E-ISSN:2454-9894 P-ISSN: 2454-9886
International Archives of
BioMedical and Clinical Research
(An Official Publication of "Ibn Sina Academy of Medieval Medicine & Sciences")
WWW.IABCR.ORG

Section Microbiology

Original Article

# A Study of Aerobic Bacterial Isolates and their Antibiotic Susceptibility Pattern from Pus Samples in a Tertiary Care Hospital, Rajasthan

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## ABSTRACT

***Background:*** *Aerobic bacteria are the major cause of pyogenic infections characterized by local and systemic inflammation and pus formation. Different studies show that bacterial profile of pus samples and their antimicrobial sensitivity pattern shows many variations. Emergence of antimicrobial drug resistance has made the treatment of pyogenic infections difficult. Pus culture and sensitivity testing done prior to start antibiotic therapy help in right approach towards selection of antibiotic and treatment.*

***Methods:*** *A study was conducted in Department of Microbiology of a private tertiary care hospital in Udaipur, Rajasthan from August 2017 to January 2018. Total of 240 pus samples were analyzed for aerobic culture and sensitivity. Processing and identification was done as per standard guidelines. Antibiotic sensitivity testing was performed by Kirby Baur disc diffusion method.*

***Results:*** *In our study, out of 240 pus samples sent from various departments, 160 (66.6%) were positive for bacterial growth. Commonest isolate was Staphylococcus aureus, followed by Pseudomonas species, E. coli, Klebsiella species, Enterococcus species, either alone or in mixed growth. All Staphylococcus aureus were sensitive to Vancomycin and Linezolid. For Pseudomonas species, effective drugs were piperacillin-tazobactem and polymyxin B; for enterobacteriacae, most effective drug was meropenem.*

***Conclusion****: It is of utmost importance for a clinician to send the pus sample for microbiological analysis and antibiotic sensitivity testing before starting antibiotic therapy to minimize the emergence of drug resistance.*

***Key words:*** *Aerobic bacteria, pus isolates, pus culture and sensitivity*

**DOI:10.21276/iabcr.2018.4.3.07**

**Received:** 20.03.18
**Accepted**: 02.04.18

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## INTRODUCTION

The human skin and soft tissue infections caused by microbial pathogens during or after trauma, burn injuries and surgical procedures result in production of pus, a white to yellow fluid comprised of dead WBCs, cellular debris and necrotic tissues.[1,2] Different studies show that aerobic bacteria are the major isolates causing pyogenic infections and most common pyogenic bacteria include Gram positive cocci like *Staphylococcus aureus*, *Staphylococcus epidermidis*, *Streptococcus pyogenes*, *Enterococcus* and Gram negative bacilli like, *E. Coli*, *Klebsiella pneumoniae*, *Proteus* species, and *Pseudomonas aeruginosa.*[3]

Various studies across the world have shown periodic monitoring of the bacterial profile in pyogenic infections, which is helpful for the empirical treatment of patients.[4] Even though the bacterial profile of pus samples in many studies remain the same, the antibiotic resistance pattern of these isolates has shown a large variation.[2,3]

Rapid emergence of multidrug resistant bacteria pose a serious threat to public health globally due to limited treatment options and lukewarm discovery of new class of antibiotics.

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| Website: www.iabcr.org | Quick Response code |
| DOI: 10.21276/iabcr.2018.4.3.07 | |

**How to cite this article**: Bhatnagar R, Patel P. Aerobic Bacterial Isolates and their Antibiotic Susceptibility Pattern. Int Arch BioMed Clin Res. 2018;4(3):19-21.

**Source of Support:** Nil, **Conflict of Interest:** None

Continuous surveillance of these changing trends has become a necessity. So, this study was done to identify aerobic bacterial profile from the pus samples and their antibiotic sensitivity pattern.

## METHODS

Pus samples were collected from in and outpatients of various departments of Pacific Medical College and Hospital, Udaipur from August 2017 to January 2018.

Specimens were collected with sterile swab or the pus was aspirated and collected into a sterile container with all aseptic precautions and transported to the microbiology laboratory.

The samples were processed on blood agar, chocolate agar and MacConkey agar media and incubated at 37˚C under aerobic conditions. The microorganisms were identified by Gram stain, biochemical reactions and motility testing as per standard guidelines.[5]

The antimicrobial susceptibility testing was done by Kirby Bauer disk diffusion method on Mueller-Hinton agar as per clinical laboratory standard guidelines.[6]

## RESULTS

A total of 240 pus samples were included over a period of 6 months study.

The most common age group affected by pyogenic infections in our study was 21-30 years of age and males were more prone than females as shown in Table 1 and Figure I respectively.

**Table 1. Distribution of pus samples in various age groups in present study**

| Age group | Number of samples (n=240) | Percentage |
|---|---|---|
| 0-9 | 22 | 9.16 |
| 11-20 | 30 | 12.5 |
| 21-30 | 52 | 21.66 |
| 31-40 | 41 | 17.08 |
| 41-50 | 36 | 15 |
| 51-60 | 30 | 12.5 |
| 61-70 | 18 | 7.5 |
| 71-80 | 9 | 3.75 |
| 81-90 | 2 | 0.83 |

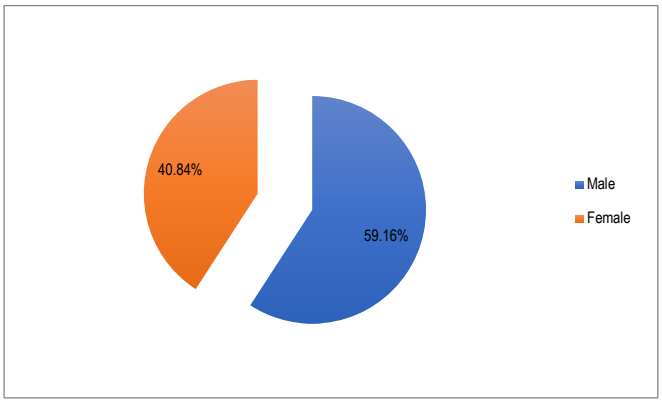


**Figure I: Gender-wise distribution of pus samples (n=160)**

Out of 240 samples, 160 (66.66%) were positive for bacterial growth.

Amongst 160 positive samples, 11 (6.87 %) showed poly-microbial growth. Gram-positive isolates (n=84) outnumbered Gram-negative isolates (n=76) as shown in Figure II.

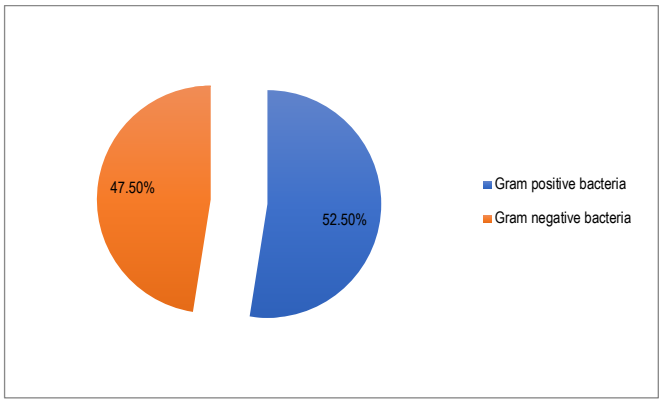


**Figure II: Percentage of Gram positive (n=84) and Gram-negative (n=76) isolates**

Out of the total isolates, the most common bacterial isolate was *Staphylococcus aureus* (40.65%), followed by *Pseudomonas* species (17.5%), *E.coli* (13.12%), *Klebsiella* species (8.75%). All the isolates are listed in the descending order of their prevalence in Table 2.

**Table 2: Prevalence of bacterial isolates in Pus culture in this study (n=160)**

| Organism isolated | Number of isolates | Percentage |
|---|---|---|
| Staphylococcus aureus | 65 | 40.65 |
| Pseudomonas species | 28 | 17.50 |
| E.coli | 21 | 13.12 |
| Klebsiella species | 14 | 8.75 |
| Coagulase negative Staphylococcus | 10 | 6.25 |
| Proteus species | 8 | 5 |
| Enterococcus species | 6 | 3.75 |
| Streptococcus pyogenes | 3 | 1.87 |
| Citrobacter | 3 | 1.87 |
| Acinetobacter species | 2 | 1.25 |

Antibiotic sensitivity pattern of *Staphylococcus aureus* showed highest sensitivity towards vancomycin (100%) and linezolid (95.65%) followed by clindamycin (84.95%), gentamycin (79.85%), Azithromycin (54.25%). Maximum antibiotic resistance was seen for penicillin (87.25%).

**Table 3: Antibiogram (%) of *Staphylococcus aureus***

| Antibiotic | Staphylococcus aureus (n=65) | |
|---|---|---|
| | Sensitive | Resistant |
| Penicillin | 12.75 | 87.25 |
| Vancomycin | 100 | 0.00 |
| Gentamycin | 79.85 | 20.15 |
| Ciprofloxacin | 51.13 | 48.87 |
| Clindamycin | 84.95 | 15.05 |
| Azithromycin | 54.25 | 45.75 |
| Cefoxitin | 85 | 15 |
| Linezolid | 95.65 | 4.35 |

Antibiotic sensitivity for *Pseudomonas* species showed highest sensitivity for polymyxin B (98.2%) followed by piperacillin (53%), ceftazidime (46%) and aztreonam

(39.8%). Maximum antibiotic resistance (100%) was observed for cotrimoxazole.

**Table: 4 Antibiogram (%) of *Pseudomonas* species (n=28)**

| Antibiotics | Sensitive | Resistant |
|---|---|---|
| Amikacin | 25 | 75 |
| Ciprofloxacin | 53 | 47 |
| Ceftazidime | 46 | 54 |
| Tobramycin | 30.5 | 69.5 |
| Cotrimoxazole | 0 | 100 |
| Piperacillin | 58 | 42 |
| Aztreonam | 39.8 | 60.2 |
| Polymyxin B | 98.2 | 1.8 |

In the isolates pertaining to Enterobacteriaceae group, highest rate of susceptibility as shown by major isolate *E. coli* was seen for meropenem (100%), followed by piperacillin-tazobactam (82.55%) and amikacin (75%). Maximum antibiotic resistance was seen for cotrimoxazole (60%).

**Table: 5 Antibiogram (%) of Enterobacteriaceae**

| Antibiotic | E. coli (n=21) | | Klebsiella species (n=14) | | Proteus species (n=8) | |
|---|---|---|---|---|---|---|
| | Sensitive | Resistant | Sensitive | Resistant | Sensitive | Resistant |
| Amikacin | 75 | 25 | 71 | 29 | 80 | 20 |
| Gentamycin | 61 | 39 | 57 | 43 | 30 | 70 |
| Ciprofloxacin | 64.82 | 35.18 | 69 | 31 | 72 | 23 |
| Ceftazidime | 53 | 47 | 49 | 51 | 51 | 49 |
| Cefepime | 55 | 45 | 59 | 41 | 82 | 18 |
| Cotrimoxazole | 40 | 60 | 48 | 52 | 35 | 65 |
| Piperacillin-Tazobactem | 82.55 | 17.45 | 85 | 15 | 87 | 13 |
| Meropenem | 100 | 0 | 98 | 2 | 100 | 0 |

## DISCUSSION

Among 240 study pus samples, bacterial pathogens were isolated from 160 patients (66.6%). This isolation rate correlates with other study done on pus culture.[3,8] The difference in isolation rates in various studies may be due to different laboratory facilities used.

The most common age group seen in pyogenic infections in our study was 21-30 years, which is similar to study done by Roopa et al[8] and male predominance in our study is comparable to the study done by Birodar et al.[3]

This could be because usually in our country young males are more involved in outdoor activities due to their occupations, making them prone to injuries and causation of wounds.[9]

Out of total 160 positive isolates, no of Gram-positive isolates was more (52.50%). *Staphylococcus aureus* is the most common bacterial isolate (n=65, 40.65%). Similar results were shown in study done by M. Chauhan et al.[4]

Antibiogram of *Staphylococcus aureus* revealed maximum susceptibility for Vancomycin (100%) and linezolid (95.65%) followed by cefoxitin, clindamycin, gentamycin, azithromycin, ciprofloxacin and least sensitivity for penicillin.

These results are in agreement with the study done by Biradar et al.[3]

2nd most common isolates were Gram-negative bacilli, *Pseudomonas* species (17.5%) and *E. coli* (13.12%). Agnihotri et al[10] and Basus et al [11] also reported the same findings.

Enterobacteriaceae showed good response towards meropenem, piperacillin-tazobactem and amikacin. And *Pseudomonas* species were sensitive to polymyxin B, piperacillin, ceftazidime. This result correlate with the study by Suguneshwari et al.[12]

The high incidence of resistance in bacterial isolates is because of irrational use of empirical antibiotics and for inadequate duration.

## CONCLUSION

Pyogenic infections are important cause of prolonged hospital stay and morbidity. Organism evolves resistance as soon as antibiotics are introduced for treatment purpose. Emergence of drug resistant strains along with non-availability of new antibiotics leads to complications in managing the infection. Our study indicates the prevalence of resistance to different class of antibiotics in bacterial isolates from pus samples and thus highlight the need for effective surveillance, regular reporting and anti-biogram guided antibiotic prescription.

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