Original Research Article

One year study of aerobic bacterial profile and antimicrobial susceptibility pattern of pus samples

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Abstract

Introduction: Pyogenic wound infection is one of the major cause of morbidity. The pace at which the bacterial isolates develop drug resistance is far exceeding the rate of discovery of newer drugs and thus highlights the need for conducting periodic studies to determine their antimicrobial susceptibility patterns.

Materials and Methods: This study was conducted from June 2015 to May 2016, in Santhiram medical college and general hospital. Pus samples submitted to Microbiology department were processed and identified using standard protocols. Antimicrobial testing of all isolates was performed by Kirby- Bauer’s disc diffusion method as per CLSI guidelines.

Results: In our study a total of 490 pus samples were received, of which 279 (56.9%) were culture positive. Gram negative bacilli (78%) outnumbered Gram positive cocci (22%). Majority of samples were from Surgical departments (94.6%). E.coli (29%) was the commonest organism isolated followed by klebsiella spp. (19.7%), Staphylococcus aureus (15.4%). All Staphylococcal isolates were susceptible to Linezolid, Teicoplanin, Vancomycin where as Gram negative bacilli were susceptible to Imipenem (96.7%), Piperacillin-tazobactum (84.7%), Gentamicin (62.2%), Cefoperazone sulbactum (57.6%). Among Pseudomonas isolates, Imepenem (97.2%), Piperacillin-tazobactum (94.3%), were effective drugs.

Conclusion: Microbiological analysis and antibiogram of pus isolates can serve as a useful tool for appropriate and judicial use of antibiotics and thus minimizing the evolution of drug resistance strains in future.

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1. Introduction

Pyogenic infections are associated with local and systemic inflammation characterised with pus formation.1 The cause of these infections may be either exogenous or endogenous. As the bacteria make their entry into the body, the immune cells accumulate at the site of entry to fight against the bacteria and eventually lead to formation of pus.2

Several studies have been conducted from time to time to access the bacterial profile and the antibiotic sensitivity pattern in pus samples, which will help the treating physician to start empirical treatment in patients until the lab culture reports are available.3

Though various studies show similarity in bacterial profile of pus samples, there is much variation in the susceptibility pattern of antibiotics which highlights the emergence of resistant bacteria and also a need for continuous surveillance of such changing trends. The present study was designed to evaluate the profile of aerobic pyogenic bacteria along with their susceptibility pattern to various antimicrobial agents.

2. Materials and Methods

In this study a total number of 490 pus samples obtained for aerobic culture and sensitivity from various inpatient and outpatient departments of Santhiram medical college and general hospital, Nandyal during the period of July 2015 to June 2016 were included. Informed consent was taken from
the patient.

Pus samples collected with sterile cotton swabs and sterile syringes were transported and processed in microbiology laboratory immediately. Received pus samples were inoculated on blood agar, mac Conkey agar, chocolate agar and nutrient agar media and incubated at 37°C for 24 to 48 hrs under aerobic conditions. Identification of the organisms from the positive cultures was done by Grams stain, motility tests, oxidase tests, biochemical reactions as per the standard operative procedures.4

The antimicrobial susceptibility testing was done by Kirby bauer’s disc diffusion method and interpretation was done as per clinical laboratory standard institution guidelines. Antibiotics like Pencillin (10 units), Amoxycillin plus clavulanic acid (20/10mcg), ciprofloxacin (5mcg), clindamycin (2mcg), erythromycin (15mcg), gentamicin (10mcg), Amikacin (30mcg), Sparfloxacin (5mcg), Netilmicin (30mcg), Ceftriaxone (30mcg), Cefazidime (30mcg), Cefotaxime (30mcg), Cefepirame and sulbactum(75/10mcg), Piperacillin and tazobactum (100/10mcg), Imipenem (10mcg), Linezolid (30mcg), Teicoplanin (30mcg), Vancomycin (30mcg) were tested (HIMEDIA INDIA). Results were analysed using MS EXCELL, 2007 version.

3. Results

A total of 490 samples were received for aerobic culture and sensitivity testing in microbiology lab. 279 (56.9%) isolates were culture positive and 211 (43.06%) were negative. Among culture positives 209 (74.9%) were from male patients and 70(25%) were from females (Figure 1). Male: female ratio is 2.99. With regard to age distribution among culture positive samples patients between 51-60 yrs contributed 29.3% (Table 1).

<table>
<thead>
<tr>
<th>Age</th>
<th>Number(%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 – 10</td>
<td>4 (1.4)</td>
</tr>
<tr>
<td>11 – 20</td>
<td>17(6.09)</td>
</tr>
<tr>
<td>21 – 30</td>
<td>28 (10.0)</td>
</tr>
<tr>
<td>31 – 40</td>
<td>38 (13.6)</td>
</tr>
<tr>
<td>41 – 50</td>
<td>75 (26.8)</td>
</tr>
<tr>
<td>51-60</td>
<td>82 (29.3)</td>
</tr>
<tr>
<td>61 – 70</td>
<td>31 (11.1)</td>
</tr>
<tr>
<td>71 – 80</td>
<td>4 (1.4)</td>
</tr>
</tbody>
</table>

Followed by orthopaedics (5.73%) and obstetrics and gynaecology (3.94%) (Figure 2).

A total of 217 (78%) were Gram negative bacilli (GNB) and 62(22%) were Gram positive cocci(GPC) among culture positives (Figure 3).

Among ward wise distribution of culture positive samples, general surgery department contributed 45.3%

![Fig. 1: Pie diagram showing gender distribution in culture positive sample](image1)

E.coli (29%) was the most common bacterial isolate among culture positives followed by klebsiella spps (19.7%), Staphylococcus aureus (15.4%) and Pseudomonas spps.(13.3%). Antibiogram of staphylococcus aureus revealed 4 (9.3%) MRSA, 39 (90.6%) MSSA both of which are 100% sensitive to vancomycin, linezolid and teicoplanin.

Among GNB’s E.coli and Proteus spps showed 100% sensitivity to imipenem where as Klebsiella spps showed 90.9% and Pseudomonas spps. showed 97.2% respectively.

4. Discussion

In our study, we found the predominance of Gram negative bacteria as the causative agents of pyogenic lesions which is supported by Zubair et al5 and Ghosh et al.6 we found that E.coli was the most common organism isolated which differs from the studies of Swati et al7 and Birader et al8 where they got Pseudomonas spps and staphylococcus aureus respectively. The above variation can be attributed to much bigger sample size in our study when compared to the mentioned studies.
Table 2: Bacterial isolates from culture positive samples (N = 279)

<table>
<thead>
<tr>
<th>Bacterial Isolate</th>
<th>Number (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Citrobacter spp</td>
<td>6 (2.2%)</td>
</tr>
<tr>
<td>Coagulase negative Staphylococcus</td>
<td>2 (0.7%)</td>
</tr>
<tr>
<td>Escherichia coli</td>
<td>81 (29%)</td>
</tr>
<tr>
<td>Enterobacter spp</td>
<td>1 (0.4%)</td>
</tr>
<tr>
<td>Enterococcus spp</td>
<td>9 (3.2%)</td>
</tr>
<tr>
<td>Klebsiella spp</td>
<td>55 (19.7%)</td>
</tr>
<tr>
<td>NFGNB</td>
<td>9 (3.2%)</td>
</tr>
<tr>
<td>Proteus mirabilis</td>
<td>21 (7.5%)</td>
</tr>
<tr>
<td>Proteus vulgaris</td>
<td>7 (2.5%)</td>
</tr>
<tr>
<td>Pseudomonas spp</td>
<td>37 (13.3%)</td>
</tr>
<tr>
<td>Staphylococcus aureus</td>
<td>43 (15.4%)</td>
</tr>
<tr>
<td>Streptococcus spp</td>
<td>8 (2.9%)</td>
</tr>
<tr>
<td>Total</td>
<td>279 (100%)</td>
</tr>
</tbody>
</table>

Table 3: Antibiotic sensitivity pattern of staphylococcus aureus (N=43)

<table>
<thead>
<tr>
<th>Drugs</th>
<th>MSSA (39) (%)</th>
<th>MRSA (4) (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Penicillin</td>
<td>2 (5.1)</td>
<td>0 (0)</td>
</tr>
<tr>
<td>Amoxyclav</td>
<td>29 (74.3)</td>
<td>0 (0)</td>
</tr>
<tr>
<td>Ciprofloxacin</td>
<td>35 (89.7)</td>
<td>0 (0)</td>
</tr>
<tr>
<td>Clindamycin</td>
<td>31 (79.4)</td>
<td>2 (50)</td>
</tr>
<tr>
<td>Erythromycin</td>
<td>26 (66.6)</td>
<td>1 (25)</td>
</tr>
<tr>
<td>Linezolid</td>
<td>39 (100)</td>
<td>4 (100)</td>
</tr>
<tr>
<td>Teicoplanin</td>
<td>39 (100)</td>
<td>4 (100)</td>
</tr>
<tr>
<td>Vancomycin</td>
<td>39 (100)</td>
<td>4 (100)</td>
</tr>
<tr>
<td>Gentamycin</td>
<td>36 (92.3)</td>
<td>1 (25)</td>
</tr>
<tr>
<td>Netilmycin</td>
<td>38 (97.4)</td>
<td>4 (100)</td>
</tr>
</tbody>
</table>

Table 4: Antibiotic sensitivity pattern of e.coli (N=81)

<table>
<thead>
<tr>
<th>Drug</th>
<th>Sensitive (%)</th>
<th>Resistant (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Amoxy-clav</td>
<td>17 (20.9)</td>
<td>64 (79.0)</td>
</tr>
<tr>
<td>Ciprofloxacin</td>
<td>24 (29.6)</td>
<td>57 (70.3)</td>
</tr>
<tr>
<td>Sparfloxacin</td>
<td>21 (25.9)</td>
<td>60 (74.0)</td>
</tr>
<tr>
<td>Gentamicin</td>
<td>57 (70.3)</td>
<td>24 (29.6)</td>
</tr>
<tr>
<td>Amikacin</td>
<td>66 (81.4)</td>
<td>15 (18.5)</td>
</tr>
<tr>
<td>Ceftriaxone</td>
<td>16 (19.7)</td>
<td>65 (80.2)</td>
</tr>
<tr>
<td>Cefaperazone + sulbactum</td>
<td>43 (53.0)</td>
<td>38 (46.9)</td>
</tr>
<tr>
<td>Imipenem</td>
<td>81 (100)</td>
<td>0 (0)</td>
</tr>
<tr>
<td>Pipercillin + tazobactum</td>
<td>68 (83.9)</td>
<td>13 (16)</td>
</tr>
</tbody>
</table>

Table 5: Antibiotic sensitivity pattern of klebsiella spp (N=55)

<table>
<thead>
<tr>
<th>Drug</th>
<th>Sensitive (%)</th>
<th>Resistant (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Amoxy- clav</td>
<td>12 (21.8)</td>
<td>43 (18.1)</td>
</tr>
<tr>
<td>Ciprofloxacin</td>
<td>25 (45.4)</td>
<td>30 (54.5)</td>
</tr>
<tr>
<td>Sparfloxacin</td>
<td>24 (43.6)</td>
<td>31 (56.3)</td>
</tr>
<tr>
<td>Gentamicin</td>
<td>26 (47.2)</td>
<td>29 (52.7)</td>
</tr>
<tr>
<td>Amikacin</td>
<td>30 (54.5)</td>
<td>25 (45.4)</td>
</tr>
<tr>
<td>Ceftriaxone</td>
<td>12 (21.8)</td>
<td>43 (78.1)</td>
</tr>
<tr>
<td>Cefaperazone + sulbactum</td>
<td>25 (45.4)</td>
<td>30 (54.5)</td>
</tr>
<tr>
<td>Imipenem</td>
<td>50 (90.9)</td>
<td>5 (9)</td>
</tr>
<tr>
<td>Pipercillin+ tazobactum</td>
<td>40 (72.7)</td>
<td>15 (27.2)</td>
</tr>
</tbody>
</table>

Table 6: Antibiotic sensitivity pattern of proteus Sp (N=28)

<table>
<thead>
<tr>
<th>Drug</th>
<th>Sensitive (%)</th>
<th>Resistant (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Amoxy- clav</td>
<td>18 (64.2)</td>
<td>10 (35.7)</td>
</tr>
<tr>
<td>Ciprofloxacin</td>
<td>23 (82.1)</td>
<td>5 (17.8)</td>
</tr>
<tr>
<td>Sparfloxacin</td>
<td>11 (39.2)</td>
<td>17 (60.7)</td>
</tr>
<tr>
<td>Gentamicin</td>
<td>20 (71.4)</td>
<td>8 (28.5)</td>
</tr>
<tr>
<td>Amikacin</td>
<td>21 (75.0)</td>
<td>7 (25.0)</td>
</tr>
<tr>
<td>Ceftriaxone</td>
<td>16 (57.1)</td>
<td>12 (42.8)</td>
</tr>
<tr>
<td>Cefaperazone + sulbactum</td>
<td>21 (75.0)</td>
<td>7 (25.0)</td>
</tr>
<tr>
<td>Imipenem</td>
<td>28 (100)</td>
<td>0 (0)</td>
</tr>
<tr>
<td>Pipercillin+ tazobactum</td>
<td>28 (100)</td>
<td>0 (0)</td>
</tr>
</tbody>
</table>
Table 7: Antibiotic sensitivity pattern of *pseudomonas* Sps (N= 37)

<table>
<thead>
<tr>
<th>Drugs</th>
<th>Sensitivity (%)</th>
<th>Resistant (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ciproflaxacin</td>
<td>30 (81.0)</td>
<td>7 (18.9)</td>
</tr>
<tr>
<td>Gentamicin</td>
<td>29 (78.3)</td>
<td>8 (21.6)</td>
</tr>
<tr>
<td>Amikacin</td>
<td>30 (81.0)</td>
<td>7 (18.9)</td>
</tr>
<tr>
<td>Netilmicin</td>
<td>30 (81.0)</td>
<td>7 (18.9)</td>
</tr>
<tr>
<td>Ceftriaxone</td>
<td>29 (78.3)</td>
<td>8 (21.6)</td>
</tr>
<tr>
<td>Cefazidime</td>
<td>31 (83.7)</td>
<td>6 (16.2)</td>
</tr>
<tr>
<td>Cefotaxime</td>
<td>30 (81.0)</td>
<td>7 (18.9)</td>
</tr>
<tr>
<td>Cefaperazone+ sulphactum</td>
<td>33 (89.1)</td>
<td>4 (10.8)</td>
</tr>
<tr>
<td>Imipenem</td>
<td>36 (97.2)</td>
<td>1 (2.7)</td>
</tr>
<tr>
<td>Piperacillin + tazobactum</td>
<td>35 (94.5)</td>
<td>2 (5.4)</td>
</tr>
</tbody>
</table>

In our study male: female distribution of pus isolates was 2.99:1 which is similar to the studies of Swati et al and Pappu AK et al.⁹

Among Gpc’s *Staphylococcus aureus* is the most common isolate in our study which also correlates with the studies of Tivari et al ᵉ and LeeCY et al,¹¹ but the prevalence of Methicillin resistant *Staphylococcus aureus* (MRSA) was low in our study 4 (9.3%) when compared to the studies Swati et al (35.9%). The reason can be because of the variation in the location of the hospitals where the studies were done. As our study was done in a hospital located in a rural area where the usage of higher class antibiotics was much lower when compared to above mentioned studies which were done in hospitals located in urban areas. All isolates of *Staphylococcus aureus* are 100% sensitive to vancomycin, which correlates with studies of Samra et al¹² but studies of Swati et al and Chauhan et al¹³ showed 88% and 90.22% respectively.

In our study the percentage of klebsiella isolates which are imipenem resistant was closely similar to study of Birader et al. Our study showed much lower resistance to imipenem among pseudomonas isolates compared to studies of Raghav et al¹⁴ and Swathi et al. The effectiveness of Piperacillin and tazobactum (PIT) and Amikacin (AK) on *pseudomonas* was much similar to study of Swathi et al and Sharma et al.¹⁵ As surgical departments contributed to more number of culture positive isolates, it highlights the need for proper antibiotic coverage among the patients. In our study all the isolates of E.coli were sensitive to imipenem but in studies of Birader et al and Raghav et al 20% of isolates were resistant to imipenem.

5. Limitations of Our Study

1. Anaerobic cultures were not done.
2. Lack of adequate history on prior antibiotic usage before sample was sent to the lab.

6. Conclusion

Pyogenic infections are a major concern in health care settings as they are the major cause of morbidity in many occasions. The situation has been more worsened now a days with the emergence of multidrug resistant strains. Inspite of some limitations, the present study can serve as an useful tool for clinicians for appropriate and judicial use of antibiotics which not only contribute to the better treatment but also aids in prevention of emergence of drug resistant strains in future.

7. Source of funding

None.

8. Conflict of interest

None.

References

Author biography

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S Sreedevi Professor and HOD

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