The Anti-Microbial Profile of Pyoderma in a Tertiary Care Institute

CRV Narasimhalu¹, M.Kalyani², K. Deepalakshmi³, Ramya⁴

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Abstract

Introduction: Pyoderma is a superficial skin infection caused by various bacteria. It can be primary or secondary to pre-existing skin condition. Pyoderma is a common and easily treatable clinical condition but has many complications if not properly treated. There is a change in the spectrum of organisms causing pyoderma and changing antibiotic sensitivity due to irrational use of antibiotics. Hence we studied the organisms causing pyoderma and their sensitivity pattern in our tertiary referral centre. Aim: To identify the organisms causing pyoderma and to identify their antibiotic sensitivity pattern. Materials and Methods: All patients attending the dermatology department with pyoderma were studied. Result: Of the 60 samples collected, majority of them were males from low socio economic status. 68% of them had primary pyoderma. Staphylococcus aureus was the predominant gram positive cocci and it is resistant to Penicillin, Ciprofloxacin and Cephalosporin. Other organisms like Streptococcus pyogenes was sensitive to Ampicillin and gram negative bacteria were sensitive to ciprofloxacin. Conclusion: Pyoderma is common in the lower socio economic groups and there is an increase in the resistance to the routinely used antibiotics. Hence routine culture sensitivity of pyoderma would help in treating the patients and prevent complications.

Key words: Antibiotic sensitivity, skin infection, microbiology

Introduction

Skin and soft-tissue infections are among the most common infections and serves as a major cause of serious local and systemic complications. These complications can range from mild to severe thus making skin infections a significant condition in medical practice today. They are caused by bacteria, fungi, virus or parasite. Bacteria are the most important causes of these superficial skin infections. Although many bacteria come in contact with or reside on the skin, they are normally unable to establish an infection. When they do occur however, they can range in size from a tiny spot to the entire body surface which can either be harmless or life threatening. An example of such type of skin disease caused by bacteria is pyoderma.

Any condition that results in accumulation of neutrophilic exudate can be termed as pyoderma. It has various etiologies are infection, inflammation or neoplasm; however, pyoderma usually refers to bacterial infection of skin. The factors which are associated with the increased incidence of pyoderma include poverty, malnutrition, overcrowding, poor sanitation, and seasonal variation thus explaining the higher incidence in the lower socio economic strata especially among the children who are the common victims [1].

Pyoderma can either manifest as primary or secondary pyoderma. Primary infections have a
A characteristic morphology and course, caused by a single organism and arise on normal skin \[1\]. Primary are most frequently caused by coagulase positive Staphylococci or β-haemolytic Streptococci. Secondary pyoderma occurs as a superimposed condition in diseases like eczema, ulcers, scabies, pediculosis etc. Staphylococci and streptococci can also cause secondary pyoderma along with Gram-negative microorganisms like Proteus, Klebisella, Pseudomonas aeruginosa and Escherichia coli \[1\].

Though easily treatable, the condition is known for its chronicity, recurrence, and other complications like post streptococcal glomerulonephritis \[2\]. Therefore, timely recognition and prompt bacterial diagnosis with antimicrobial sensitivity is imperative for the effective management and treatment of pyoderma \[2\]. Previously various antibiotics were very effective for such cases but indiscriminate use of topical and systemic antibiotics has contributed to resistance thus posing a big problem to clinicians. So for successful treatment of pyoderma a detailed knowledge about the causative microorganisms and antibiotic sensitivity pattern is essential \[3\].

The rapid emergence of multidrug resistance in most of the Gram positive bacterial isolates complicates the management of pyoderma and demonstrates the need for more judicious use of antimicrobial agents \[2\]. The pattern of skin diseases varies from one country to another and in different parts within the same country \[4,5\]. Changing trends are being noted in the etiological aspect of primary pyodermas and the problem of emergence of drug resistant strains is an ever increasing one. Hence it would be ideal to do culture and sensitivity tests before prescribing antibiotics \[6\]. In view of the above facts, this present study was undertaken to isolate and characterize bacterial pathogens from clinical samples over a period of six months in our hospital and to detect the sensitivity pattern of those isolates to the commonly used antibiotics.

**Aim:** To identify the bacterial pathogens from cases of pyoderma and to find out their antibiotic susceptibility pattern.

**Objectives:**
1. To isolate and characterize the bacteriological agents from infection sites.
2. To identify the common bacteria causing pyoderma.
3. To detect the antibiotic sensitivity pattern of bacterial isolates to the commonly used antibiotics.

**Materials and Methods**

The study was performed in a medical college hospital in South India for 6 months. Total number of sample collected was 60. Pus swabs were collected from the patients with pyoderma attending the dermatology outpatient department.

**Inclusion criteria:** All patients with pyoderma attending dermatology outpatient department.

**Exclusion criteria:** Those patients who are on topical or systemic antibiotics were excluded.

**Specimen:** The pus was collected using 2 swabs from the abscesses, boils, skin lesions or from the infected area.

**Methodology**

Sample processing was done in three steps a) Microscopy b) Identification of bacteria c) Antibiotic susceptibility testing. The lesions were swabbed with alcohol and the pus was collected by using a sterile cotton swab. In the case with intact pustule lesions, the pustule was ruptured with a sterile needle and material was taken with sterile swab. In crusted lesions, the crusts were partly lifted and material was taken from underneath \[8\].

The swabs were transported immediately to the laboratory. Of the two swabs collected one was used for Gram stain and microscopic examination and the other for culture. Second swab was inoculated on to the following media \[4\],

1. Blood agar
2. MacConkey agar
3. Crystal violet blood agar (1:500000 of crystal violet in blood)

4. Chocolate agar

Bacterial pathogens were identified by inoculation into the above mentioned media after which they were incubated aerobically at 37°C for 24 hours and also by biochemical characteristics. MacConkey agar plate was used for Gram negative bacilli while Crystal violet blood agar was used for the growth of *Streptococci* [4] and Blood agar plate was used to identify haemolytic organisms. The tube coagulase test was done to identify *Staphylococcus* species.

**Table 1– Details of organisms from positive samples**

<table>
<thead>
<tr>
<th>S. No</th>
<th>Organism isolated</th>
<th>No. Of isolates</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td><em>Staphylococcus aureus</em></td>
<td>35</td>
<td>44.87%</td>
</tr>
<tr>
<td>2</td>
<td><em>Streptococcus pyogenes</em></td>
<td>14</td>
<td>17.94%</td>
</tr>
<tr>
<td>3</td>
<td>CONS*</td>
<td>9</td>
<td>11.53%</td>
</tr>
<tr>
<td>4</td>
<td><em>Enterococcus</em> spp.</td>
<td>5</td>
<td>6.41%</td>
</tr>
<tr>
<td>5</td>
<td><em>Pseudomonas aeruginosa</em></td>
<td>8</td>
<td>10.29%</td>
</tr>
<tr>
<td>6</td>
<td><em>Citrobacter</em> spp.</td>
<td>2</td>
<td>2.56%</td>
</tr>
<tr>
<td>7</td>
<td><em>Klebsiella</em> spp.</td>
<td>2</td>
<td>2.56%</td>
</tr>
<tr>
<td>8</td>
<td><em>E. coli</em></td>
<td>1</td>
<td>1.28%</td>
</tr>
<tr>
<td>9</td>
<td><em>Proteus</em></td>
<td>1</td>
<td>1.28%</td>
</tr>
<tr>
<td>10</td>
<td><em>Enterobacter</em></td>
<td>1</td>
<td>1.28%</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>78</td>
<td></td>
</tr>
</tbody>
</table>

*CONS- Coagulase negative *Staphylococcus*

**Results**

During the period of six months 60 samples were collected from the patients with clinically diagnosed pyodermal infections attending Dermatology outpatient department. Out of 60 samples, 18 (30%) pyodermal cases were from age group below 10 years which was predominant age group. Out of 60 samples received, 41 were male and 19 were females of which 37 males yielded a positive culture and 18 females yielded a positive culture. Among the total 60 number of samples, 45 (75%) patients were from poor, 13 (21.67%) from fair and 2 (3.33%) from good socio economic status. Out of 60 pus samples, 55 (92%) yielded bacterial growth culture positive and 5 (8%) samples had no growth. Out of 55 positive samples, 37 patients were infected with primary pyoderma (67.27%) and 18 (32.73%) were with secondary pyoderma. With regard to the site of infection, the maximum lesion isolated from the lower limbs 32 (53.33%), followed by 10 (16.66%) on scalp, 8 (13.34%) on face, 6 (10%) on trunk, and 2 each on hand & gluteal region (6.67%) (Figure 1).

On the basis of type of infection, out of 55 positive samples, 18 (33%) patients were having predominantly impetigo followed by furunculosis 13 (23.64%), cellulitis 10 (18%), folliculitis 9 (16.36%) and others such as eczema, stasis dermatitis, plantar psoriasis, & scabies constitutes the remaining 9% (Figure 2).

**Figure 1: The distribution of type of infections**

Among the total 55 positive samples, monomicrobial growth was detected from 32 (58.18%) samples and 23 (41.82%) had polymicrobial growth. The total number of bacterial isolates was 78 (Figure 3).

Out of the total 78 bacterial isolates, 63 (80.76%) were Gram positive cocci and 15 (19.24%) were Gram negative bacilli. Out of 63 Gram positive isolates, *Staphylococcus aureus* was the predominant isolate i.e 35 (55.55%), followed by *Streptococcus*.
Figure 2: Distribution of site of infection

<table>
<thead>
<tr>
<th>Site of infection</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Leg</td>
<td>3%</td>
</tr>
<tr>
<td>Scalp</td>
<td>3%</td>
</tr>
<tr>
<td>Feet</td>
<td>10%</td>
</tr>
<tr>
<td>Face</td>
<td>13%</td>
</tr>
<tr>
<td>Trunk</td>
<td>15%</td>
</tr>
<tr>
<td>Hand</td>
<td>27%</td>
</tr>
<tr>
<td>Gluteal</td>
<td>50%</td>
</tr>
</tbody>
</table>

pyogenes - 14 (22.23%), Coagulase negative Staphylococci (CONS) - 9 (14.28%) and Enterococcus spp. - 5 (7.94%). Among the Gram negative bacterial isolates Pseudomonas aeruginosa was the predominant isolates i.e. 8 (53.33%) and out of this 8, 1 strain was ESBL*, followed by Citrobacter & Klebsiella each 2 (13.33%) and E.coli, proteus & Enterobacter each 1 isolates (6.66%). The E.coli isolated was also ESBL*

*ESBL- Extended spectrum beta lactamase

Among the 35 isolates of Staphylococcus aureus, maximum resistance was seen to cephalxin & penicillin and least to vancomycin, Linezolid & rifampicin. Antibiotic resistance pattern of Staphylococcus aureus, which was the predominant isolate,is as follows Cephalexin (77.27%), Penicillin (72.72%), Cotrimoxazole (52.27%), Ciprofloxacin (40.90%), Gentamicin(29.54%), Erythromycin (18.18%), Clindamycin (9.09%). All strains of Staphylococcus aureus were 100% sensitive to vancomycin, linezolid and rifampicin. Among 35 Staphylococcus aureus strains isolated 3 (8.57%) were MRSA (Figure 4).

All 14 strains of Streptococcus pyogenes were 100% sensitive to ampicillin, ciprofloxacin, & vancomycin and 93% sensitive to gentamycin, cotrimoxazole, & erythromycin (Figure 5). Pseudomonas spp. isolated had shown 100% sensitive to Ciprofloxacin, Ceferpine & Piperacillin and 88% sensitive to gentamicin, ofloxacin, & amikacin. Enterococcus spp was 100% resistance to pencillin, followed by Ampicillin (80%), Cephalexin (40%). Cotrimoxazole, Erythromycin, Vancomycin showed (40%) resistance each and Ciprofloxacin, Gentamicin were 100% sensitive (Figure 6).

Discussion

In the present study during a period of six months from 60 samples were collected from patients with clinically diagnosed pyodermal infections attending dermatology outpatient of our Hospital. Out of 60 pus samples, 55 (91.67%) yielded bacterial growth. 5 (8.33%) samples had no growth which tends to occur as seen in a study by Sujata Baveja et al in which 16.3% of patients were culture negative [8,9]. Baslas et al also reported negative cultures in 14.9% of patients [9].

In our study, out of 60 samples, 18 (30%) were from the age group below 10 years. A similar study by M Jyothi Nagmoti et al showed most of the patients (45%) belonged to the age group of 1-4 years [10]. Another study by S Mariette Mathew et al showed that the maximum incidence was in the 14 year age group (54.2%), followed by the 5-8 years age group (24.2%) [1]. Another study by Adarsh Chopra et al had 31% cases between 0-10 year age group [11].

Males were (69%) were predominantly affected than females which is similar to the report by M Jyothi Nagmoti et al [10]. But S Mariette Mathew et al showed a higher prevalence of pyoderma in female children (60%) [6]. In our study 45 (75%) patients were from poor socio-economic status which is similar to a study by M Jyothi Nagmoti et al confirming socio economic status is an important risk factor for the development of pyoderma [10]. Out of 55 positive samples, 37 were having primary pyoderma and 18 with secondary pyoderma. Polymicrobial growth was found in 23 (41.82%) and monomicrobial in 32(58.18%) of samples. A similar result was also seen in study by DP Ghadage et al in which single infecting organism was isolated...
Figure 3: The distribution of monomicrobial & polymicrobial growth

Figure 4: Antibiogram of Staphylococcus aureus

Figure 5: Antibiotic sensitivity pattern of Streptococcus pyogenes
Figure 6: Antibiotic sensitivity pattern of Pseudomonas

from 46.9% cases and more than one type of organism from 65.46% cases \[3\]. But Sujata Baveja et al have reported as 100% monomicrobial growth in her study \[8\]. Other studies have reported polymicrobial flora ranging from 5-16% \[12,13\].

In our study 18 (33%) patients were having impetigo which was the predominant lesion. 13% of patient studied by Ramani et al \[14\] and Saxena et al \[15\] were of secondary pyoderma type, of which the commonest was impetigo while Khandari et al \[16\] found 16% of their cases were of secondary bacterial infection due to eczema. In this present study, Staphylococcus aureus accounted for 55.55% of all the bacterial pathogens identified and were less frequently associated with secondary pyodermas than with primary pyodermas. Many similar studies also had reported Staphylococcus aureus as commonest isolates from pyodermal infections which are close to our result like 52.1% in KV Ramana et al \[2\] and 52.6% in Khalil Ahmed et al \[17\]. Other studies by CB Bhaskaran et al \[18\], S Mariette Mathew et al \[6\] and M Jyothi Nagmoti et al \[10\] had reported 69.8%, 47.5% and 45% Staphylococcus aureus as common isolates respectively. In Sujata Baveja et al \[8\] and Rama Raghu Rao et al \[19\] studies S. aureus were isolated from 81.4% and 80% of patients respectively which are comparatively higher. Other studies \[12, 13, 15, 20, 21, 22\] also reported Staphylococcus aureus as predominant.

In our study, out of total 35 Staphylococcus aureus isolated, 3 were MRSA i.e (8.57%). In a series on community-acquired pyodermas from Mangalore, Nagaraju et al \[20\] reported that 11.8% of strains of 202 Staphylococcus aureus strains were methicillin resistant which is similar to our study. The antibiotic resistance pattern of Staphylococcus aureus, which was the predominant isolate, is as follows: Cephalexin (77.27%), Penicillin (72.72%), Cotrimoxazole (52.27%), Ciprofloxacin (40.90%), Gentamicin (29.54%), Erythromycin (18.18%), and Clindamycin (9.09%). All strains of Staphylococcus aureus were 100% sensitive to Vancomycin, linezolid and rifampicin.

In S Mariette Mathew et al \[6\] study the antibiotic resistance patterns showed that resistance to penicillin is 79.3% was corresponding to our study and in DP Ghadage et al study they found maximum strains of
Staph. aureus were susceptible to cotrimoxazole (72%), clindamycin (61%) and ciprofloxacin (61%). A low susceptibility was observed to gentamicin (12%), penicillin (21%) and norfloxacin (39%). In our study, Streptococcus pyogenes strain isolated were 14 (22.23%) and they were 100% sensitive to Ampicillin, Ciprofloxacin, Vancomycin & 93% sensitive to Gentamycin, Cotrimoxazole, & Erythromycin. Beta haemolytic Streptococcus accounted for 26.98% of the total isolates in Singh G et al [23] 25% in RG Baslas et al [9] and 17.4% in CB Bhaskaran et al [18] study 5 (7.94%) Enterococcus spp. were isolated and had shown 100% resistance to Penicillin, followed by Ampicillin (80%), Cephalexin (40%). Cotrimoxazole, Erythromycin, Vancomycin showed (40%) resistance each and Ciprofloxacin, Gentamicin were 100% sensitive. More than 60% of the Pseudomonas spp. isolated in our study had shown sensitive to all the drugs. Ciprofloxacin, Cefepime and Piperacillin were 100% sensitive. One out of 8 isolates of Pseudomonas spp. was ESBL. Among the other gram negative bacilli, E. coli strain was also ESBL which were confirmed by double disk synergy test for ESBL enzyme. Other Gram negative bacilli isolated like Citrobacter, Enterobacter, Klebsiella, and Proteus did not show any significant resistant pattern.

Conclusion
Pyoderma is a significant dermatological condition in India especially in the lower socioeconomic class which was evident in our study as well as other studies. Our aim was to highlight the organisms responsible for pyoderma and its antibiotic susceptibility pattern. We found that most of our samples were from males (69%) and 68% our subjects suffered from primary pyoderma. Almost a third of our samples were found to be due to gram positive cocci of which Staphylococcus aureus was the most predominant and the rest were caused by other organisms. We also found that Staphylococcus aureus had an increasing resistance pattern to Penicillin, Ciprofloxacin and Cephalosporin but Streptococcus pyogenes was highly sensitive to Ampicillin, Ciprofloxacin and Vancomycin. With regard to the Gram negative organisms, they were sensitive to Ciprofloxacin. We also found out that organisms that caused pyoderma were more sensitive to stronger antibiotics.

We conclude that there is increasing antibiotic resistant among the commonly used drugs hence a culture and sensitivity test would be useful to successfully treat pyoderma in order to avoid the complications of pyoderma. Also knowing antibiotic sensitivity pattern in a locality would help the general practitioner in choosing the right drug.

Conflicts of interest:
Nil declared.

References
1. Virendra N Sehgal; Textbook of clinical dermatology; 4th edition; pyodermas; chapter 11; page39-40
2. Ramana KV, Mohanty SK, Kumar A. In-vitro activities of current antimicrobial agents against isolates of pyoderma. Indian J Dermatol Venereol Leprol 2008; 74:430
3. Ghadage DP, Sali YA. Bacteriological study of pyoderma with special reference to antibiotic susceptibility to newer antibiotics. Indian J Dermatol Venereol Leprol 1999; 65:177-81
4. Sayal SK, Das AL, Gupta CM. Pattern of skin diseases among civil population and armed forces personnel at Pune. Indian J Dermatol Venereol Leprol 1997;63:29-32

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