

Bacterial Isolation and Their Antibiotic Susceptibility Pattern from Post-Operative Wound Infected Patients

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Abstract

Background: Postoperative wound infections are found to be the cause of morbidity and mortality in the surgical patients. The wound that drain purulent discharge, with bacteria identified on culture is Postoperative infection. Wound draining pus, wounds that are opened by the surgeon; and wounds that the surgeon considers infected are considered postoperative wound infection. **Aim:** Bacterial isolation and antibiotic susceptibility pattern of postoperative wound infected patients and to find the correlation between their age, sex and the site of infection. **Material and methods:** 200 post surgical patients with wound infections admitted in different surgical wards were included. Pus and serous fluid samples from the wounds were collected. Gram staining & culture was done via conventional techniques followed by AST by Kirby Bauer disk diffusion technique. **Results:** Gram negative (27.5%) were predominant over gram positive (11.5%). In gram positive organism maximum isolates were *S. Aureus* followed by *Enterococcus* and *Streptococcus*. In gram negative organism's maximum isolate was *E. coli* followed by *Pseudomonas Aeruginosa*, *Klebsiella* & *Proteus*. **Conclusion:** *E. coli* (14.5%) was the commonest pathogen isolated due to more laparotomy surgical procedures followed by equal rate of *Staphylococcus aureus* (7%) and *Pseudomonas aeruginosa* (7%), *Klebsiella* (3.5%), *Proteus* (2.5%), *Enterococcus* (2.5%) and *Streptococcus* (2%). First generation of Cephalosporins and most of the Aminoglycosides were sensitive against gram positives whereas successive generations of cephalosporins were sensitive against gram negatives including some penicillin drugs like Ampicillin, Amoxicillin, and Piperacillin-Tazobactam which were sensitive for both gram positive and gram negative organisms.

Keywords: Postoperative wound infection, surgical site infection, Bacterial isolation, Bacterial characterization, Antibiotic susceptibility testing (AST).

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Introduction

Postoperative wound infection is an infection of the tissues with deep cut or an incision through surgical equipments and at operative area. The patient may be infected from the 1 day to many years after an operation or may occur between fifth to tenth day after surgery [5]. Surgical site infections (SSI) are the second most common nosocomial infections in our population and represent 38% of all infections in surgical

patients. [1-3] Skin and soft tissue infections (SSTIs) or Surgical site infections are common and range in severity from minor, self-limiting, surface infections to severe diseases requiring all the resources of modern medicine. [4] They are also known as "The Silent Killer: nosocomial Infections". High mortality and morbidity rate can be seen in India too along with other countries. According to a team led by World Health Organization researchers found developing countries had much higher infection rates than the developed world it is said "poor nation face: greater hospital infection burden". Wound infection results from microbes thriving in the surgical site because of poor preoperative preparation, wound contamination,

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improper antibiotic selection, or the lack of ability of an immunocompromised patient to fight against infection. Contamination of the wound is present to some extent in all incisions. A setback in recovery such as malnutrition, cardiac failure, or decreased oxygen to the tissues will deteriorate the individual and allow the infection to take hold.[4,5,6] Postoperative wound infections may make any illness more severe and make the condition of the patient worse & lead to a poor surgical outcome. With suitable treatment (antibiotics and/or wound drainage), the infection may recover, and the incision may heal. However, healing may become more delayed than normally expected for the type of surgery performed. Without treatment, there is a significant risk of the infection spreading systemically, causing associated irresistible infection, tissue distortion and destruction, and possibly death.

Material and method

Study design

This was a single-center, prospective study was conducted at the Department of Microbiology, at Patna Medical College and Hospital, Patna from March 2020 to September 2020. The present study was conducted on 200 patients of all age group with postoperative wound infections admitted in post operative surgery, Obst& Gynae and Ortho ward, after taking a relevant clinical history. The study was approved by the Institutional Research Committee. An informed and written consent was obtained from all the participating subjects before the commencement of the study.

Inclusion Criteria:

All the post surgical patients with wound infections admitted in different surgical wards were included for study.

Exclusion Criteria: Patients with wound Infections without surgery were excluded.

Sample collection: The pus and serous fluid samples from the wounds were collected with the help of two sterile moist swab sticks from the patients, under all aseptic conditions.

Transportation and Storage: Swab sticks were transported in 2 ml normal saline & BHI broth to laboratory as early as possible. In case of any delay the sample were refrigerated. **Processing of samples:** One swab stick was dipped in normal saline which was used for gram staining & was incubated for 24 hours at 37°C & other swab stick which was dipped in BHI was inoculated on Blood Agar & MacConkey Agar and were cultured for 24-48 hours at 37°C, followed by the identification of the isolates based on their cultural characteristics and morphology with their biochemical reactions (like IMViC Pattern, catalase, coagulase, oxidase & urease test. All the isolates were tested for antimicrobial susceptibility by Kirby Bauer disk diffusion technique on Muller Hinton Agar. Antibiotics used for susceptibility testing were: Amikacin, Amoxycylav, Ampicillin, Azithromycin, Cefepime, Cefixime, Cefopodaxime, Cefotaxime, Ceftizidime, Ceftriaxone, Ciprofloxacin, Cotrimaxazole, Erythromycin, Gentamycin, Linezolid, Piperacillin-Tazobactam.

Results

The present study which was conducted on 200 patients of all age group with postoperative wound infections admitted in different surgical wards, after taking a relevant clinical history whose samples were processed. The maximum culture positivity of the samples was in the age group 16-45(24%) followed by 46-60(14%) and then followed by 61-75(10%) lastly 2(0%) in >75 of age group respectively.

Table 1: Distribution of age and positive cultures

Age(yrs.)	No. of samples Studied	Culture positive
0-15	7	1(.92%)
16-45	98	48(24%)
46-60	59	28(14%)
61-75	34	10(5%)
>75	2	0(0%)

20% Females shows almost equal distribution of 19% of males.

Table 2: Positive cultures according to gender

GENDER	NO OF Samples	Positive Culture
MALE	107(53.5%)	38(19%)
FEMALE	93(46.5%)	40(20%)

The highest positive samples were found to be from surgery ward (67.5%) followed by Ortho (22.5%) & then Gynae ward (10%).

Table 3:Ortho ward and surgery ward

Total Patients	ortho Ward	Surgery Ward
200	45(22.5%)	135(67.5%)

Wound (52%) was the most common type of infection followed by abscess (22%), ulcer (18%), sinus (7%), & fistula(1%).

Table 4:Samples studied in different respects

Total No of samples studied	wound	abscess	sinus	fistula	Ulcer
200	104(52%)	44(22%)	14(7%)	2(1%)	36(18%)

Culture results of the isolates showed that sterile were (52%) followed by Pathogenic (39%) and nonpathogenic(11%).

Table 5:Samples isolated

Total samples Isolated	Pathogenic Organisms	Non Pathogenic Organisms	Sterile
200	78(39%)	22(11%)	104(52%)

Systemic Pathogenic isolation of Body showed maximum culture positive in skin and soft tissue (10.5%) followed by GIT (10%), Extremities (6.5%), skelton (joints)(4.5%), Excretory 4% and Reproductive(3.5%) respectively.

Table 6:Total pathogens isolated

Total		Reproductive	GIT	Extremities	Skelton (Joints)	skin & soft tissue	Excretory
Total Pathogens Isolated	78	7(3.5%)	20(10%)	13(6.5%)	9(4.5%)	21(10.5%)	8(4%)

In gram positive organism maximum isolates were S.aureus 7% followed by Enterococcus 2.5% and streptococcus 2%.

Table 7:Pathogenic strains

Total Pathogenic Strains	Gram +ve	Gram -ve
78	23(11.5%)	55(27.5%)

Shows distribution of gram negative (27.5%) and gram positive (11.5%) in pathogenic isolates.

Table 8:Total Gram + strains

Total Gram +ve	Streptococcus	S.aureus	Enterococcus
23	4(2%)	14(7%)	5(2.5%)

In gram negative organism's maximum isolate was E.coli (14.5%) followed by Pseudomonas Aeruginosa (7%), Klebsiella (3.5%), & Proteus(2.5%).

Table 9: Total Gram - strains

Total gram -ve	E.coli	P.aeruginosa	klebsiella	Proteus
55	29(14.5%)	14(7%)	7(3.5%)	5(2.5%)

S.aureus showed maximum antibiotic sensitivity to Azithromycin (42.85%) followed by Amikacin (35.71%) whereas Enterococcus was sensitive to Ampicillin (20%) and Vancomycin (20%) and Streptococcus showed maximum sensitivity to Amikacin (75%) followed by ciprofloxacin (50%).E.coli was highly sensitive to Amikacin

(72.41%) followed by Gentamycin (68.96%) and Azithromycin (55.1%) whereas for P.Aeruginosa, Amoxyclav (42.8%) was the choice of drug and followed by Klebsiella, Amikacin (57.1%), Azithromycin(28.5%) then for Proteus, chromphenicol (50%) and Gentamycin (50%) showed maximum sensitivity.

Discussion

Post-operative wound infections have been found to pose a major problem in the field of surgery for a long time. Data from the past several years had shown that an increasing resistance for drugs has become that were considered as the first line of treatment for post-operative wound infections.[7] In the present study, a total of 200 patients undergoing various surgical procedures were assessed. According to age wise distribution S.K.Shau et.al reported that maximum number of patients were found in age group of 41-60 (38%) lowest infection was in age group of 21-40 (4.1%)[8] Sohn et.al reported an average of 39 years.(9) Anush.S et al. reported maximum of infection (28%) in 41-50 years of age group. The lowest at (1.4%) at 81-90year age group. The present study reveals the maximum no of SSI in 16-45years of age group (24%). Reason being heavy work load, stress at this age group and less number of patients. According to the previous studies males were predominant over females having surgical site infection. S.k.Sahu et.al recorded higher infection in males as compared to females.[8] Hernandez et.al reported (65.6%) males and (34.4%) females among the SSI patients.[10]Anush.S et.al.screened patients out of which maximum number were males (62.68%) and (37.32%) were females. In contrast present study reveals that males (19%) and females (20%) have insignificant difference.Ward wise distribution, maximum cases of wound infection were from general surgery ward(67.5%) as compared to ortho (22.5%) and Gynae ward (10%). it may be due to the fact that most of the open and abdominal surgeries are from general surgery ward and ortho and Gynae have selected patients for surgeries.According to the type of infection our present study reveals that wound as highest (52%) followed by abscess (22%) then ulcer (18%), sinus (7%) and fistula(1%).In present study (52%) samples were found to be sterile may be due to exposure of antibiotic therapy. 39% were found to be pathogenic causing different kind of surgical site infection and nosocomial infection and (11%) were nonpathogenic(i.e. they were considered as contaminants).S.K.Sahu et al. reported the incidence of superficial incisional surgical site infection in midline incision was 4.39% but was highest in thoracoabdominal incision and lowest in Pfannenstiel incision. Similarly, in a study by Anvikar et al. The commonest surgery performed was from reproductive site (lower-segment Cesarean section and prostatectomy) followed by laparotomy and out of the surgical site infection cases, the cases of

laparotomy (25%) were seen most frequently, followed by prostatectomy (20.5%).[11]But according to present study skin and soft tissue site infection was maximum (10.5%) followed by GIT (10%), extremities (6.5%),skleton (joints) (4.5%), excretory (4%)and reproductive(3.5%). This may be because the patients were moreover from the rural background with lack of awareness and more exposure to malnutrition, alcohol, smoking, diabetes and respiratory distress.Anusha S et al.reported (65.34%) gram -ve and (34.66%) gram +ve whereas in contrast to this study Aizza Zafar et al. concluded that gram positive and gram negative was found to be almost equal(49.54%) and (50.45%) respectively. our study shows gram negative (27.5%) and gram positive (11.5%).[12,9] Mahmood et al. (50.32%) and Mumtaz et al. (49%) has found S.aureus (gram positive) as most frequent organism responsible for causing postoperative wound infection or surgical site infection.[13,14]Azzizza far recorded S.aureus as most isolated organism (41.28%) followed by Streptococcus (2.75%).Similarly Anusha S et al. reported S.aureus (30%) dominating over Streptococcus (26%) and beta- haemolytic Streptococcus (19%)[9] Present study shows (7%) S.aureus followed by (2.5%) Enterococcus and (2%) Streptococcus. Anusha S et.al.reported maximum rate of (gram negative) organism, E.coli (27.7%) followed by Klebsiella (19.8%) then Pseudomonas (11.8%) and lastly proteus mirabilis (5.9%). Mumtaz et al. has found E.coli (25.9%), Klebsiella (9.5%), Pseudomonas Aeruginosa(8.6%) and Proteus (4%). Mahmood has somewhat different pattern pseudomonas aeruginosa (16.3%) and E.coli (14.37%), Klebsiella (11.76%). According to K Prabhat Ranjan et al. pseudomonas aeruginosa is the most prevalent (29.6%)followed by E.coli(20.3%), Klebsiella (16.6%)and Proteus (6.3%).[15]Present study reveals highest rate of infection because of E.coli (14.5%) then Pseudomonas Aeruginosa (7%), Klebsiella (3.5%) and Proteus (2.5%).That goes in agreement with other studies.

Conclusion

After the assessment of 200 samples from postsurgical patients with wound infection, E.coli (14.5%) was the commonest pathogen isolated due to more laprotomy surgical procedures followed by equal rate of Staphyalococcusaureus (7%) and Pseudomonas aeruginosa (7%), Klebsiella (3.5%), Proteus(2.5%),Enterococcus(2.5%)and Streptococcus (2%).

Gram negative organisms (27.5%) were found to be causing more infection than gram positive (11.5%) organism as they were responsible for causing more nosocomial infections than positive ones. First line of generation, of Cephalosporins and most of the Aminoglycosides were active against gram positive bacteria whereas successive generations of cephalosporins were found to be active against gram negative including some penicillin drugs like Ampicillin, Amoxicillin, and Piperacillin-Tazobactam which were sensitive for both gram positive and gram negative organisms.

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