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Original Research Article

# Comparison of Bacteriological Profile and Antibiotic Sensitivity Patterns of Aerobic Organisms Isolated from Pus Samples

**Nazia Anwar[1], Poonam Kumari[2], Kumari Milan[3]**

[1]Tutor, Department of Microbiology, Sri Krishna Medical College and Hospital, Muzaffarpur, Bihar.
[2]Associate Professor and HOD, Department of Microbiology, Sri Krishna Medical College and Hospital, Muzaffarpur, Bihar.
[3]Associate Professor, Department of Microbiology, Sri Krishna Medical College and Hospital, Muzaffarpur, Bihar.

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**Corresponding author: Dr. Nazia Anwar**
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**Abstract**

**Background**: Inflammation and pus formation can result from the appearance of pyogenic bacteria during or after trauma, burn injuries, and surgical procedures. Wound infections result in significant morbidity, extended hospital stays, and a significant financial burden. The study's goals are to identify the aerobic bacteria that cause wound infections and to ascertain the isolated organisms' pattern of antibiotic susceptibility.

**Methods:** At SKMCH in Muzaffarpur, Bihar, a retrospective analysis was carried out between February and July of 2025. Samples of pus were obtained and treated in an aseptic manner. The Kirby Blair disk diffusion method was used to identify and determine the antibiotic susceptibility pattern in accordance with conventional protocols.

**Results:** Out of 536 pus samples, 115 samples showed bacterial growth. Most of the bacterial growth were isolated from 21-40 years of age with 41 (36%). Among 115 bacterial isolates, 62(54%) were Gram-positive cocci and 53 (46%) were gram-negative bacilli. Among gram-positive cocci, the highest isolated organism is Staphylococcus aureus with 26 (42%). In gram-negative bacilli, the most common organism isolated is Enterobacter spp. 13 (24.5%) followed by Pseudomonas spp. with 11 (20.8%). 96% of the Staphylococcus aureus were sensitive to Linezolid and the least sensitivity was observed with Levofloxacin with 17.3%.

**Conclusion:** The pyogenic wound infections were discovered to be common in the tertiary care hospital with staphylococcus aureus isolated and exhibiting the highest occurrence followed by Enterobacter and Pseudomonas spp. When putting empirical treatment options for pyogenic infections into practice, the susceptibility statistics from this article might be worth taking into account.

**Keywords:** Pus; Staphylococcus aureus; Enterobacter; Pseudomonas.

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## Introduction

Pyogenic bacteria can cause inflammation and pus buildup after or after burns, trauma, and surgical treatments [1,2]. The body's immune system sends defense cells to the site of infection to fight microorganisms. Pus is produced when these cells build up, resulting in pyogenic infection, which actually slows down the healing of wounds and may have consequences like wound disintegration [3]. Both aerobic and anaerobic microbes have been linked to wound infections, which are common in hospital settings and cause severe morbidity, extended hospital stays, and a substantial financial burden [4]. Globally, the fast spread of antibiotic resistance among pathogenic bacterial isolates poses a severe threat to public health. Multidrug-resistant Gram-negative bacterial strains, including Acinetobacter baumannii, E. coli, Klebsiella pneumoniae, Pseudomonas aeruginosa, and Gram-positive organisms such as, Methicillin-resistant Staphylococcus aureus (MRSA), have become more frequently linked to hospital-acquired pus infections in recent decades as a result of widespread antibiotic mis-prescriptions and inadequate dosage regimens [5, 6, 7]. Because of the absence of effective therapies and the sluggish development of new antibiotic classes, the fast proliferation of multidrug-resistant bacteria poses a huge threat to public health globally [7, 8]. Clinicians who treat patients with surgical site infections and skin and soft tissue infections must determine whether an infection is present, evaluate its severity, identify the causative microorganism,

prescribe the appropriate antibiotics, and select surgical treatments for purulent and necrotizing infections [3, 9]. The current study goals are to identify the aerobic bacteria that cause wound infections and to ascertain the isolated organisms' pattern of antibiotic susceptibility.

## Material and Methods

A six-month retrospective study was carried out at Sri Krishna Medical College and Hospital in Muzaffarpur, Bihar, between February 2025 and July 2025. A consistent collection method was used to gather test results and demographic information from microbiological laboratory registration books. Two sterile swabs were used to aseptically collect pus samples, which were then stored in a test tube. One swab is used for gram staining, while the other is inoculated into nutritional agar, blood agar, MacConkey agar, and chocolate agar. For a whole day, the plates were incubated at 370°C. The Kirby Blair disk diffusion method was used to identify and determine the antibiotic susceptibility pattern in accordance with conventional protocols.

All known pathogenic gram-positive and gram-negative bacteria isolated from pus samples were included in the study. Commensals or contaminant bacteria isolated from pus samples were excluded from the study.

MS Excel version 22.0 was used for the analysis.

## Results

115 of the 536 pus samples that were taken from various hospital wards had bacterial growth. Males had more positive cultures (94, 82%), followed by females (21, 18%) (Table 1). 41 (36%) of the bacterial growths were recovered from people between the ages of 41 and 60. Table 2 shows the other age groups and their positive culture percentages.

**Table1: Positive cultures sex ratio**

| Sex | No. of Positive cultures | Percentage |
|---|---|---|
| Males | 94 | 82% |
| Females | 21 | 18% |

**Table 2: Age-wise culture positivity**

| Age | No. of Positive cultures | Percentage |
|---|---|---|
| ≤20 years | 19 | 16% |
| 21 to ≤40 years | 34(30%) | 30% |
| 41 to ≤60 years | 41(36%) | 36% |
| >60 years | 21(18%) | 18% |

Among 115 bacterial isolates, 62 (54%) were gram-positive cocci and 53 (46%) were gram-negative bacilli. Among gram-positive cocci, the highest isolated organism is staphylococcus aureus with 26 (42%) followed by Coagulase-negative staphylococci with 23 (37%), and Enterococci spp. with 8 (12.9%) and streptococci sp. with 5 (8.1%) (Table 3).

**Table 3: Gram-positive cocci isolated**

| Organism | No. of Gram Positive Cocci (n=62) | Percentage |
|---|---|---|
| Staphylococcus aureus | 26 | 42% |
| Cons | 23 | 37% |
| Enterococci sp. | 8 | 12.9% |
| Streptococci sp. | 5 | 8.1% |

In gram-negative bacilli, the most common organism isolated is Enterobacter spp. 13 (24.5%) followed by Pseudomonas spp. with 11(20.8%), Klebsiella spp 9(17%), Escherichia coli 6 (11.3%), Acinetobacter spp. and Serratia spp. with 5 (9.4%) and the least is Proteus spp. 4 (7.6%) (Table 4). The antimicrobial-sensitive pattern of Staphylococcus aureus is listed in (Table 5). 96% of the organisms were sensitive to Linezolid and the least sensitivity was observed with Levofloxacin at 17.3%.

**Table 4: Gram-negative bacilli isolated**

| Organism | No. of Gram Negative Bacilli | Percentage |
|---|---|---|
| Enterobacter sp. | 13(24.5%) | 24.5% |
| Pseudomonas sp. | 11(20.8%) | 20.8% |
| Klebsiella sp. | 9(17%) | 17% |
| Escherichia coli | 6(11.3%) | 11.3% |
| Acinetobacter sp. | 5(9.4%) | 9.4% |
| Serratia sp. | 5(9.4%) | 9.4% |
| Proteus sp. | 4(7.6%) | 7.6% |

**Table 5: Antimicrobial sensitivity pattern of Staphylococcus aureus and Cons**

| **GPC Antibiogram** | **Staphylococcus aureus (26)** | **Cons (23)** |
|---|---|---|
| Antibiotic | % Sensitivity | % Sensitivity |
| Linezolid | 96 | 98 |
| Teicoplanin | 91.3 | 95 |
| Vancomycin | 91.3 | 93 |
| Tigecycline | 91.3 | 91 |
| Daptomycin | 91.3 | 87 |
| Rifampicin | 86.9 | 88 |
| Tetracycline | 82.6 | 95 |
| Clindamycin | 78 | 89 |
| Trimethoprim/Sulphamethoxazole | 73.9 | 81 |
| Cefoxitin | 69.5 | 89 |
| Erythromycin | 65.2 | 91 |
| Gentamycin | 65.2 | 79 |
| Ciprofloxacin | 21.7 | 54 |
| Levofloxacin | 17.3 | 52 |

The sensitivity pattern of Enterobacteriaceae and non-fermenting isolates are listed in Table 6 and 7 respectively.

**Table 6: Antibiogram of Enterobacteriaceae isolates**

| **Enterobacteriaceae Antibiogram** | **E. coli (6)** | **Klebsiella sp. (9)** | **Enterobacter sp. (13)** | **Proteus sp. (4)** |
|---|---|---|---|---|
| **Antibiotic** | **% Sensitivity** | **% Sensitivity** | **% Sensitivity** | **% Sensitivity** |
| Ceftriaxone | 33.3 | 44.4 | 84.6 | 100 |
| Ertapenem | 83.3 | 88.8 | 84.6 | 100 |
| Imipenem | 83.3 | 44.4 | 76.9 | 50 |
| Meropenem | 83.3 | 66.7 | 76.9 | 100 |
| Piperacillin-Tazobactam | 66.6 | 44.4 | 69.2 | 100 |
| Ciprofloxacin | 66.6 | 33.3 | 76.9 | 100 |
| Gentamicin | 66.6 | 55.5 | 76.9 | 100 |
| Amikacin | 66.6 | 66.7 | 100 | 100 |
| Cefepime | 66.6 | 33.3 | 76.9 | 100 |
| Trimethoprim/ Sulphamethoxazole | 83.3 | 55.5 | 76.9 | 75 |
| Colistin | 66.6 | 100 | 100 | 25 |
| Amoxy-clavulanate | 50 | 44.4 | 61.5 | 75 |
| Levofloxacin | 66.6 | 77.7 | 92.3 | 100 |
| Tigecycline | 83.3 | 100 | 100 | 25 |

**Table 7: Antibiogram of Non-fermenters**

| **NonfermentersAntibiogram** | **Pseudomonas sp.(11)** | **Acinetobacter sp.(5)** | **Serratia sp.(5)** |
|---|---|---|---|
| **Antibiotic** | **% Sensitivity** | **% Sensitivity** | **% Sensitivity** |
| Trimethoprim/Sulphamethoxazole | 27.2 | 60 | 60 |
| Colistin | 90.9 | 100 | 100 |
| Ceftazidime | 81.8 | 60 | 40 |
| Gentamicin | - | 60 | 40 |
| Piperacillin-Tazobactam | 63.6 | 40 | 100 |
| Levofloxacin | 81.8 | 60 | 40 |
| Minocycline | 45.4 | 100 | 100 |
| Cefepime | 90.9 | 80 | 80 |
| Ceftriaxone | - | - | 80 |
| Aztreonam | - | 60 | - |
| Cefoperazone-Salbactum | 90.9 | 40 | 80 |
| Amikacin | 90.9 | 60 | 40 |
| Ciprofloxacin | 63.6 | - | 40 |
| Tigecycline | - | - | 80 |
| Doripenem | - | - | - |
| Imipenem | 54.5 | 20 | 60 |
| Meropenem | 81.8 | 20 | 60 |

## Discussion

A total of 115 (21.4%) bacterial pathogens were identified from pus cultures. However, it was lesser when compared with other studies in India with 58.28% and 84.4%. This could have been caused by poorly maintained hygiene and lack of awareness of the patient's medical care are the main contributing causes to infections linked to health care [10, 11]. Kursheed et al., did a similar study and quoted 49.5% [12].

Among 115 isolates, 21 (18.3%) showed poly-microbial growth and the rest 94 (81.7%) showed pure growth which was in accordance with the study of Manmeet Kaur Gill et al., with 21.5% [13]. Most of the samples in our study belong to 41-60 years with 41 (36%). The result is similar to those of the study by Biradar et al., with 38.28%. This may be due to immunological status, lifestyle diseases and delayed wound care [14]. Males 94 (82%) had a higher infection rate than females 21 (18%) in our study which was similar to previous studies from India by Manmeet et al., [13].

Among the isolates the most predominant organisms isolated were gram-positive cocci with 62 (54%) and gram-negative bacteria with53(46%) which is disagreed with other studies as the majority of the specimens generated were gram-negative bacteria which were superior to gram-positive organisms in accordance with Trojan et al., & Hanumanthappa [15, 16]. Among gram-positive cocci, the predominant organism is Staphylococci aureus with 42% which is similar to the study of Kumari et al., Bhumbla et al., & Roopashree et al., [17, 18, 19].

In hospitals, inanimate items, Healthcare workers and other patients can harbour Staphylococcus aureus. Furthermore, endogenous illnesses are also possible because Staphylococcus aureus is a normal part of the human body flora.

30.5% of Staphylococcus aureus were determined to be MRSA as they were showing drug resistance to Cefoxitin which was familiar to Deboral et al., [20]. Other research studies done by Mudassar et al., and Khan et al., had shown 42% & 65% of MRSA in their studies respectively. It is also essential to know that MRSA transmission can differ from place to place and from hospital to hospital. Therefore, additional research would be necessary to address the concerning MRSA situation [21, 22]. MRSA infection rates in our study are less due to effective infection control practices being followed. Staphylococcus aureus has shown the least sensitivity to Ciprofloxacin and Levofloxacin with 21.7% and 17.3% because of target mutation, higher efflux pump activity and decreased permeability and shown highly sensitive to Linezolid with 96% due to its unique mechanism of action, low existing resistance and excellent tissue penetration and Vancomycin with 91% which is similar to the study of Wadekar et al., [23].

According to antibiogram of the present study, the predominant organism among gram-negative bacteria isolated is Enterobacter spp. (24.5%) which had shown 100% sensitivity to Minocycline, Amikacin, Tigecycline, Colistin and the least sensitivity for Amoxy-clavulanate with 61.5%.E.coli has shown the highest sensitivity to Carbapenems with 83.3%and50% of resistance was shown with minocycline and Amoxy-clavulanate.

In our study, Klebsiella spp. has shown resistance to most of the drugs like Ciprofloxacin (33.3%), Imipenem (44.4%) and Cefepime (33.3%) which was in agreement with Jamatia et al., [24]. In non-fermenters highest sensitivity was with colistin and resistance to carbapenems was shown by Acinetobacter spp. Pyogenic wound infections in tertiary care hospitals are rising day by day due to multiple interventions, extensive antibiotic use and occasional infection control failures. All of these studies highlight the importance of monitoring antibiotic susceptibility changes and understanding the presence of multidrug-resistant (MDR) bacteria in pus. This study aims to contribute to the existing body of knowledge by evaluating the findings of this relevant research.

This is a retrospective study in which we could not examine significant factors such as the source of infection, the duration of hospital stays, and clinical outcomes. Additionally, the study relied solely on the characterization of bacterial isolates using conventional and automated methods.

## Conclusion

Pyogenic wound infections are prevalent in the tertiary care hospital, with Staphylococcus aureus identified as the most commonly isolated pathogen, followed by Enterobacter spp. and Pseudomonas spp. The bacterial isolates exhibited a high to moderate level of resistance to various classes of antibiotics.

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