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RESEARCH ARTICLE

BACTERIOLOGICAL PROFILE OF SURGICAL SITE INFECTION AMONG POSTOPERATIVE PATIENTS AT A TERTIARY CARE CENTRE IN NANDED.

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Abstract

INTRODUCTION: *Despite the advances made in asepsis, antimicrobial drugs, sterilization and operative techniques, surgical site infections(SSI) continue to be a major problem in all branches of surgery in the hospitals. Based on the National Nosocomial Infections Surveillance, SSIs are the third most frequently reported nosocomial infections. The incidence of nosocomial infections is about 5-10% in most developed nations while in India, one in four patients admitted in to hospital acquire nosocomial infection. The incidence of Surgical Site Infection Rate in India ranges from 4.04% to 30%.* ***AIMS AND OBJECTIVES:*** *This study was carried out in terms of 1) Providing up-to-date information on frequently isolated aerobic bacterial species from patients with postsurgical site infection. 2) Providing clinicians with the best antimicrobial agents to which the organisms are susceptible. 3) Providing baseline information for further detailed and large epidemiological and drug resistance investigations in attempt to develop comprehensive treatment protocol.* ***MATERIALS ANS METHODS:*** *The present study was conducted in Department of Microbiology at Dr. Shankarrao Chavan Government Medical College. The study group included all post operative surgical site infections in this hospital and the case selection was carried out after the information collected in laboratory and the wards. The type of wound whether Clean or Clean Contaminated or Contaminated or Dirty were also noted. All the samples were processed without delay using standard microbiological methods.* ***RESULTS and OBSERVATIONS :*** *880 patients developed Surgical Site Infections. The rate of SSI was observed to be 13.57%. Out of the 620 culture positive cases, 380 (61.29%) were males while 240 (38.70%) were females. SSI rate is more in dirty wounds as compared to contaminated ,clean contaminated and clean wounds. S. aureus 220(35.48%) was the most frequent isolate causing Surgical Site Infections. Other predominant organisms isolated were P. aeruginosa 111(17.9%). S. aureus showed 100% Sensitivity to Linezolid and Vancomycin. A total of 40(18.18%) isolates were detected to be MRSA. Pseudomonas aeruginosa showed 100% sensitivity to Imepenem and Piperacillin/Tazobactam* ***CONCLUSION :****-Our study reveals that though SSIs have been widely studied since a long time, they still remain as one of the most important causes of morbidity and mortality in surgically treated patients. The steps taken to reduce SSIs are still not adequate. Proper infection control measures, a sound antibiotic policy and a higher degree of collaboration between Surgeons and Microbiologists should reduce SSIs in the future.*

INTRODUCTION

Despite the advances made in asepsis, antimicrobial drugs, sterilization and operative techniques, surgical site infections(SSI) continue to be a major problem in all branches of surgery in the hospitals. Based on the National Nosocomial Infections Surveillance, SSIs are the third most frequently reported nosocomial infections..[1] They have been responsible for the increasing cost, morbidity and mortality related to the surgical operations and continue to be

a major problem even in hospitals with most modern facilities and standard protocols of preoperative preparation and antibiotic prophylaxis.[2]

In 1992, the US Centers for Disease Control (CDC) revised its definition of "wound infection," creating the definition "surgical site infection" (SSI) to prevent confusion between the infection of a surgical incision and the infection of a traumatic wound. Nosocomial infections occurs worldwide and affect both developed and resource poor countries. Surgical wound infection is a serious hazard to patients, with incidence according to CDC was 15.45%, and according to the UK nosocomial infection surveillance was 11.32%, and according to ASEPSIS was 8.79%. [3]

The incidence of nosocomial infections is about 5-10% in most developed nations while in India, one in four patients admitted in to hospital acquire nosocomial infection.[4] The incidence of Surgical Site Infection Rate in India ranges from 4.04% to 30%.[5]

This study was carried out in terms of 1) Providing up-to-date information on frequently isolated aerobic bacterial species from patients with postsurgical site infection. 2) Providing clinicians with the best antimicrobial agents to which the organisms are susceptible. 3) Providing baseline information for further detailed and large epidemiological and drug resistance investigations in attempt to develop comprehensive treatment protocol.

MATERIALS ANS METHODS:

The present study was conducted in Department of Microbiology at Dr. Shankarrao Chavan Government Medical College and Dr. S.G.G.S. Hospital Nanded, Maharashtra between January 2011 to December 2014. The study group included all post operative surgical site infections in this hospital and the case selection was carried out after the information collected in laboratory and the wards. The type of wound whether Clean or Clean Contaminated or Contaminated or Dirty were also noted according to the CDC definition of surgical wound infections.[6]

The Sample collected from the surgical wound site was processed for Gram staining and then cultured on Blood Agar and MacConkey Agar. The etiologic agents were identified using routine tests for identification. The Kirby Bauer Disc Diffusion method was used for the antimicrobial susceptibility patterns. All the samples were processed without delay using standard microbiological methods.[7] The various Antibiotic discs used for the antimicrobial susceptibility patterns are shown in the Table 1.

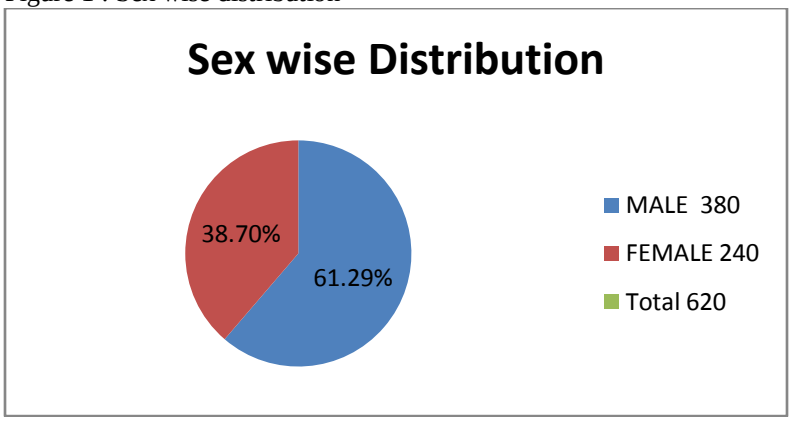
Table 1 : Antibiotic discs used for gram positive and gram negative isolates

Antibiotics used against Gram Positive Organisms	Antibiotics used against Gram Negative Organisms
Gentamicin	Amikacin
Tetracycline	Amoxicillin / Clavulanic Acid
Erythromycin	Ampicilin
Penicillin	Cefotaxime
Linezolid	Cefoxitin
Vancomycin	Ceftazidime
Cotrimoxazole	Cefuroxime Sodium
Cefoxitin	Gentamicin
	Imipenem
	Piperacillin
	Tobramycin
	Cefazolin
	Chloramphenicol
	Piparacillin – Tazobactum

RESULTS and OBSERVATIONS :

In all the surgeries included in our Hospital within the study period, 880 patients developed Surgical Site Infections. The rate of SSI was observed to be 13.57%.
In all 880 hospital acquired wound infections, aerobic bacteria were isolated in 620 (70.45%) cases.
Out of the 620 culture positive cases, 380 (61.29%) were males while 240 (38.70%) were females. The Sex wise Distribution of patients with SSIs is as shown in Figure 1.

Figure 1 : Sex wise distribution



The SSI rate among the different Wound class, as described by the CDC, was observed and is shown in Table 2.
Table 2: SSI rate according to Wound Class

Wound Class	**No. of Patients**	**SSI Rate**
Clean	68	7.73%
Clean Contaminated	127	14.43%
Contaminated	205	23.29%
Dirty	**480**	**54.55%**

Gram Positive organisms isolated were 300 (48.38%) whereas Gram Negative organisms were 320 (51.62%).
Staphylococcus aureus 220(35.48%) was the most frequent isolate causing Surgical Site Infections. Other predominant organisms isolated were Pseudomonas aeruginosa 111(17.9%), Escherichia coli 95(15.32%), Klebsiella pneumoniae 86(13.87%), Coagulase Negative Staphylococci 80 (12.9%), Proteus mirabilis 19(3.06%) and Citrobacter freundi 9(2.81%) as shown in Table 3.

Table 3: Distribution of Isolates

Organism	**Number of isolates [Total = 620]**	**Percentage**
S.aureus	220	35.48
P. aeruginosa	111	17.9
E.coli	95	15.32
K.pneumoniae	85	13.87
CONS	80	12.9
Proteus mirabilis	19	3.06
Citrobacter freundi	9	2.81

Staphylococcus aureus showed 100% Sensitivity to Linezolid and Vancomycin. Other Sensitive antibiotics were Gentamicin, Erythromycin and Tetracycline which were 79.17%, 76.71% and 71.55% resp. While Staphylococcus aureus showed resistance to Penicillin and Cotrimoxazole which were 90.77% and 64.55% resistant respectively.

A total of 40(18.18%) isolates of Staphylococcus aureus showed resistance to Cefoxitin. The Methicillin Resistant Staphylococci showed 100% sensitivity to Linezolid and Vancomycin while other sensitive antibiotics were Gentamicin and Ciprofloxacin with 66.67% and 66.67% respectively, it showed resistance to Penicillin (100%) and Cotrimoxazole (71.43%).

Pseudomonas aeruginosa showed 100% sensitivity to Imepenem and Piperacillin/Tazobactam. Other sensitive antibiotics were Tobramycin (90.80%), Amikacin (81.97%), Ciprofloxacin(80%) and Piperacillin (76.19%) while it showed resistance to Amoxicillin/Clavulanic acid(74.63%), Ampicillin (70.73%) and Ceftazidime (68.93%).

Escherichia coli showed 100% sensitivity to Imepenem and Piperacillin/Tazobactam. Other sensitive antibiotics were Chloramphenicol (92.50%), Tobramycin(80%) and Ciprofloxacin(54.17%) while it was resistant to Amoxicillin/Clavulanic acid (90.48%) and Ampicillin (89.85%). Escherichia coli showed resistance to Cephalosporins viz. Ceftazidime(87.50%), Cefuroxime (82.86%) and Cefotaxime (80.95%) and Cefazolin(80%)

Klebsiella pneumoniae was 100% sensitive to Imepenem and Piperacillin/Tazobactam. Other sensitive antibiotics were Chloramphenicol (90.57%), Tobramycin(87.55%) and Ciprofloxacin(66.67%) while it was resistant to Ampicillin (92..86%) and Amoxicillin/Clavulanic acid (87.50%). Klebsiella pneumoniae showed resistance to Cephalosporins viz. Ceftazidime(77.14%), Cefuroxime (82.76%) , Cefotaxime (71.11%) and Cefazolin(66.67%).

Coagulase Negative Staphylococci was 100% sensitive to Linezolid and Vancomycin. Whereas Tetracycline, Ticarcillin, Ciprofloxacin, Gentamicin, Cotrimoxazole and Erythromycin showed 84.48%, 73.91%, 66.67%, 64.29%, 61.76% and 55.41% sensitivity respectively. Coagulase Negative Staphylococci showed resistance to Penicillin(91.43%).

Proteus mirabilis was sensitive to Imepenem(100%), Ciprofloxacin(100%), Chloramphenicol(93.75%), Gentamicin(91.67%) and Tobramycin(85.71%) while it was resistant to Amoxicillin/Clavulanic acid(80%) and Ampicillin(78.57%). Proteus mirabilis showed resistance to cephalosporin antibiotics Cefuroxime(53.33%) and Cefotaxime (53.33%).

Citrobacter freundi was sensitive to Impenem(100%), Chloramphenicol(100%) Ciprofloxacin(75%) and Tobramycin (55.56%) while it was more resistant to Ampicillin(100%), Cefazolin(100%) and Amoxicillin/Clavulanic acid (83.33%).

DISCUSSION:

The prevalence rate of surgical site wound infection, though preventable, is high (National nosocomial infections surveillance, 1999). Studies by Agarwal (1972), Rao and Harsha (1975), Kowli et al. (1995) and Anvikar (1999) have shown surgical site infection rates in India to be between 4 to 30% (Agarwal, 1972; Rao and Harsha, 1975; Kowli et al., 1985; Anvikar et al., 1999).[8][9][10] The Surgical Site Infection Rate observed in our study is 13.57% which is in concurrence with the study conducted by Suchitra Joyce B. and Lakshmidevi N. [11]

In all 880 hospital acquired wound infections, aerobic bacteria were isolated in 620 (70.45%) cases which correlates with the study of Khyati Jain et al which showed 70% aerobic bacteria isolation.[12]

Out of the 620 culture positive cases, 380 (61.29%) were males while 240 (38.70%) were females, hence a male predominance is seen in the results which correlates with numerous studies conducted worldwide. Study conducted by Saxena A et al also correlates withour findings.[13]

In our study we found that the infection rate goes on increasing as there is a increase in wound class. SSI rate is more in dirty wounds as compared to contaminated ,clean contaminated and clean wounds. Similar findings have also been observed by other authors such as Patel Sachin et al, Nandi PL et al and Satyanarayan V et al.[14][15][16]

The predominant bacterial isolates recovered in our study included S. aureus (220 isolates- 35.48%) followed by P. aeruginosa (111 isolates- 17.9%), E.coli (95 isolates- 15.32%), K. pneumoniae (85 isolates- 13.87%), CONS (80 isolates 12.9%), Proteus mirabilis (19 isolates 3.06%) and Citrobacter freundii(9 isolates 2.81%). Many studies have reported S. aureus as the commonest isolate from post-operative wound infection. In the present study predominance of S. aureus in surgical site infection is consistent with reports from other studies and is however not surprising as it forms the bulk of the normal flora of skin and nails. Our study was comparable to the study which was conducted by Edwards et al [17], who reported a high incidence of S. aureus (30.3%). Also, previous studies in India by Surange et al [18] and Subramanian et al [19] have reported the incidence of S. aureus to be 34.2% and 30.9% respectively. Again, recent studies on SSIs in India by Kownhar et al in 2008, have shown an incidence of 37% [20] and those done in USA by Eagye et al [21] have shown an incidence of 39% of S.aureus. A higher percentage of S.aureus (51.6%) was observed by Keith et al [22] in older operative patients. It is our postulation that there may be more S.aureus carriers, as the hospital staff could be carriers and this finding may be relevant to our hospital setting.

The high incidence of gram-negative organisms in the postoperative wound infections can be attributed to be acquired from patient's normal endogenous microflora.[23]

A number of studies in literature such as Agrawal SL et al and Rao AS et al indicate gradual increase in the emergence of antibiotic resistant microorganisms in surgical patients. A special interest in S. aureus surgical site infection is mainly due to its predominant role in hospital cross infection and emergence of virulent antibiotic resistant strains. In the present study all S. aureus strains from the infected wounds were resistant to penicillin. Ineffectiveness of penicillin in Staphylococcus aureus has been reported in other studies as well such as Gayathree Naik et al. While studying the antibiotic sensitivity patterns, we observed that Vancomycin and Linezolid were the most sensitive (100%) antibiotics for S.aureus this result is consistent with the results of the study of Gayathree Naik et al and Malik et al.[24][25]

Isolation of 18.18% MRSA strains from the Staphylococcus aureus isolates of wounds of admitted patients with a rising trend over the past few years is a cause for concern not only for the control of Nosocomial infections but also for the treating physicians and surgeons in our hospital. A study by Weigelt et al in USA, found an incidence of 20.6% MRSA in SSIs so our study correlates with its observations.[26] All the MRSA strains were 100% sensititve to Vancomycin and Linezolid

In the present study, all the Gram-negative isolates were found to be resistant to Ampicillin(>70%) and Amoxicillin/Clavulanic acid (100%) ,also, Most of the Gram-negative isolates in our study showed resistance to Cephalosporins (>70%) which holds in agreement to the findings of Kakati B et al.[27] Most of the Gram Negative isolates were sensitive to Imepenem and Piperacillin/Tazobactam which correlates with the study conducted by Jyoti Sonawane et al.[28] Most of the Gram negative isolates were sensitive to Aminoglycosides and Fluoroquinolones.

All the strains of P. aeruginosa were sensitive to Imipenem and Piperacillin-Tazobactam. Shenoy et al also reported that all strains of P. aeruginosa in their study were sensitive to Imipenem and Meropenem.[29] Domingo et al also found Imipenem as most effective drug against P. aeruginosa.[30]

CONCLUSION

The spectrum of bacteria most frequently involved in surgical infections has changed over a period of time. Streptococcus being the most frequent and feared pathogen nearly a century ago was replaced by Staphylococcus aureus and Gram negative isolates as principal offenders in recent years. Staphylococcus aureus was the commonest bacteria (35.48%) isolated from SSIs in this study. Isolation of MRSA strains is an existing problem with a rising trend in Indian hospitals.

Drug regimens using Amoxicillin-Clavulanate and Ampicillin for preoperative prophylaxis and post-operative prophylactic coverage need to be carefully but urgently revised for controlling the existing status of SSIs in our hospital considering the high level of resistance observed.

Our study reveals that though SSIs have been widely studied since a long time, they still remain as one of the most important causes of morbidity and mortality in surgically treated patients. The steps taken to reduce SSIs are still not adequate. Proper infection control measures, a sound antibiotic policy and a higher degree of collaboration between Surgeons and Microbiologists should reduce SSIs in the future.

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