillin. *Citrobacter freundii* was isolated from a single sample. It was sensitive to cefixime, ciprofloxacin, gentamicin, pipercillin+tazobactum, and co-trimoxazole.

Discussion

This study conducted at tertiary care hospital in Kathmandu included 85 patients with pyodermas. The male: female ratio was 1.83:1. Male preponderance has been seen in several studies.[5,6,7] The reason for this may be more outdoor activities of males and regional variation.

Most common age group was 15-24 years in 28 (32.9%) patients, followed by 25-34 years in 17 (20%) patients. Similar result was seen in a study done by Paudel et al., where most of the patients belonged to the 15-24 years age group.3 In this study, only 8.2% of the population was below 15 years of age. Most pediatric population visits to pediatric OPD for skin problems, so there was less percentage of pediatric population in this study.

There was history of similar lesions in 22 (25.9%) patients, this finding was consistent with a study done by Malik et al., where there was recurrence of pyodermas in 24% of the patients.[8]

Lower extremities were the most common site affected by pyodermas in 22(25.9%) patients; this finding was reported by a few other studies as well.[9,10,11] This may be due to exposure to the outer environment leading to micro trauma and secondary infection. In studies predominating the pediatric population, the face was the most common site involved with the most common diagnosis of impetigo.[12]

In this study, 45 (52.9%) were primary pyodermas, while 40 (47.1%) were secondary pyodermas. Other studies reported similar result.[9,10] Folliculitis was the

most common diagnosis in 22 (25.9%) cases; this result was consistent with the study done by Kamble et al., where 22% of cases were folliculitis.[13] Furuncles were more common in other studies.[9,10] Among secondary pyodermas, various eczemas with secondary infection were seen in 20 (23.5%) patients. Similar findings were reported by other studies.[9,10,13]

The most common organism isolated was *Staphylococcus aureus* in 46 (54.1%) cases, out of which 43 (50.6%) were as single isolate and 3 (3.5%) were as mixed growth. This was similar to the study done by Biswokarma et al., in which *Staphylococcus aureus* was isolated in 42 (58.3%) cases.[14] *Staphylococcus aureus* was the most common isolate in studies from different parts of India.[9,10,15] Among *Staphylococcus aureus,* 39 (45.9%) isolates were methicillin sensitive, and 4 (4.7%) isolates were methicillin resistant. Thind et al., isolated 75 (90.3%) methicillin-sensitive *Staphylococcus aureus* (MSSA) and 8 (9.4%) methicillin-resistant (MRSA) in pyodermas.[16] In another study done by Sharma et al., the incidence of MSSA and MRSA was 27 (47%) and 10 (17%), respectively.[17] Few years back, streptococcus was considered to be the most common pathogen causing pyodermas, but in this study, Streptococcus was not isolated in any sample. This may be due to changing trends of etiological agents. In this study, Coagulase-negative Staphylococci (CoNS) was isolated in 25 (29.4%) cases, being the second commonly isolated organism; this finding was similar to a study done by Harshita et al., where CoNS was the second most commonly isolated organism.[18]

Out of 46 isolates of *Staphylococcus aureus,* 41 (89.1%) were sensitive to cephalexin and cloxacillin whereas only 9 (19.6%) were sensitive to penicillin. The sensitivity with co-trimoxazole was seen in 31 (67.4%) isolates. In the study by Mishra et al., *Staphylococcus aureus* isolates showed maximum resistance to penicillin in 97.70% of cases and with co-trimoxazole in 28.73% of cases and 100% sensitivity to cephalexin.[19] In a study by Bishwokarma et al., sensitivity of staphylococcus to cloxacillin was seen in 72 (79.1%).[14]

Out of 25 isolates of coagulase-negative Staphylococci, all were sensitive to gentamicin, followed by ciprofloxacin in 24 (96.0%), cephalexin and cloxacillin in 23 (92.0%) isolates each. Erythromycin and penicillin were the least sensitive in 7(28.0%) isolates. Similar results were seen in the study done by Devi et al., where CoNS were sensitive to gentamicin in 15(100%) isolates.[12]

Out of 5 isolates of *Enterococcus faecalis,* all isolates were sensitive to vancomycin, followed by 4(80%) isolates with ampicillin, ciprofloxacin and erythromycin. Similar results were shown in the study done by Singh et al., where 16 (94.1%) and 13 (76.4%) isolates of *Enterococcus faecalis* were sensitive to vancomycin and erythromycin, respectively.[20] In the study by Paudel et al., *Enterococcus faecalis* was sensitive to ciprofloxacin in 5 (100%) and erythromycin in 4(80%) isolates, respectively.[3]

0ut of 2 isolates of *Escherichia coli,* both were most sensitive to pipercillin+tazobactum while it was 50% sensitive to ciprofloxacin and gentamicin and 100% resistant to ampicillin. Similar findings were seen in the study conducted by Singh et al., where 23(95.8%) isolates of *Escherichia coli* were sensitive to pipercillin+tazobactum.[20] *Proteus mirabilis* and *Citrobacter freundii* were unusual isolates in pyodermas. However, they were sensitive to conventional antibiotics like cefixime, ciprofloxacin, and gentamicin.

Conclusion

This study yielded crucial data regarding the clinical types of pyodermas, their causative organisms and antibiotic sensitivity patterns. Folliculitis and eczemas with secondary bacterial infections were the most common primary and secondary pyodermas, respectively. *Staphylococcus aureus* was the most common isolate, followed by coagulase-negative staphylococci. Most of the isolates of *Staphylococcus aureus* were methicillin-sensitive, and most were resistant to penicillin and erythromycin. Cephalexin and cloxacillin still had higher sensitivity for both *Staphylococcus aureus* and coagulase-negative staphylococci; hence they can be considered an effective option for the treatment of pyodermas. However, a multicentered study with a larger population is required for the validation of these findings and fora proper understanding of the actual situation regarding the causative organisms and their antibiotic sensitivity pattern in different geographic areas.

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