Research Article

Aerobic Bacteriological Profile and Antimicrobial Susceptibility Pattern in Postoperative Wound Infections at a Tertiary Care Hospital

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ABSTRACT:

Background: Postoperative wound infections are global problem in the field of surgery associated with long hospital stay, higher treatment expenditure, morbidity and mortality. The spectrum of infecting agents varies in each institution and same institution at different time points. Surveillance of surgical site infection with feedback of appropriate data to surgeons would be desirable to reduce surgical site infection rate. Hence we conducted this research to determine the prevalence and antimicrobial susceptibility patterns of aerobic bacteria in post surgical wound infected patients in ACS Medical College & Hospital, Chennai. Materials and Methods: Pus samples collected from the patients were processed using standard bacteriological methods to be used for bacterial isolation and Antimicrobial Susceptibility pattern.

Results: Among the 102 pus samples, 61 (59.80%) had bacterial growth and in that 51 (83.61%) were monomicrobial and 10 (16.39%) were polymicrobial with a total of 73 bacterial isolates. Among the 73 bacterial isolates 33 (45.20%) were Gram positive cocci and 40 (54.80%) were Gram negative bacilli. The most common bacteria isolated was Staphylococcus aureus 19 (26.03%), followed by Escherichia coli 18 (24.65%) and Coagulase Negative Staphylococcus 11 (15.07%). Antibiotic susceptibility test of the isolates showed that Vancomycin (100%) and Linezolid (100%) followed by Amikacin (93.94%) were the most effective antibiotics for Gram positive bacteria and for Gram negative isolates Amikacin (85%), Cefaperazone-sulbactam (80%) and Gentamycin (77.5%) were found to be the most effective.

Conclusion: Surveillance of the postoperative wound infection should be done in each and every hospital at regular intervals to evolve the control strategies and reduce the infection rate.

Key Words: Postoperative wound infection, Staphylococcus aureus, Escherichia coli

INTRODUCTION

Postoperative wound infection, also known as surgical site infection (SSI) is one of the most common surgical complications in the world particularly in developing countries1. As defined by the Centers for Disease Control and Prevention (CDC) these infections typically occur within 30 days of an operation at the site or part of the body where the surgery took place, or within a year if an implant is left in place and the infection is thought to be secondary to surgery2,3.

Inspite of modern standards of preoperative preparation, antibiotic prophylaxis and operative technique, postoperative wound infections remain a serious problem. They lead to various host and perioperative factors. However, a vast majority of these infections are preventable.

Most of these infections are superficial limited to the skin and subcutaneous tissue and readily treated with a regimen of local care and antibiotics. Deep infections involving the fascia and muscle, or organ space are less frequently encountered but are associated with greater morbidity and mortality, readmission rates, longer hospital stay and increased overall hospital associated costs4. The incidence of infection varies from surgeon to surgeon, from hospital to hospital, from one surgical procedure to another and most importantly from one patient to another.

The spread of antimicrobial resistance is now a global problem, which is due to significant changes in microbial genetic ecology, as a result of indiscriminate use of antimicrobials5. The emergence of high anti-microbial resistance among bacterial pathogens has made the management and treatment of post-operative wound infections...
difficult. The situation is serious in developing countries due to irrational prescriptions of antimicrobial agents. Moreover the rising of multidrug resistant strains pose challenges in the management of postoperative wound infections.

Employing methods that could reduce the incidence of postoperative wound infections would significantly reduce patient morbidity and mortality. Surveillance of postoperative wound infection with feedback of appropriate data to surgeon would be desirable to reduce the surgical site infection rate. Hence the present study was conducted with an objective to evaluate the various pathogens causing postoperative wound infections in our hospital with their antibiotic susceptibility pattern.

MATERIALS AND METHODS

The present study was conducted in the Department of Surgery and Department of Microbiology, ACS Medical College and Hospital, Chennai from February 2016 to June 2016. The study included 102 pus samples collected from clinically suspected cases of postoperative wound infections of all age groups and both the sexes admitted in the General surgery department of our Hospital. All the wound infections other than postoperative wound were excluded from the study. Patients with surgeries done more than thirty days were excluded from the study. An informed consent was taken from all the patients.

A. Sample collection: The samples were collected from the depth of the wound with strict aseptic precautions with the help of dry sterile cotton swab sticks for bacteriological examination. Two culture swabs from each sample were obtained, one for direct smear study and the other for aerobic culture and sent immediately to the laboratory for investigation.

B. Processing of sample: From the two swabs collected for each sample one was used to make smear for detection of pus cells and microorganisms. Other swab was used to inoculate onto Blood agar and MacConkey agar media and incubated at 37°C for 24 hours. After incubation, identification of bacteria from positive cultures was done with standard microbiological technique which included Gram staining and biochemical reactions. The antibiotic sensitivity test of all isolates was performed as per Clinical Laboratory Standards Institute (CLSI) guidelines by modified Kirby Bauer’s disc diffusion method.

RESULTS

Out of the 102 pus samples included in our study, 61 (59.80%) were culture positive for aerobic bacteria whereas 41 (40.20%) were sterile (Table 1)

Table 1 Percentage of Bacterial growth in Postoperative wound infection

<table>
<thead>
<tr>
<th>Total No of Samples</th>
<th>Growth/No growth</th>
<th>No of Samples</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>102</td>
<td>Growth</td>
<td>61</td>
<td>59.80</td>
</tr>
<tr>
<td></td>
<td>No growth</td>
<td>41</td>
<td>40.20</td>
</tr>
</tbody>
</table>

Among the total 102 pus samples, 53 (51.96%) were from male patients and 49 (48.04%) were from female patients and out of the 61 culture positive samples, 35 (57.38%) were from male patients and 26 (42.62%) were from female patients. (Table 2)

Out of the 61 culture positive samples 51(83.61%) were monomicrobial and 10 (16.39%) were polymicrobial with a total of 73 bacterial isolates. (Table 3)

Table 2 Sex Distribution in Postoperative wound Infection

<table>
<thead>
<tr>
<th>Sex</th>
<th>Total Samples (n = 102)</th>
<th>Culture Positive Samples (n = 61)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>53 (51.96%)</td>
<td>35 (57.38%)</td>
</tr>
<tr>
<td>Female</td>
<td>49 (48.04%)</td>
<td>26 (42.62%)</td>
</tr>
</tbody>
</table>

Among the 73 bacterial isolates 40 (54.79%) were Gram negative bacilli and 33 (45.21%) were Gram positive cocci.

Chart 1: Distribution of Gram Positive and Gram Negative bacteria

The most commonly isolated organism was Staphylococcus aureus 19 (26.03%) followed by Escherichia coli 18 (24.65%) and CONS (Coagulase Negative Staphylococcus) 11(15.07%). (Table 4)

Table 3 Pattern of Bacterial isolation in Postoperative wound infection

<table>
<thead>
<tr>
<th>Pattern of organism isolated</th>
<th>No of samples</th>
<th>No of isolates</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pure</td>
<td>51 (83.61%)</td>
<td>51</td>
</tr>
<tr>
<td>Mixture (2 organisms)</td>
<td>8 (13.11%)</td>
<td>16</td>
</tr>
<tr>
<td>Mixture (3 organisms)</td>
<td>2 (3.28%)</td>
<td>6</td>
</tr>
<tr>
<td>TOTAL</td>
<td>61</td>
<td>73</td>
</tr>
</tbody>
</table>

The most effective antibiotic for Gram Positive isolates were Vancomycin and Linezolid followed by Amikacin (Table 5) and for Gram negative isolates Amikacin, Cephalosporin-sulbactam and Gentamycin. (Table 6)
Table 5 Antibiotic susceptibility pattern of Gram Positive Cocci in Postoperative wound infection

<table>
<thead>
<tr>
<th>Antibiotics</th>
<th>S. aureus (n = 19)</th>
<th>CONS (n = 11)</th>
<th>Enterococci (n = 3)</th>
<th>Total (n = 33)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ciprofloxacin 5mcg</td>
<td>16 (84.21%)</td>
<td>5 (45.45%)</td>
<td>2 (66.67%)</td>
<td>23 (69.70%)</td>
</tr>
<tr>
<td>Gentamycin10mcg/HLG* 120mcg</td>
<td>19 (100%)</td>
<td>7 (63.64%)</td>
<td>*3 (100%)</td>
<td>29 (87.88%)</td>
</tr>
<tr>
<td>Cotrimoxazole 25mcg</td>
<td>11 (57.89%)</td>
<td>2 (18.18%)</td>
<td>2 (66.67%)</td>
<td>15 (45.45%)</td>
</tr>
<tr>
<td>Amikacin 10mcg</td>
<td>17 (89.47%)</td>
<td>11 (100%)</td>
<td>3 (100%)</td>
<td>31 (93.94%)</td>
</tr>
<tr>
<td>Amoxiclav 15mcg</td>
<td>11 (57.89%)</td>
<td>4 (36.36%)</td>
<td>3 (100%)</td>
<td>18 (54.55%)</td>
</tr>
<tr>
<td>Erythromycin 15mcg</td>
<td>14 (73.68%)</td>
<td>4 (36.36%)</td>
<td>2 (66.67%)</td>
<td>20 (60.61%)</td>
</tr>
<tr>
<td>Vancomycin 30mcg</td>
<td>19 (100%)</td>
<td>11 (100%)</td>
<td>3 (100%)</td>
<td>33 (100%)</td>
</tr>
<tr>
<td>Linezolid 15mcg</td>
<td>19 (100%)</td>
<td>11 (100%)</td>
<td>3 (100%)</td>
<td>33 (100%)</td>
</tr>
<tr>
<td>Ampicillin 10mcg</td>
<td>9 (47.36%)</td>
<td>3 (27.27%)</td>
<td>3 (100%)</td>
<td>15 (45.45%)</td>
</tr>
</tbody>
</table>

Table 6 Antibiotic susceptibility pattern of Gram Negative Bacilli in Postoperative wound infection.

<table>
<thead>
<tr>
<th>Antibiotics</th>
<th>E.coli  (n = 18)</th>
<th>Pseudomonas (n = 9)</th>
<th>Klebsiella (n = 6)</th>
<th>Proteus (n = 3)</th>
<th>Citrobacter (n = 2)</th>
<th>Acinetobacter (n = 2)</th>
<th>Total (n = 40)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ciprofloxacin5mg</td>
<td>9 (50%)</td>
<td>7 (77.78%)</td>
<td>5 (83.33%)</td>
<td>1 (33.33%)</td>
<td>1 (50%)</td>
<td>1 (50%)</td>
<td>24 (60%)</td>
</tr>
<tr>
<td>Amikacin10mcg</td>
<td>17 (94.44%)</td>
<td>8 (88.89%)</td>
<td>5 (83.33%)</td>
<td>2 (66.67%)</td>
<td>1 (50%)</td>
<td>1 (50%)</td>
<td>34 (85%)</td>
</tr>
<tr>
<td>Ceftazidime30mg</td>
<td>4 (22.22%)</td>
<td>5 (55.56%)</td>
<td>3 (50%)</td>
<td>1 (33.33%)</td>
<td>1 (50%)</td>
<td>1 (50%)</td>
<td>15 (37.50%)</td>
</tr>
<tr>
<td>Ceftaperazone– Sulbactam50mcg</td>
<td>16 (88.89%)</td>
<td>7 (77.78%)</td>
<td>5 (83.33%)</td>
<td>2 (66.67%)</td>
<td>1 (50%)</td>
<td>1 (50%)</td>
<td>32 (80%)</td>
</tr>
<tr>
<td>Cefotaxime 30mcg</td>
<td>2 (11.11%)</td>
<td>5 (55.56%)</td>
<td>3 (50%)</td>
<td>2 (66.67%)</td>
<td>0</td>
<td>0</td>
<td>12 (30%)</td>
</tr>
<tr>
<td>Ampicillin 10mcg</td>
<td>3 (16.67%)</td>
<td>1 (11.11%)</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>4 (10%)</td>
</tr>
<tr>
<td>Gentamycin 10mcg</td>
<td>15 (83.33%)</td>
<td>6 (66.67%)</td>
<td>4 (66.67%)</td>
<td>3 (100%)</td>
<td>2 (100%)</td>
<td>1 (50%)</td>
<td>31 (77.5%)</td>
</tr>
</tbody>
</table>

DISCUSSION

Postoperative surgical wound infections have been found to pose a major problem in the field of surgery for a long time. Although surgical wound infections cannot be completely eliminated, a reduction in the infection rate to a minimum level could have significant benefits, by reducing postoperative morbidity and mortality and wastage of health care resources.

Among the 102 samples included in our study 61 (59.80%) had bacterial growth. This culture positivity rate in our study is in accordance with Biadglign et al study in which the culture positivity is 53.0%. But Taye, 2005 and Tesfahunegn et al, 2009 reported culture positivity of 14.8% and 44.1% which is much lower than our study whereas Amrita et al and Guta et al reported higher culture positivity of 84% and 92%. This difference in culture positivity rate may be due to variation in common nosocomial pathogens inhabitant, difference in policy of infection control and prevention between countries and hospitals and study design used in the researches.

Bacterial growth was not seen in 41 (40.20%) samples, which could attribute to the normal healing process of the wound by host immune system, antimicrobial activity or appropriate use of antiseptics for cleaning the wounds. It could also be due to anaerobic bacteria or fungi infection which we could miss due to the use of culture media that only support the aerobic bacteria.

Out of the 102 samples included in our study, 53 (51.96%)
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CONCLUSION

Postoperative wound infections are real risks associated with any surgical procedure and represent a significant burden contributing to morbidity and mortality and increased cost to health care services around the world. Therefore periodic surveillance of postoperative wound infections should be done in every hospital at regular intervals to evolve the control strategies and reduce the infection rate.

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