Original Article

# Antibiotic sensitivity patterns in cases of pyoderma around Jaipur

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## Abstract

**Introduction:** Skin infections are one of the commonest conditions encountered in dermatological practice. These infections are commonly caused by Staphylococcus. aureus and Streptococcus. pyogens. Of late there is a significant change in the pattern of organisms causing pyodermas and their antibiotic sensitivities due to indiscriminate use of topical and systemic antibiotics. The present study was undertaken to find the causative organisms and their pattern of antibiotic susceptibility. **Objective:** The objective was to isolate and identify various microorganisms and study the antibiotic sensitivity patterns in primary and secondary pyodermas. **Methods:** 100 consecutive clinically diagnosed and untreated cases of primary and secondary pyoderma were studied over a period of 1 year. All clinically diagnosed cases of pyoderma with positive pus culture report, irrespective of age and sex were included. Cases with history of using topical or systemic antibiotic in the past 2 weeks were excluded. Primary inoculation of the swab was done on MacConkey Agar Plate (M.A), Nutrient Agar Plate (N.A) and Blood Agar Plate (B.A). These samples were incubated aerobically at 37 degree C for 24 hours. Plates showing no growth during the first next 24 hours were further incubated for 24 hours. Various subcultures and standard biochemical tests were performed for identification of organisms. Sensitivity of the organisms to antibiotics was tested on Muller Hinton agar by Kirby- Bauer disc diffusion method. For analysis of data, Chi-Square test was applied. **Results:** Higher incidence of primary pyodermas were seen in all age groups compared to secondary pyodermas. Lower extremities were involved frequently. In 93 (93%) patients gram-positive organisms, while in 6(6%) patients gram-negative organisms were isolated. Staph. aureus was isolated from 84 (84%) samples followed by coagulase negative staphylococcus (5, 5%) E.coli (4;4%), Strept. Haemolyticus (2; 2%), strept. Non-haemolyticus (3; 3%), pseudomonas (1;1%) enterobacter (1;1%). Conclusion: This study yielded some useful epidemiological andclinico-bacterilogical data that might assist clinicians to choose suitable antibiotics for pyodermas, especially in absence of culture and sensitivity report.

**Keywords:** pyoderma

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## INTRODUCTION

Pyoderma is defined as the cutaneous bacterial infection that is characterized by polymorphonuclear response from infected host. Primary pyoderma have a characteristic morphology amd caused, by a single organism, and arise on normal skin. In India, skin infections constitute a large percentage of skin diseases among which pyodermas take a very prominent place. Various studies[1,2] in India from1962-2003 showed the incidence of pyoderma from 7.37% to 10.74% of total skin diseases. Factors like poverty, malnutrition, overcrowding and poor hygiene have been stated to be responsible for its higher incidence. Climatic conditions play an important role with hot and humid seasons being the period of maximum occurrence. These factors prevail in congested industrial cities and slum areas. The skin is sterile at birth for only a

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short period of time thereafter, staphylococcus aureus colonization of the infants on the very first day of life. The organisms that characteristically survive and multiply in various ecologic niches of skin constitute the normal cutaneous flora. Resident flora: Organisms which are found more or less regularly in appreciable number on the skin of most normal individuals, form stable community on the skin and are not easily dislodged. Transient flora: Organisms do not maintain themselves indefinitely on the normal skin. They can be easily removed by scrubbing and disinfectants. Almost any organism may survive temporarily on the cutaneous surface under appropriate conditions. Normal flora defends skin against bacterial infection through bacterial interference. Primary pyoderma includes impetigo, ecthyma, folliculitis, furunculosis, carbuncle, sycosis and cellulitis. Secondary pyoderma includes infection of eczema, infestations, and ulcers etc. If treatment of pyoderma has to be started before the antibiotic sensitivity test result is available, then one should have up to date knowledge about the strains of causative organisms prevalent in the local community, their sensitivity and resistance pattern to various antibiotics. Hence, importance to identify various microorganisms causing pyoderma and their antibiotic susceptibility to various antibiotics needs no emphasis. Streptococci and staphylococci are the most common organisms causing primary and secondary pyoderma. On rare occasions other organisms like Pseudomonas, E. coli and Proteus may be isolated from chronic pyoderma lesions. Universal indiscriminate use of antibiotics is well known and enabled the emergence of increased resistance to antibiotics in clinical practice. Many reports in India have highlighted the emergence of methicillin-resistant staphylococcus aureus (MRSA) in the community as well as in community-acquiredpyodermas[3,4]. In various studies, it has been observed that there is a significant change in the pattern of organisms causing pyodermas and their antibiotic sensitivities. Many cases do not respond to the antibiotics which were previously very effective for such cases. Perhaps indiscriminate use of topical and systemic antibiotics has contributed largely to this situation. On observing an increasing rate of treatment failures, the present study was undertaken to find out the causative organisms and their latest pattern of antibiotic susceptibility.

## AIMS AND OBJECTIVES

1. To identify and isolate different microorganisms and study these antibiotic sensitivity patterns in primary and secondary pyodermas.
2. To compare the present study with similar studies done by other workers in the past.

## MATERIALS AND METHODS

A prospective non-randomized study on pyodermas was conducted in the Department of Dermatology at Tertiary Care Hospital at Jaipur. Laboratory procedures were carried out in Central laboratory of the hospital.100 consecutive clinically diagnosed and untreated cases of primary and secondary pyoderma were studied over a period of one year.

### Inclusion Criteria

All clinically diagnosed cases of pyoderma with positive pus culture report, irrespective of age and sex.

### Exclusion Criteria

1. History of using topical or systemic antibiotic in the past 2 weeks.
2. All clinically diagnosed cases of pyoderma with sterile culture report. Relevant details regarding the chief complaints, duration, progression of lesions, past history, family history and associated conditions (Diabetes mellitus, HIV infection, etc.) were noted. A complete dermatological examination followed by general physical and systemic examination was done. All these findings were recorded in the proforma.

### Sample and culture sensitivity testing

Samples were collected before the antibiotic therapy. Primary inoculation of the swab was done MacConkey Agar Plate (M.A), Nutrient Agar Plate (N.A) and Blood Agar Plate (B.A). After inoculation, these samples were incubated aerobically at 37 degree C for 24 hours. Plates showing no growth during the first 24 hours were further incubated for next 24 hours. Various subcultures and standard biochemical tests were performed for identification of organisms. Sensitivity of the organisms to antibiotics was tested on Muller Hinton agar by Kirby-Bauer disc diffusion method.

### Stastical Analysis

For analysis of data, the software 'EPI-INFO' Version 6 was used, and Chi-Square test was applied. The results were considered significant at p- value$< 0.05$.

## OBSERVATION AND RESULTS

The study was conducted on 100 consecutive new cases of pyoderma. 72% were males and 28% females. The youngest patient was a 3 month old male child, and the eldest was 72 year old female. The average age was 24.67 years. Rural patients (54) outnumbered the urban patients (46). Most of the patients (74%) maintained good hygiene, and the others (26%) had poor hygiene. Maximum (78%) patients were averagely nourished, followed by well nourished (15%) and poorly nourished patients (7%). Majority (60%) of patients were school-educated, followed college-educated (21%), then by illiterate patients (13%), and preschool children (6%).

**Table 1**

| Entity | Age group in years | | | | | | Total | |
|---|---|---|---|---|---|---|---|---|
| | Up to 10 | >10-20 | >20-30 | >30-40 | >40-50 | >50 | No | % |
| **Primary pyoderma** | | | | | | | | |
| Folliculitis | 2 | 11 | 12 | 2 | 2 | 1 | 30 | 30 |
| Furuncle | 0 | 8 | 7 | 4 | 1 | 0 | 20 | 20 |
| Impetigo | 5 | 0 | 0 | 0 | 0 | 0 | 5 | 5 |
| Abscess | 1 | 1 | 1 | 0 | 0 | 0 | 3 | 3 |
| Ecthyma | 0 | 3 | 0 | 0 | 1 | 0 | 4 | 4 |
| Cellulitis | 0 | 0 | 1 | 1 | 2 | 1 | 5 | 5 |
| Acute paronychia | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 1 |
| Carbuncle | 0 | 1 | 1 | 0 | 0 | 1 | 3 | 3 |
| **Subtotal** | **8** | **25** | **22** | **7** | **6** | **3** | **71** | **71** |
| **Secondary pyoderma** | | | | | | | | |
| IED | 1 | 0 | 1 | 0 | 1 | 3 | 6 | 6 |
| Infected scabies | 2 | 2 | 2 | 0 | 0 | 0 | 6 | 6 |
| Periporitis | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 1 |
| Infected dematophytosis | 2 | 0 | 1 | 0 | 0 | 0 | 3 | 3 |
| Infected ulcer | 0 | 0 | 2 | 3 | 0 | 1 | 6 | 6 |
| Miscellaneous secondary pyoderma | 0 | 3 | 3 | 1 | 0 | 0 | 7 | 7 |
| **Subtotal** | **5** | **5** | **10** | **4** | **1** | **4** | **29** | **29** |
| **Total** | **13** | **30** | **32** | **11** | **7** | **7** | **100** | **100** |

IED= infectious eczematoid dermatitis

Higher number of cases of primary pyodermas were seen in all age groups compared to secondary pyodermas, and this difference was statistically significant (p value< 0.05). Among primary pyodermas, folliculitis (30%) was the commonest entity, followed by furuncle (20%), impetigo and cellulitis (5%) each. Infectious eczematoid dermatitis, infected scabies and infected ulcers (6% each) were the most common entities among secondary pyodermas. Folliculitis was found to be more common in 3rd and 4th decades. Furunculosis was seen with least frequency in the 1st decade. Impetigo occurred more commonly in 1st decade; as did infected scabies. Males outnumbered the females in both primary and secondary pyodermas; the male to female ratio being 2.57:1. Lower extremities were involved most frequently, followed by upper extremities, trunk and face. Groin and genitalia were least commonly involved, followed by head and neck. The time to seek treatment was up to 7 days and 8-15 days in 33% and 29% cases respectively. Most (62%) of the patients sought treatment within a span of 15 days. Those who reported at or after 1 month were mostly the cases of secondary pyoderma. History of recurrence was present in 24% cases i. e. in IED (33.33%), furuncle (25%), folliculitis (46.66%), and ulcer (16.66%). It was found to be statistically significant ($p < 0.01$). Out of 100 cases, 21 patients had diabetes mellitus and history of recurrence was present in 75% and 100% cases of folliculitis and furunculosis respectively in these cases.

**Table 2:** Bacterial isolates from cases of pyoderma(n=100)

| Gram status | Organism | Primary pyoderma samples | | Secondary pyoderma samples | | Total samples | |
|---|---|---|---|---|---|---|---|
| | | No. | % | No. | % | No. | % |
| Gram positive | Staph.aureus | 62 | 62 | 22 | 22 | 84 | 84 |
| | Coagulase negative staph. | 3 | 3 | 2 | 2 | 5 | 5 |
| | Strept.haemolyticus | 2 | 2 | 0 | 0 | 2 | 2 |
| | Strept.non-haemolyticus | 1 | 1 | 2 | 2 | 3 | 3 |
| | **Subtotal** | **68** | **68** | **26** | **26** | **94** | **94** |
| Gram negative | E coli | 3 | 3 | 1 | 1 | 4 | 4 |
| | Pseudomonas | 0 | 0 | 1 | 1 | 1 | 1 |
| | Enterobacter | 0 | 0 | 1 | 1 | 1 | 1 |
| | **Subtotal** | **3** | **3** | **3** | **3** | **6** | **6** |
| | **Total samples** | **71** | **71** | **29** | **29** | **100** | **100** |

A total of 100 samples (71 primary pyoderma; 29 secondary pyoderma) were subjected to culture and sensitivity pattern study. In 94 (94%) patients gram-positive organisms, while in 6 (6%) patients gram-negative organisms were isolated. Staph.aureus was isolated from 84 (84%) samples followed by coagulase negative staphylococcus 5 (5%), E.coli 4(4%), Strept. Haemolyticus 2 (2%), Strept. Non-haemolyticus 3(3%),

pseudomonas 1(1%) enterobacter 1(1%). In both primary and secondary pyoderma groups, gram-positive organisms (94/100), mainly Staph.aureus were isolated. Gram-negative organisms, although less frequently grown (6/100) as compared to gram-positive organisms, but were equally found in primary and secondary pyoderma groups (3 each). Antimicrobial susceptibility testing was carried out on all isolates. Sensitivity pattern of 5 most common organisms i. e. Staph. aureus, Strept.haemolyticus, Strept. Non-haemolyticus, coagulase negative staphylococcus and E. coli is shown in table-3

**Table 3:** Antibiotic susceptibility pattern (in percent)

| Antibiotic tested | Staph. Aureus | SH | SNH | CNS | E. coli |
|---|---|---|---|---|---|
| Ampicillin | 35.71 | 0 | 0 | 0 | 0 |
| Amikacin | 91.83 | NT | 33.33 | 100 | 33.33 |
| Cotrimoxazole | 58 | 0 | 0 | 60 | 50 |
| Ciprofloxacin | 66.12 | 100 | 0 | 50 | 33.33 |
| Augmentin | 51.35 | 0 | 66.66 | 50 | 0 |
| Vancomycin | 91.66 | 0 | 0 | 0 | NT |
| Cefotaxime | 90.62 | NT | NT | 0 | 0 |
| Cefuroxime | 84.61 | 100 | 0 | 66.66 | 100 |
| Ceftriaxone | 100 | NT | NT | NT | 0 |
| Doxycycline | 94 | 50 | 0 | 66.66 | 33.33 |
| Tetracycline | 83.33 | 100 | 0 | NT | NT |
| Ofloxacin | 73.33 | 0 | 100 | NT | NT |
| Ampicillin + Subactum | 56 | 0 | 0 | 33.33 | 50 |
| Piperacillin | 72.72 | NT | NT | 0 | 0 |
| Amoxicillin | 33.33 | 0 | 66.66 | 25 | 0 |
| Azithromycin | 52.63 | 100 | NT | NT | 100 |
| Cefoxitin | 90 | NT | NT | 0 | NT |
| Linezolid | 96.77 | 100 | NT | 100 | NT |
| Gentamycin | 87.50 | NT | NT | 66.66 | 100 |
| Amoxycillin + Subactum | 86.84 | 0 | 0 | 100 | 100 |
| Levofloxacin | 95.65 | 0 | 100 | NT | 100 |
| Tobramycin | 71.42 | 100 | NT | 100 | NT |
| Ticarcillin+Clavulanate | 100 | NT | NT | 0 | NT |
| Chloramphenicol | 75 | 100 | NT | NT | 100 |
| Nitrofurantoin | 0 | NT | NT | NT | NT |
| Cefpodoxime | 100 | NT | NT | NT | 0 |
| Ceftazidime | 0 | NT | NT | NT | 0 |

NT= not tested; SH= Streptococcus haemolyticus ; SNH=Streptococcus non-haemolyticus ; CNS= Coagulase Negative Staphylococcus.

Staph. Aureus was most susceptible to cefpodoxime (100%), ceftriaxone (100%), ticarcillin+ clavulanate (100%) followed by linezolid (96.77%), levofloxacin (95.65%), doxycycline (94%), vancomycin (91.66%), amikacin (91.83%), cefoxitim (90%), cefotaxime (90.62%), cefoxitin (90%), gentamycin (87.50%), amoxicillin+ sulbactum (86.84%), cefuroxime (84.61%), tetracycline (83.33%). Least susceptibility was noted to nitrofurantoin (0%), amoxicillin (33.33%), ampicillin (35.71%), augmentin (51.35%). Strept. Haemolyticus was most susceptible (100%) to ciprofloxacin, cefuroxime, tetracycline, azithromycin, tobramycin and chloramphenicol. Susceptibility to doxycycline was found to be low (50%). Strept.non haemolyticus was found to be most susceptible to ofloxacin and levofloxacin (100%) followed by augmentin and amoxicillin (66.66%) and amikacin (33.33%). Coagulase negative staphylococcus was most susceptible to amikacin, linezolid, amoxicillin+sulbactum, tobramycin (100%), followed by cefuroxime, doxycycline and gentamycin (66.66%), cotrimoxazole (60%), ciprofloxacin and augmentin (50%), ampicillin+sulbactum (33.33%), amoxicillin (25%). E coli was most susceptible to cefuroxime, levofloxacin, azithromycin, gentamycin, amoxicillin+sulbactum and chloramphenicol, followed by cotrimoxazole, ampicillin+sulbactum (50%), amikacin, ciprofloxacin and doxycycline (33.33%).

## DISCUSSION

Infective conditions, especially bacterial skin infections, constitute a large number of cases seen in dermatological practice. Knowledge of the causative pathogens of pyodermas facilitates the planning and provision of health care needs. Because of the high prevalence of pyoderma,

changing pattern of causative microorganisms and altered antibiotic susceptibility pattern, there is a constant need to obtain more information about aetiological agents, predisposing factors, modes of transmission and effective methods to control The index study was undertaken to find out the antibiotic sensitivity pattern among 100 consecutive untreated patients of pyoderma attending the dermatology OPD at a tertiary care center in jaipur. The highest number of cases were in 3rd (32.32%) and 2nd (30.30%) decades of life, followed by (14.14%) 1st decade. A study by Ghadage5also revealed highest number of pyoderma cases in 2nd and 3rd decades (62.36%) as compared to 1st decade (37.64%). Similar high frequency of pyodermas in 2nd and 3rddecades has been observed in many other studies[6,7] although Bhaskaran *ET AL*5 and Khare *ET AL*6 reported maximum cases of pyoderma in age group of 21- 30 years. High incidence of pyoderma in first 3 decades may be consequent to more active life in their study. Our study showed a distinct male predominance, in all age- group the male-female ratio being 2.5:1; though the male-female ratio of general population of Jaipur district in census-2008 is almost equal (0.90:1). Male preponderance has also been observed in many other studies[9,10,11,5,12,13,14,15,3,16,17]. However, in one study18 female preponderance has also been reported. The disproportionately high number of males in our study as well as other studies could be because of greater involvement of males in outdoor activities, thus exposing them to trauma and infection. The largest group was of school-educated patients (60; 60%), followed by 21 (21%) college educated and illiterates (13; 13%). This points towards the inverse relationship between level of education and occurrence of pyoderma. Out of 100 patients, 33% patients were employed, followed by students 25%, housewives 14%, preschool/other children not yet enrolled in school 6.6%, farmers 13%, labourers 5.5% and pensioners 3.3%. Combined together, preschool/other children not yet enrolled in school and students formed the largest group. These findings are partially supported by Belcher *ET AL*19, who reported highest rate of pyoderma in school-age children, particularly 5-9 year old. This could be due to the fact that they injure themselves frequently during play and thus are more prone to bacterial contamination of wounds. Employed patients were next in order, which may be consequent to their active-life style and more exposure to the external environmental factors. Of 100 pyoderma patients, 74 (74%) maintained good hygiene. Even among the 24 cases gave history of recurrence, 19 (79.16%) maintained good hygiene. Most[9,11,5,12,20,21,16] of the previous studies have not commented upon the relationship between hygiene and prevalence of pyoderma. However, Masawe *et al*[22], in a study, concluded that the socioeconomic and hygienic standards do not appreciably influence the prevalence of pyoderma. Some other studies[23,24] have, however, reported high prevalence of pyoderma in people with poor standards of hygiene. Status of nourishment didn't reveal significant relationship with bacterial skin infections, as 78 (78%) patients were average-nourished, followed by well-nourished patients15 (15%). Only 7 (7%) patients were poorly nourished. In our study, primary pyodermas 71(71%) outnumbered the secondary pyodermas 29(29%). These findings are consistent with various other studies[9,25,5,3,26,19,27]. Most studies[9,25,5,13,14,28,26,17] recorded impetigo as the most commonly occurring primary pyoderma. In the index study, folliculitis 30(30%) was the commonest entity among primary pyodermas, followed by furuncle 20 (20%), impetigo 5 (5%) and cellulitis 5 (5%). A similar study3 carried out on pyoderma, in the past, reported folliculitis (36.5%) as the commonest primary pyoderma, followed by furuncle (31.8%), cellulitis (5%) and impetigo (4.5%). Among secondary pyodermas, infectious eczematoid-dermatits (IED)(6;6%), infected scabies and infected ulcer 6 (6%) each were common entities in our study. IED was the commonest secondary pyoderma in some other studies[10,12,26,21] also. Several studies[11,13,29,19,24] have reported infected scabies as the most common presentation. Impetigo was predominantly seen in children. All 5 cases of impetigo, presented in 1st decade. Many other studies have also reported impetigo, as most common pyoderma during childhood18,19,24. In the index study, lower extremities were the most frequently involved sites, followed by upper extremities. Genital region was least commonly affected, followed by head and neck, trunk and face. Predilection for lower limbs has been reported in many other studies[14,30,31,22,32]. Contrary to our study, Nagmoti *et al*[33] reported face, scalp and upper limbs as the commonly involved sites. History of recurrence was revealed by 24% patients. A recurrence rate of 45% was reported by Mathew *et al*. Recurrence was the highest among patients of folliculitis, followed by IED, furuncle, ecthyma and infected ulcer, in that order. Twenty one patients in our study had diabetes mellitus, in whom furunculosis (n=5) was the most frequent pyoderma, followed by folliculitis (n=4). A total of 100 samples (71-primary pyoderma; 29-secondary pyoderma) were sent for culture and sensitivity. Single organism was isolated in all samples. Gram positive organisms were cultured from 94 (94%) patients, while from 6 (6%) patients gram negative organisms were isolated. Most of the studies[2,5,3,24,34,6,36,14,25,32,11] also documented gram positive organisms to be the commonest isolates from pyoderma. Staph. aureus was isolated from 84 (84%)

samples followed by E. Coli (4;4%), Stept. Haemolyticus (2; 2%), coagulase negative staphylococcus (5; 5%) and Strept. Non haemolyticus (3;3%). Alike our study, Staph.aureus was the commonest isolate in other studies[9,10,25,12,20,13,14,33,22,26,19,17]. Among gram-negative organisms, E. coli was isolated most frequently, followed by Klebsiella and Enterobacteriae. Most of the cases of impetigo (5/5), furunculosis (17/20) and folliculitis (27/30) were caused by Staph.aureus, and this is in accordance with several other studies[10,25,5,12,13]. Staph. Aureus was found to be most susceptible to cefopodoxime (100%), ceftriaxone (100%), ticaricillin+ clavulanate(100%) followed by linezolid (96.77%), levofloxacin (95.65%), doxycycline (94%), vancomycin (91.66%), amikacin (91.83%), cefoxitim (90%), cefotaxime (90.62%), cefoxitin (90%), gentamycin (87.50%), amoxicillin+sulbactum (86.84%), cefuroxime (84.61%), tetracycline (83.33%). Least susceptibility was noted to nitrofurantoin (0%), amoxicillin (33.33%),ampicillin(35.71%), augmentin(51.35%). Many other studies[9,10,25,12,19] have reported that Staph. aureus to behighly susceptible to aminoglycosides, around 90% sensitivity particularly to gentamicin along with fluroquinolones as in several studies[21,16] done in the past. Linezolid, considered as the drug of choice for Staph. aureus, also doesn't seem to have escaped the resistance to this bacterium (96.77%susceptibility). Strept. haemolyticus and coagulase negative Staphylococcus were most susceptible (100%) to linezolid and amoxicillin+sulbactum. E. coli was most susceptible (100%) to levofloxacin, cefuroxime, azithromycin, gentamycin, amoxicillin+sulbactum and chloramphenicol, followed by cotrimoxazole, ampicillin+sulbactum (50%), amikacin, ciprofloxacin and doxycycline (33.33%); though sample size was very small(n=4).

## CONCLUSION

The index study on pyoderma cases, highlighted the following findings-

1. The highest number of cases (32%) was observed in 3rd decade. Lower extremities were the commonest site of predilection.
2. Primary pyodermas outnumbered the secondary pyodermas, folliculitis (30%) and furuncle (20%) were the commonest entities.
3. Staph.aureus was the commonest causative agent in both primary (61/70) and secondary pyodermas (23/30).
4. Staph. aureus showed high susceptibility to cefopodoxime, ceftriaxone, ticarcillin+clavulanate. Low susceptibility was observed to amoxicillin, ampicillin and augmentin. Strept. Haemolyticus was highly susceptible to ciprofloxacin, cefuroxime, tetracycline, azithromycin, tobramycin and chloramphenicol.
5. E. coli showed high susceptibility to levofloxacin, amikacin, linezolid, amoxicillin+sulbactum and tobramycin.

In conclusion, this study yielded some useful epidemiological and clinic-bacterilogical data about pyodermas that might assist clinicians to choose suitable antimicrobials for pyodermas, especially in absence of culture and sensitivity report. The changing trend of causative agents of pyodermas and their susceptibility pattern needs constant monitoring through prospective studies in future also.

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