ABSTRACT

INTRODUCTION

Postoperative wound infections are a significant complication of surgical procedures, which increases morbidity, mortality, prolonged hospital stay, and increased healthcare costs. The study was undertaken with an aim to investigate the etiological agents of postoperative wounds and their sensitivity to commonly used antibiotics.

MATERIAL AND METHODS

This study was a descriptive cross-sectional prospective study, carried out at Universal College of Medical Sciences-Teaching Hospital, Bhairahawa, Nepal, on 100 postoperatively wounded infected cases, during April 2023-August 2023. Non Probability sampling method (Purposive sampling) was used, and specimens were collected by sterile cotton swabs and pus was aspirated with a sterile needle and syringe and processed using standard bacteriological techniques. Antibiotic sensitivity test was conducted by disc diffusion (Kirby-Bauer) method.

RESULTS

Postoperative wound infections caused by Gram negative bacilli were more frequent and predominant pathogens involved were *Pseudomonas aeruginosa*, followed by *Klebsiella spp* and *Enterobacter aerogenes*. Among Gram positive bacteria *Staphylococcus aureus* was predominant. Gram positive cocci were highly sensitive to Ampicillin, and Gram negative bacilli were highly sensitive to Ceftazidime, Gentamicin, and Amikacin. Coagulase negative staphylococci were resistant to all drugs tested.

CONCLUSION

*Pseudomonas aeruginosa* was the commonest etiological agent for postoperative wound infections. Gram positive cocci and E.coli were highly sensitive to Ampicillin and Gram negative bacilli were highly sensitive to Ceftazidime, Gentamicin, Amikacin. *Staphylococcus aureus* was resistant to vancomycin and Teicoplanin and coagulase staphylococci were resistant to all drugs tested. Gram negative bacilli were resistant to Polymyxin B and Tigecycline. Increasing resistance to commonly used antibiotics warrants the judicious use of antibiotics and establishment of antibiotic policy in the hospital.

KEYWORDS

Antibiogram, Postoperative wound infection, *Pseudomonas aeruginosa*
INTRODUCTION

The incidence of surgical site infections in developing countries has been reported to be around 2-40%. Postoperative wound infection can be caused by exogenous and endogenous sources. The incidence of postoperative wound infections depends on several factors, including the type of surgery, age, and underlying medical conditions. Postoperative wound infections delay recovery of patients, increases length of hospital stay requiring additional resources for investigation, management and treatment of patient. Therefore its prevention increases quality of patient care and decreases morbidity and mortality of patients. For control of wound infections and administration of proper therapy we should know bacteria causing wound infections and their antibiotic sensitivity pattern must be made available.

The present study was undertaken with an aim to investigate the etiological agents of postoperative wounds and their sensitivity to commonly used antibiotics. The study will help to identify the most common bacteria causing postoperative wound infections and the effectiveness of antibiotics used in their treatment. This study will be useful in the development of appropriate antibiotic regimens for the management of postoperative wound infection.

MATERIAL AND METHODS

This study was a descriptive cross-sectional prospective study, carried out at Universal College of Medical Sciences-Teaching Hospital (UCMS-TH), Bhairahawa, Nepal. The study was carried out on surgeries done in General Surgery, Obstetrics/Gynecology and Orthopedic & Trauma during April 2023 – August 2023, at Universal College of Medical Sciences & Teaching Hospital, Bhairahawa, Nepal, after obtaining ethical approval from Institutional Review Committee (IRC No. UCMS/IRC/009/23). Non Probability sampling method (Purposive sampling) was used for the study. Out of total 2390 surgeries, postoperatively wound infected cases were 100.

The inclusion criteria for the study were patients of all age groups except neonates with presence of post-operative wound infections and those who give informed consent to participate. The exclusion criteria for the study were infection on episiotomy site and those who refuse to participate in the study.

Specimens were collected by sterile cotton swabs and pus was aspirated with a sterile needle and syringe and transported to laboratory immediately. Samples were processed using standard bacteriological techniques by direct microscopic examination using Gram’s stained smears and cultured on to MacConkey agar, blood agar, chocolate agar and isolates were identified by biochemical tests. Simultaneously antibiotic sensitivity test was conducted by using Mueller-Hinton agar medium by disc diffusion (Kirby-Bauer) method.

RESULTS

Out of total 2390 surgeries, postoperatively wound infected cases were 100, and the results are depicted in following tables.
**Table 6. Antimicrobial resistance pattern of Gram negative bacilli**

<table>
<thead>
<tr>
<th>Antibiotics</th>
<th>Acinetobacter spp. N = 4 (40%)</th>
<th>Citrobacter spp. N = 4 (40%)</th>
<th>E.coli N=12 (%)</th>
<th>Enterobacter cloacae N = 22 (%)</th>
<th>Klebsiella spp. N = 4 (40%)</th>
<th>Proteus mirabilis N = 4 (40%)</th>
<th>Pseudomonas aeruginosa N=49 (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ampicillin</td>
<td>NT</td>
<td>NT</td>
<td>NT</td>
<td>NT</td>
<td>NT</td>
<td>NT</td>
<td>NT</td>
</tr>
<tr>
<td>Piperacillin+Tazobactam</td>
<td>10 (100)</td>
<td>4 (100)</td>
<td>12 (100)</td>
<td>NT</td>
<td>28 (96.6)</td>
<td>0</td>
<td>48 (69.6)</td>
</tr>
<tr>
<td>Cefotaxime</td>
<td>10 (100)</td>
<td>4 (100)</td>
<td>12 (100)</td>
<td>22 (100)</td>
<td>29 (100)</td>
<td>1 (28)</td>
<td>NT</td>
</tr>
<tr>
<td>Cefazidime+Clavulanic acid</td>
<td>10 (100)</td>
<td>4 (100)</td>
<td>12 (100)</td>
<td>22 (100)</td>
<td>29 (100)</td>
<td>4 (80)</td>
<td>65 (94.2)</td>
</tr>
<tr>
<td>Cefotaxime+Clavulanic acid</td>
<td>10 (100)</td>
<td>4 (100)</td>
<td>11 (91.7)</td>
<td>22 (100)</td>
<td>2 (50)</td>
<td>25 (86.2)</td>
<td>48 (80)</td>
</tr>
</tbody>
</table>

**DISCUSSION**

Postoperative wound infections are a significant cause of morbidity and mortality in surgical patients. The post-operative wound infections vary from hospital to hospital and from one geographic location to another. In this study, in majority (62%) of the postoperative wound infections more than one organism were isolated (polymicrobial), and 38% were monomicrobial (Table 2). High infection rate was seen in males (96.7%) than females (37%). Similar to our findings, in a study by Kurhade A et al., high infection rate varied from hospital to hospital and age group 30-40 years (25.5%). 292 isolates of 10 different bacterial species (69%) were culture positive. High infection rate was seen in males (63%) and than females (37%). A total of 163 isolates of 10 different bacterial species were obtained. The infection rate was high in males (63%) and than females (37%). In our study, post-operative infection rate was high in the age group of 31-40 years (27%) followed by 21-30 years (25%). The infection rate was high in males (63%) and than females (37%). A total of 163 isolates of 10 different bacterial species were obtained. *Pseudomonas aeruginosa* was the commonest etiological agent 69 (42.3%) followed by *Klebsiella* spp. 28 (96.5) and *E.coli* 21 (72.4). In a study by Sisira D et al., the most commonest etiological agent 17 (35.42%) was *Pseudomonas aeruginosa*. In a study be Kurhade et al., the most commonest etiological agent was *Staphylococcus aureus* (26.51%), followed by *Pseudomonas aeruginosa* (18.18%), *Escherichia coli* (15.9%), *Klebsiella pneumoniae* (11.36%), Coagulase negative staphylococci (6.81%), *Bacteroides* species (5.30%), *Proteus mirabilis* (4.54%), beta haemolytic streptococci (3.78%), *Peptococcus* species (3.03%), *Proteus vulgaris* and *Citrobacter* species (2.27%) each. In a study by Sisira D et al. *Staphylococcus aureus* emerged as the commonest etiological agent 17 (35.42%) followed by *Pseudomonas aeruginosa* 14 (29.17%), *E.coli* 6 (12.5%). In a study by Sisira D et al. *Amikacin* (72.9%) was found to be the most effective antibiotic, and multidrug resistance was observed with *Staphylococcus aureus* (79.16%) and *Pseudomonas aeruginosa* (83.3%).

The antibiotic sensitivity pattern of Gram positive cocci is presented in Table 5. All the 4 isolates (100%) of *Staphylococcus aureus* were sensitive to Ampicillin, Piperacillin+Tazobactam, Cefoxitin, and Ce-trimoxazole; whereas 3 isolates (75%) were sensitive to Cefepime, Erythromycin, and Clindamycin. Two isolates (50%) were sensitive to Gentamicin, and Ciprofloxacin. Only one isolate was sensitive to Doxycycline. All the isolates of *S.aureus* were resistant to Vancomycin, and Teicoplanin. Out of 3 isolates of *Enterococcus spp.*, 2 isolates (66.67%) were sensitive to high level Gentamicin, Doxycycline, Erythromycin, and Ciprofloxacin; whereas one isolate (33.33%) was sensitive to Ampicillin. All the 3 isolates of *Enterococcus* were resistant to Vancomycin, Teicoplanin, and Linezolid. The only 1 isolate of coagulase negative staphylococci was resistant to all drugs tested i.e., Ampicillin, Piperacillin+Tazobactam, Cefoxitin, Cefepime, Vancomycin, Teicoplanin, Erythromy-

---

**NT**: Not tested.
cin, Clindamycin, Linezolid, Ciprofloxacin, and Co-tromoxazole. In a study by Amatya, the most effective antibiotic for Gram positive isolates was Oxacillin (96.1%) followed by Chloramphenicol (85.2%), and Ceftriaxone and Cefoperazone Sultbam (66.7% each). In a study by Narula H in Rajasthan, India, most of the Gram-positive isolates were resistant to penicillin and cephalosporin antibiotics and were moderately susceptible to fluoroquinolones and aminoglycosides. In a study by Budhni D et al, Gram positive isolates revealed maximum sensitivity to Linezolid and Vancomycin. In a study by Kurhade et al, both Gram positive and Gram negative bacterial isolates were multi drug resistant.

The antibiotic sensitivity pattern of Gram negative bacilli is shown in Table 6. Among 69 isolates of *Pseudomonas aeruginosa*, 65 (94.2%) isolates were sensitive to Cefazidime; 64 (92.7%) isolates were sensitive to Cefoperazone+Sultbam; 58 (84.1%) isolates were sensitive to Ciprofloxacin; 54 (78.3%) isolates were sensitive to Gentamicin; 53 (76.8%) isolates were sensitive to Amikacin; 50 (72.5%) isolates were sensitive to Cefepime; 48 (69.6%) isolates were sensitive to Piperacillin+Tazobactam; 41 (59.4%) isolates were sensitive to Aztreonam; 34 (49.3%) isolates were sensitive to Imipenem. All 69 isolates of *Pseudomonas aeruginosa* were sensitive to Colisim. Among 29 isolates of Klebsiella spp., all (100%) were sensitive to Cefotaxime, Cefazidime; 28 (96.5%) isolates were sensitive to Piperacillin+Tazobactam, Gentamicin, and Ciprofloxacin; 26 (89.6%) isolates were sensitive to Amikacin; 25 (86.2%) isolates were sensitive to Cefazidime+Clavulanic acid; 22 (75.9%) isolates were sensitive to Cotrimoxazole; 21 (72.4%) isolates were sensitive to Cefepime; 14 (48.3%) isolates were sensitive to Imipenem. All 29 isolates of *Klebsiella* spp. were resistant to Polymyxin B, and Tigecycline. Among 22 isolates of *Enterobacter aerogenes*, all (100%) were sensitive to Cefotaxime, Cefazidime, Cefazidime+Clavulanic acid; 20 (90.9%) isolates were sensitive to Piperacillin+Tazobactam; 17 (77.3%) isolates were sensitive to Gentamicin; 15 (68.2%) isolates were sensitive to Amikacin; 11 (50%) isolates were sensitive to Cefepime; 9 (40.9%) isolates were sensitive to Imipenem. All 22 isolates of *Enterobacter aerogenes* were resistant to Polymyxin B. Among 12 isolates of *E.coli*, all (100%) were sensitive to Ampicillin, Piperacillin+Tazobactam, and Cefazidime; 11 (91.7%) were sensitive to Cefazidime+Clavulanic acid, Amikacin, Gentamicyn, and Ciprofloxacinc; 8 (66.7%) isolates were sensitive to Cefepime, and Co-trimoxazole; 4 (33.3%) were sensitive to Imipenem. All 12 isolates of *E.coli* were sensitive to Polymyxin B, and Tigecycline. Among 10 isolates of Acinetobacter spp., all (100%) were sensitive to Piperacillin+Tazobactam, Cefotaxime, Cefazidime, and Cefazidime+Clavulanic acid; 9 (90%) isolates were sensitive to Ciprofloxacin; 8 (80%) isolates were sensitive to Gentamicin, and Co-trimoxazole; 7 (70%) isolates were sensitive to Cefepime, and Imipenem; 6 (60%) isolates were sensitive to Amikacin. All 10 isolates of *Acinetobacter* were resistant to Polymyxin B, and Tigecycline. Among 5 isolates of *Proteus mirabilis*, all (100%) were sensitive to Co-trimoxazole; 4 (80%) isolates were sensitive to Ampicillin, Cefazidime, Cefazidime+Clavulanic acid, Amikacin, and Gentamicin; 1 (20%) isolate was sensitive to Cefotaxime. All 5 isolates of *Proteus mirabilis* were resistant to Piperacillin+Tazobactam, Cefepime, Polymyxin B, and Ciprofloxacin. Among 4 isolates of Citrobacter spp., all (100%) were sensitive to Piperacillin+Tazobactam, Cefotaxime, Cefazidime, Cefazidime+Clavulanic acid, 3 (75%) isolates were sensitive to Cefepime, Amikacin, Gentamicin, Ciprofloxacin, and Co-trimoxazole; 2 (5%) isolates were sensitive to Imipenem. All 4 isolates of Citrobacter were resistant to Polymyxin B, and Tigecycline. Among 4 isolates of *Enterobacter cloacae*, all (100%) were sensitive to Piperacillin+Tazobactam, Cefotaxime, Ceftazidime, 3 (75%) isolates were sensitive to Amikacin, Gentamicin, and Co-trimoxazole; 2 (50%) isolates were sensitive to Cefepime, and Ceftazidime+Clavulanic acid. All 4 isolates of *Enterobacter cloacae* were resistant to Imipenem, Polymyxin B, and Tigecycline.

Our findings were similar to a study done by Amatya, where Imipenem was most effective (74.8%), followed by Amikacin (58.8%) against Gram negative bacteria. In a study by Murthy, Gentamycin, Cephaloridine and Norfloxacin were the most effective antibiotics against both Gram positive and Gram negative bacterial infections. In a study by Narula H in Rajasthan, India, Gram-negative isolates were resistant to beta-lactam and beta-lactam/beta-lactamase inhibitor combination also but were susceptible to fluoroquinolones, aminoglycosides, and carbapenems. In a study by Budhni D et al, the most sensitive drugs against Gram negative isolates were Imipenem, Gentamicin, Piperacillin-Tazobactam, and Amikacin.

**CONCLUSION**

*Pseudomonas aeruginosa* was the commonest etiological agent for postoperative wound infections. Antibiotic susceptibility pattern of various isolates helps in proper selection of antibiotics and in this study, it was found that Ceftazidime, Gentamicin, Amikacin were most effective drugs against Gram negative bacilli, and Ampicillin was most effective against Gram positive cocci and *E.coli*. *Staphylococcus aureus* was resistant to vancomycin and Teicoplanin and coagulase staphylococci were resistant to all drugs tested. Gram negative bacilli were resistant to Polymyxin B and Tigecycline. Increasing resistance to commonly used antibiotics warrants the judicious use of antibiotics and establishment of antibiotic policy in the hospital.

**ACKNOWLEDGEMENT**

We are greatly thankful to all patients those who participated in this study.

**REFERENCES**


