To Study The Antibiotic Susceptibility Pattern Of Organisms Responsible For Post Operative Wound Infection

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Abstract

Background and aims: Surgical site infections (SSIs) are a common cause of healthcare-associated infection. Sources of surgical site infections can include the patient's own normal flora or , indigenous flora of the lower gastrointestinal tract and genitourinary tract, or organisms present in hospital environment. It is important to know the bacteriology of SSI to formulate emperic antibiotic therapy. Therefore, the present was undertaken to evaluate the antibiotic susceptibility pattern of organisms responsible for post operative wound infection. **Material and Methods:** The present study was a prospective study carried out in the Department of Microbiology. Pus samples were collected from the General surgery, Obstetrics & gynecology & Orthopedics wards from the patients, who had undergone operations & who had developed signs & symptoms of post-operative wound infections. Antibiotic susceptibility testing was done according to modified Kirby bour's disk diffusion technique. **Results:** Among these SSI cases, 126(50.81%) cases were having clean wound. 116 (46.74%) wounds were clean-contaminated and 6(2.42%) wounds were contaminated. 185(74.60%) samples yielded monomicrobial growth while 36(14.52%) samples yielded polymicrobial growth. Gram negative isolates were predominant i.e. 171 (69.35%) than gram positive isolates were 86(34.68%). Staphylococcus aureus was the predominant organism followed by E. coli and Acinetobacter spp. **Conclusions:** On routine, microbiological analysis of wound specimens and their antibiotic susceptibility testing are recommended, which will guide Doctors to treat wound infections to reduce the spread of disease-resistant bacteria. Further, our study findings also help the hospital to develop evidence-based policy for chemoprophylaxis of SSI.

Keywords: Surgical site infection, Antibiotic susceptibility, Staphylococuss aureus, E.coli

Introduction

Surgical site infections (SSIs) are a common cause of healthcare-associated infection. The United States Centers for Disease Control and Prevention (CDC) has developed criteria that define surgical site infection as infection related to an operative procedure that occurs at or near the surgical incision within 30 days of the procedure or within one year if prosthetic material is implanted at surgery. These are the third commonest nosocomial infections and account for approximately 10-40% of all health care associated (HAI) infections [1].

The rate of SSI varies greatly worldwide and from hospital to hospital. The rate of SSI varies from 2.5% to 41.9% as per different studies[2]. Nosocomial Infection Surveillance (NNIS) system hospitals reported SSI rates according to type of surgeries and these were for clean 0.27%, clean-contaminated 4.65%, contaminated 10.17% and dirty 21.67%.

Sources of surgical site infections can include the patient's own normal flora or , indigenous flora of the lower gastrointestinal tract and genitourinary tract, or organisms present in hospital environment. In clean surgical procedures, in which the gastrointestinal, gynecologic, and respiratory tracts have not been entered, Staphylococcus aureus from the exogenous environment or the patient's skin flora is the usual cause of infection. In other categories of surgical procedures, including clean-contaminated, contaminated, and dirty, the polymicrobial aerobic and anaerobic flora closely resembling the normal endogenous microflora of the surgically resected organ are the most frequently isolated pathogens.

The risk factors associated for surgical site infection are type of wound, age, nutrition, previous hospitalization, presence of any disease condition like DM, Hypertension, malignancy.

Appropriate surgical antibiotic prophylaxis (SAP) can reduce the postoperative wound infection. Inappropriate use increases the selective pressure and favors the development of antimicrobial resistance.[3]

One of the major problems faced by the surgeons these days is to deal with surgical site infection caused by multi drug resistant bacteria. The most frequent etiologic agents of postoperative wound infections are extended spectrum β-lactamase (ESBL) producing *Escherichia coli,Klebsiella pneumoniae, Pseudomonas aeruginosa*, *Staphylococcus aureus,* and Enterobacter sp.

Surgical site infection is associated with prolonged stay, increased morbidity and occasionally mortality along with rise in cost of hospitalization. Early diagnosis and effective antibiotic therapy is must to prevent the morbidity and mortality. The surveillance of surgical site infection is necessary to find out the cause of infection so that preventive actions can be taken. It is important to know the bacteriology of SSI to formulate emperic antibiotic therapy. Therefore, the present was undertaken to evaluate the antibiotic susceptibility pattern of organisms responsible for post operative wound infection.

Material and Methods

The present study was a prospective study carried out in the Department of Microbiology. Pus samples were collected from the General surgery, Obstetrics & gynecology & Orthopedics wards from the patients, who had undergone operations & who had developed signs & symptoms of post-operative wound infections. Wounds were classified using the wound contamination class system proposed by U.S. National Research Council[4].

Inclusion Criteria: Patients suffering from post-operative wound infection from General surgery, obstetrics & gynecology and orthopedic wards.

Exclusion Criteria: Stitch abscess, Infection of an episiotomy wound, Infection of surgical wound occurring after 30 days of surgery or after 1yr of implant placement.

After taking consent, pus samples were collected from deeper part of wound with the help of two sterile swab sticks and transported immediately to laboratory. Pus samples were examined for direct gram stained

smear, cultured on Blood agar and Mac Conkeys agar. Identification of isolates were done on the basis of morphological characters and recommended standard biochemical tests. Antibiotic susceptibility testing was done according to modified Kirby bour's disk diffusion technique.
Detection of mec-A mediated Oxacillin resistance was done by using
cefoxitin (30 µg) disk.For *Staphylococcus aureus*, zone diameter ≤ 21mm was considered as MRSA and for *Coagulase negative staphylococci*, zone diameter ≤ 24 mm was considered as MR-CONS.
Staphylococcus aureus - ATCC 25923, Escherichia coli - ATCC 25922 and Pseudomonas aeruginosa - ATCC 27853 were used as control strains for AST.

Results

A total of 248 pus samples were collected from the patients suffering from post-operative wound infection. From Obstetrics and Gynecology ward 147(59.27%) samples were collected, from Surgery ward 72 (29.03%) and from Orthopedic ward. 29(11.69%) samples were collected.

Among these SSI cases, 126(50.81%) cases were having clean wound. 116 (46.74%) wounds were clean-contaminated and 6(2.42%) wounds were contaminated. Among the 248 pus samples 221 (89.11%) yielded bacterial growth and rest 27(10.88%) were sterile. 185(74.60%) samples yielded monomicrobial growth while 36(14.52%) samples yielded polymicrobial growth. Gram negative isolates were predominant i.e. 171 (69.35%) than gram positive isolates were 86(34.68%).

Table – 1: Organisms isolated from pus samples

Organisms	Number	Percentage
Staphylococcus aureus	62	24.12
E.coli	50	19.46
Acinetobacter baumanniii	46	17.90
Klebsiella spp.	42	16.34
CONS	16	6.22
Citrobacter spp.	12	4.67
Pseudomonas aeruginosa	9	3.50
Proteus spp.	8	3.11
Streptococcal spp.	8	3.11
Enterobacter spp.	4	1.56

Staphylococcus aureus was the predominant organism followed by E.coli and Acinetobacter spp. The wound wise distribution of organisms shown that the predominant organism from clean wound was *Staphylococcus aureus*, from clean-contaminated wound was Acinetobacter baumanii & *Klebsiella pneumoniae* and from contaminated wound was *E.coli* & *Klebsiella pneumonia* (Table-1)

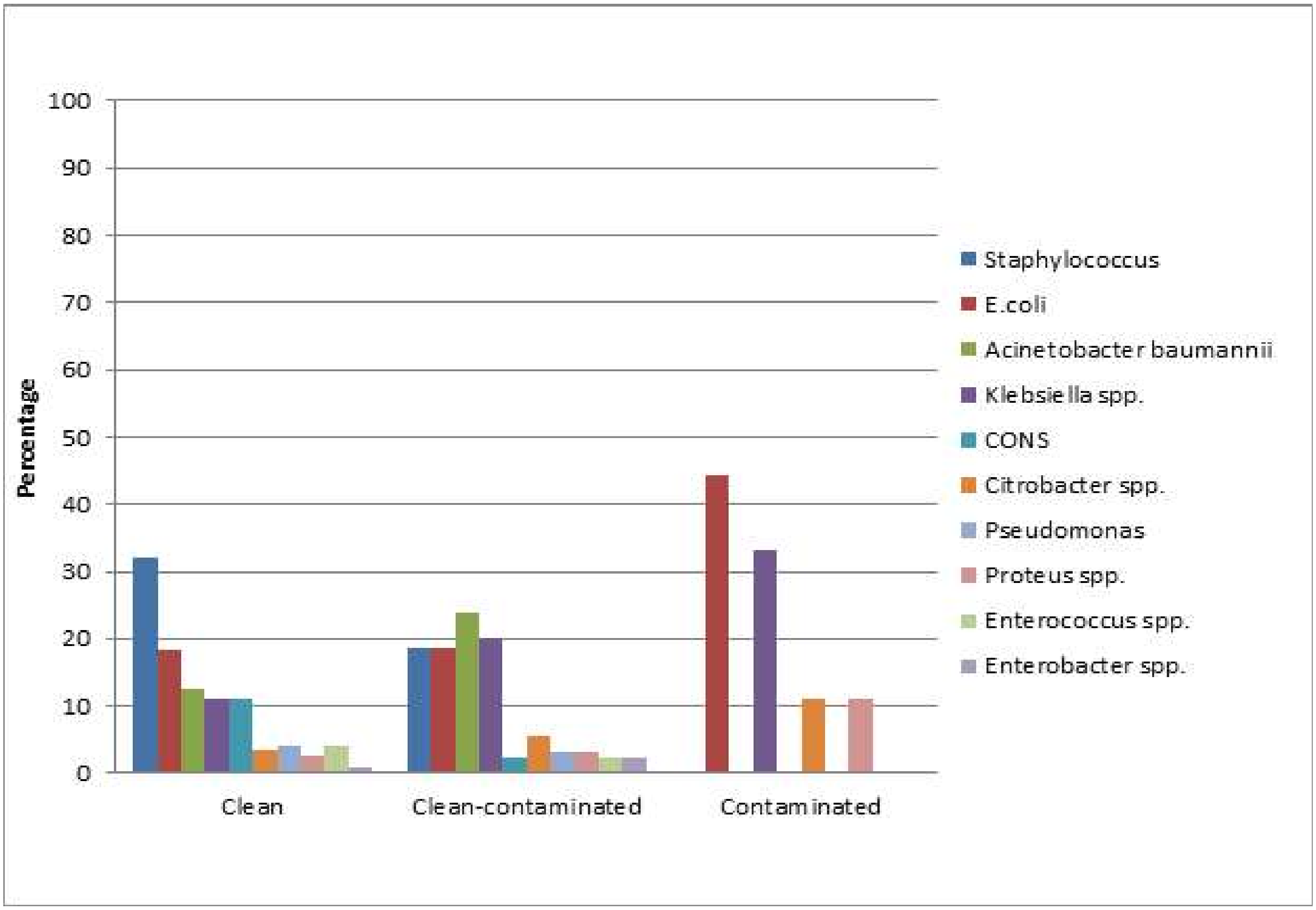

Fig.-1 : Wound wise distribution of the organisms

The predominant organism associated with clean surgeries is Staphylococcus aureus followed by E.coli, Acinetobacter baumannii, klebsiella spp, CONS. The most common organism associated with clean-contaminated surgery is Acinetobacter baumannii, followed by Klebsiella spp, E.coli, Staphylococcus aureus. Common organisms associated with contaminated surgery are E.coli, Klebsiella spp (Fig.-1).

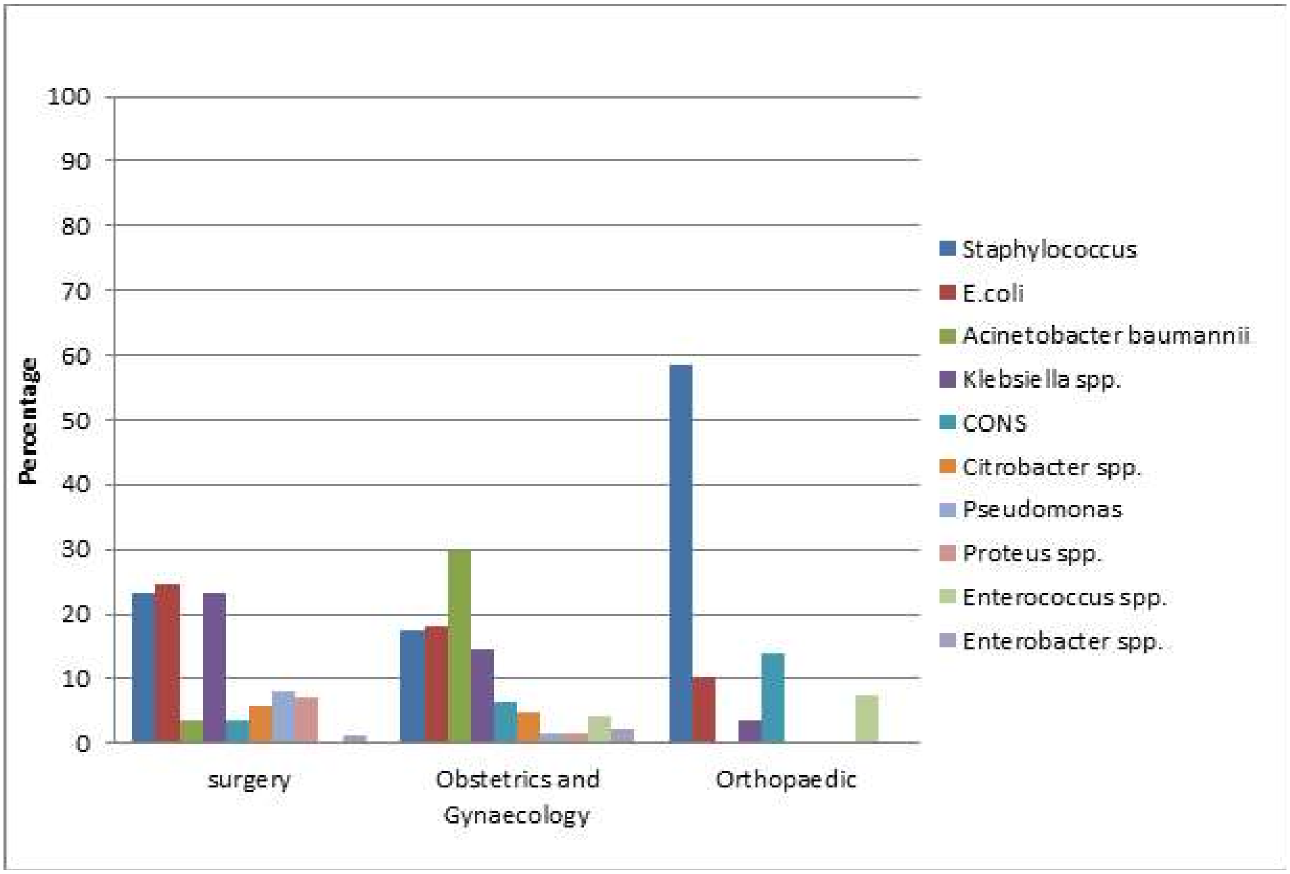

Fig.-2: Ward wise distribution of the organisms

From the general surgery ward predominant organisms were *E. coli, Klebsiella spp & Staphylococcus aureus*. From the obstetrics & gynecology ward predominant organisms were *Acinetobacter baumannii, E.coli, Staphylococcus aureus & Klebsiella spp*. From the orthopedic ward *Staphylococcus aureus* was the predominant organism (Fig.-2)

Table – 2: Percentage wise susceptibility pattern of gram negative isolate

Organism	Cefta zedime	Genta mycin	Amikacin	Cipro floxacin	Trime thoprim - Sulfame thaxazole	Tetra cycline	Imipenam
E. coli n=50	18	62	86	20	32	22	96
Acinetobacter Baumanniii n= 46	13.04	19.56	56.54	19.56	8.69	30.43	84.78
Klebsiella pneumoniae N=42	12.50	27.50	70	35	12.50	7.50	100
Citrobacter spp n= 12	16.66	41.66	66.67	41.67	25	41.66	100
Pseudomonas aeruginosa n= 9	22.22	66.67	100	55.56	-	-	77.78
Proteus spp. n=8	0	25	50	37.50	0	0	100
Enterobacter spp. n=4	0	50	100	50	0	50	100
Total n= 171	14.04	38.59	71.34	28.07	16.37	20.47	93.57

93% gram negative isolates were susceptible to Imipenem & 75% of isolates were susceptible to amikacin.. Higher resistant was shown to third generation cephalosporins, tetracycine, fluroquinolones, cotrimoxazole (Table-2).

Table – 3: Susceptibility pattern shown by staphylococci

Organisms	Penicillin (%)	Cefoxitin (%)	Genta micin (%)	Cipro floxacin (%)	Trime thoprim– Sulpha methoxazole (%)	Tetra cycline (%)	Line zolid (%)
***Staphylococcus aureus* n=62**	4.8	43.55	67.74	88.70	40.32	29.03	100
CONS n=16	0	68.75	56.25	81.25	68.75	43.75	100
Total n=78	3.84	48.71	65.38	87.17	46.15	32.05	100

Amongst Staphylococcus aureus 56.45% strains of were MRSA and all were sensitive to Linezolid. Among CONS 31.25% strains of were MR-CONS and all were sensitive to linezolid. Enterococcus spp. found to be susceptible to linezolid and vancomycin (Table-3)

Discussion

Surgical site infection represents a substantial burden of diseases for patients & health services. Although the total elimination of wound infection is not possible, a reduction in the infection rate to a minimum level & spread of resistant pathogens could have significant benefits in terms of both patients comfort & resources used.

The incidence of post operative wound infection in India was ranges from 4.04- 30% [5-7]. Maximum number of pus samples were collected from the Obstetrics & Gynaecology ward(59.27%) followed by General Surgery ward (29.03%) and Orthopaedics ward (11.69%).

Among the 248 pus samples, 27 (10.88%) yielded no growth. The reason for culture negativity could be antimicrobial activity in patients circulation since all of them were on antimicrobial therapy post operatively. It is also possible that some organism could be anaerobic or exacting in their growth requirement.

In our study most of the specimens showed monomicrobial growth (83.71%). Polymicrobial growth shown by 36 specimens (16.28 %). Studies by Classen et al. & Giacometti et al reported monomicrobial & polymicrobial wound infections respectively[8-9]. Polymicrobial growth associated predominantly with clean-contaminated surgery as compared to clean surgery.

Gram negative isolates (69.35%) were predominant as compared to Gram positive isolates(34.68%). This finding is in consistence with Sonawane J et al [10] & Mohanty S et al[11].

The most common bacterial isolate in our study was *Staphylococcus aureus.* Among the gram negative isolates *E.coli* were predominant followed by *Acinetobacter baumannii, Klebsiella pneumoniae*. Our observations are comparable to the studies done by Sonawane J et al[10] and Wassef MA et al[12].

Class of wound is a risk factor for the development of wound infection and bacteriology varies with type of wound. In our study Clean wounds were associated with predominant isolation of *Staphylococcus aureus* while clean – contaminated and contaminated wounds were associated with predominantly with Acinetobacter spp, E.coli and Klebsiella spp. These results were consistent with Wassef M A[12] and Ramesh A[13]. Ward wise distribution of bacterial flora help us in analysis of infection, tracing out source of infection and possible mode of infection.

Acinetobacter spp is an emerging pathogen. Recently many workers have reported it's association with wound infection and Health Care Associated Infection's. We observed higher rate of Acinetobacter spp.(17.89%) association with wound infection than Sonawane J (8.33%)[10] and Sharan H et al (10.56%)[14].

Pseudomonas aeruginosa is a known causative agent of wound and burn infection. It's isolation was less (3.5%). Other studies have reported higher association where as our observations are consistent with Ahmed MI et al[15] . Explanation given to the fact is that organisms vary from place to place, time to time & even in the same place.

All Gram negative isolates were predominantly susceptible to imipenem (92.40%), amikacin (71.34%). E.coli was predominant isolate and were sensitive to Imipenam(96%), Amikacin(76%) and gentamycin (62%). The next predominat isolate was Acinetobacter baumanni which were sensitive to Imipenam(84.73%) and amikacin(56.54%). Klebsiella pneumoniae organism were sensitive to Imipenam(100%) and amikacin(70%). Gram negative isolates were highly resistant to third generation cephalosporins (85.96%), trimethoprim-sulphamethoxazole (83.6%) & tetracycline (79.53%).

The isolates of *Staphylococcus aureus* were susceptible to gentamicin, ciprofloxacin while resistant to ampicillin, trimethoprim- sulfomethoxazole. Amongst these isolates 56.45% were MRSA. Similar incidence of MRSA reported by Malik S et al (55.7%)[16], lower incidence reported by Sharan H et al (33.33%)[14] & higher incidence reported by Wassef et al[12] (68%). All the isolates of MRSA were susceptible to Linezolid. CONS were susceptible to ciprofloxacin, gentamicin. 33% isolates were MR-CONS. All the MR-CONS were susceptible to linezolid. Enterococci were susceptible to vancomycin, linezolid,

Therefore, it is necessary to know the sensitivity of different bacteria in surgical site infection for two reasons, firstly, to select the appropriate antibiotics to avoid the emergence or overgrowth of resistant bacteria to currently used antimicrobial agents and secondly, these resistant bacteria can cross infect to other patient.

The study gives us an idea of the difference bacteria resistance and patterns in postoperative patients. The study may be extended to other emergency and elective surgical procedure of significant duration.

Conclusion

On routine, microbiological analysis of wound specimens and their antibiotic susceptibility testing are recommended, which will guide Doctors to treat wound infections to reduce the spread of disease-resistant bacteria. Further, our study findings also help the hospital to develop evidence based policy for chemoprophylaxis of SSI.

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