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Aerobic Bacteriological Profile of Surgical Site Infection and their Antibiotic Sensitivity Pattern in a Tertiary Care Hospital in North Karnataka

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A B S T R A C T

Surgical site infections (SSI) are one of the leading causes of nosocomial infections 2-20% which is a major public health problem worldwide. Surgical site infection is defined as infections occurring 30 days within surgery with no implant or with implant within 1 year. SSI is one of the leading causes for mortality and morbidity, leading to increased admission and readmission to the hospital. The study included clinically diagnosed cases of SSI from 122 in patients having sign & symptoms of SSIs as per CDC guide from period of one year, two swabs were collected as per guidelines, one swab for gram stain and second swab for culture on appropriate media. Antibiotic sensitivity testing done as per CLSI guidelines, detection of MRSA done using cefoxitin disc diffusion test. A total of 521 surgeries conducted during the study period and 122 patients were diagnosed clinically as SSI. Out of 122 clinically diagnosed cases 73(59.83%) cases showed aerobic bacterial culture, 34(46.57%) isolates were gram positive organisms and 39(53.42%) isolates were gram negative organism. This study found that *Staphylococcus aureus* was most common isolate 28(38.35%) followed by *Klebsiella* 17(23.28%), *Pseudomonas aeruginosa* 10(13.69%), *E.coli* (07), *Proteus* spp. 04 (05.47%), CoNS04 (05.47%), *Enterococci* 02 (2.73%), *Acinetobacter* 01(1.36%). All the gram positive isolates were found to be 100% sensitive to Vancomycin, followed by Teicoplanin. Least sensitive durgs were Clindamycin, Ampicillin was found to be only sensitive in 42.8% & 50% respectively. Gentamicin was 100%sensitive in CoNS and Enterococci & 89.82 % in *S.aureus*. MRSA was found to be 9.58% in our study. Even with the use of prophylactic antibiotics, SSIs are still a real risk and complication of surgery & represent a substantial burden of disease for both patients & health care system in terms of morbidity, mortality & financial burden. So healthcare professionals should consider the factors influencing the wound healing and proper infection control practices and antibiotic policy.

Introduction

Surgical site infection (SSI) is infections that occur after surgery in that part of body where surgery took place. Surgical site infection are defined as infections occurring 30 days within surgery with no implant or with implant within 1 year.SSI is one of the

leading cause of nosocomial infections 2-20% which is a major public health problem worldwide. Prevalence of surgical site infections is more in developing countries because of poor infection control and overcrowding in hospital and irrational use of antibiotics[1,2].

CDC defines SSI in three levels superficial incision infection, deep incision infection, organ or space infection. SSI is one of the leading causes for mortality and morbidity, leading to increased admission and readmission to the hospital. Increased number of days of hospital stay not only leads to nosocomial infections it will add to disease burden and financial burden to the patient and family[2].

Causes of SSI are both gram positive and gram negative organisms such as Staphylococcus, ConS, *Streptococcus, E.coli, Klebsiella, Pseudomonas, Citrobacter, Acinetobacter* etc. with increasing use of antibiotics drug resistant strains such as MRSA,VRSA, carbepenem resistant E.coli are increasing day by day causing difficulty in treatment[1].

Factors influencing SSI are age, comorbidities such as diabetes, obesity, nutritional status, wound contamination, inadequate sterilization of surgical instruments, preoperative part preparation, and length of operative procedure, invasiveness and virulence of causative organism[3,5,].

Bacteriological studies have shown from time to time that the etiological agents of SSI varies from hospital to hospital, region to region so it become very important to know the prevalent pattern of antibiotic resistance for effective treatment as we see increasing trend of MDRs[4,5]. Present study was conducted to know the aerobic bacteriological profile and antibiotic sensitivity pattern of SSI prevalent in this region of country, which will not only help in effective treatment but also judicious use of antibiotics and formulation of in-house antibiotic policy.

Materials and Methods[6, 7, 8, 9]

The present study is a retrospective study, aerobic bacteriological profile of surgical site infections and antibiogram carried out in the Department of Microbiology, in a tertiary care hospital in North Karnataka from August 2015 to July 2016.

A total of 521 surgeries conducted during the period and 122 patients were diagnosed clinically as SSI. The materials for the present study was obtained from patients, who had undergone operations in the departments of Surgery, Obstetrics and Gynaecology, ENT, Ophthalmology and Orthopaedics, and who had developed signs and symptoms of postoperative wound infections.

Inclusion criteria

All patients with Clean, Clean Contaminated, Contaminated, Dirty wound surgeries conducted in the departments of Surgery, Obstetrics and Gynecology and Orthopedics.

Exclusion Criteria

Procedures in which healthy skin was not incised, such as opening of an abscess, Infection of burn wounds, Surgeries conducted in other specialties.

Sample Collection

All clinically diagnosed cases of surgical site infections classified under CDC

guidelines were included for sample collection. The wounds were examined for signs and symptoms suggestive of surgical site infections during the postoperative period and two swab samples was collected if the surgical site was found to be infected according to the criteria. Before collecting the sample, careful cleaning of infected surgical site has to be done using 70% ethyl alcohol followed by 10% povidone iodine and allowed to remain for 2 minutes.

Wearing a sterile gloves the wound margins were separated with thumb and forefinger of one hand and with the other hand gentle pressure is applied and pus exudates was collected from the depth of the wound using two sterile cotton swabs for aerobic culture and for anaerobic culture. The entire specimen collected was transported immediately to the laboratory for further processing.

Processing of Specimen

The samples collected were processed as follows direct microscopic examination of Gram stain smears using the first swab, a smear was made on a clean glass slide and stained by Gram staining method. The smear was screened for the presence of pus cells, the Gram reaction, size, shape, arrangement and types of organisms.

Second swab was used for Culture of Aerobic organisms; the swab was inoculated into Nutrient agar plate, 5% Sheep Blood agar, MacConkey agar and incubated at 37°C for 24-48 hrs. Identification and speciation of organism done by morphological characters and battery of biochemical reactions. Antibiotic sensitivity testing done on Muller- Hinton agar by Kirby bauers disc diffusion method as per CLSI guidelines. Detection of MRSA was done using cefoxitin disc diffusion test.

Results and Discussion

A total of 521 surgeries conducted during the study period and 122 patients were diagnosed clinically as SSI. Out of 122 clinically diagnosed cases 73(59.83%) cases showed aerobic bacterial culture, 34(46.57%) isolates were gram positive organisms and 39(53.42%) isolates were gram negative organism.

This study found that *Staphylococcus aureus* was most common isolate 28(38.35%) followed by *Klebsiella pneumoniae* 17(23.28%), *Pseudomonas aeruginosa* 10(13.69%), *Escherichia coli* 07(09.58%), Proteus spp 04 (05.47%), CoNS 04 (05.47%), *Enterococci* 02 (2.73%), *Acinetobacter* 01(1.36%)

All the gram positive isolates were found to be 100 sensitive to Vancomycin, followed by Teicoplanin. Least sensitive durgs were Clindamycin & Ampicillin was found to be only sensitive in 42.8% and 50% respectively. Gentamicin was 100%sensitive in CoNS and Enterococci and 89.82 % in *S.aureus.*

Ampicillin was least sensitive drug and Imipenem, Piperacillin-tazobactam were found to be 100% sensitive in gram negative organisms in our study.

Total 28 isolates were *Staphylococcus aureus* in which MRSA were 07 (25% of *S.aureus*) and 9.58% among the total isolates, MRSA detection was done by cefoxitin disc diffusion test.

This retrospective study was conducted in a tertiary care hospital in North Karnataka, surgical site infection is a real risk complication of surgical procedures, SSI not only increases the mortality and morbidity of patient but also increases the number of

hospital stay and financial burden on the family. The present study was undertaken to study the frequency of SSI, type of aerobic bacterial isolates prevalent in the region and their antibiogram.

The rate of SSI varies from hospitals to hospitals and region to region, worldwide it is estimated to be ranging from 2.5% to 41% but our study showed SSI rate of 14.01% which is line with most of the studies. Naveen *et al.,* (10) SSI rate 21.66% and SP Lilani *et al.,* (11) 8.9%, other studies showed SSI rate up to 49.5%.Where as in developed countries SSI rate is low as 2 to 5%.

Surgical site infections increased with the age of the patients, most common age group was 51-60 years with 22.13% of cases. Other studies such as Anand Saxena *et al.,* (5) and Mohamed Issa Ahmed (13) showed a similar age group ie older than 50 years as most common age group.

Present study had a male preponderance which was in line with most of the studies conducted (1,10,11).

In our study prophylactic antibiotics was given in (58) 47.5% of SSI cases which was higher than other studies Naveen *et al.,* (10),

Diabetes mellitus is most common risk factor Comorbidities with 29.50 % which was not in line with studies such as Naveen *et al.,* (10) where it was 83.33%, diabetes was also most common comorbidity as per study done by Anand Saxena *et al.,* (5). Frequency of SSI was found to be higher in dirty wound 37.70%, whereas Kurhade *et al.,*(12) showed 32.2%, while in clean contaminated surgeries the SSI was 24.59%.

Most common trend seen in our study was gram negative isolates 39 and gram positive 34 which was in line with other studies.

Most common isolate is *staphylococcus aureus* 38.35% which was similar to other studies, Naveen *et al.,* (10), Kurhade A *et al.,* (12), Ahmed (13), Mohammad S R *et al.,* (14), found that *Staphylococcus aureus* was most common isolate.

MRSA was found to be 9.58% in our study, which was slightly lower than studies such as Vikrant Negi *et al.,* (1) with 15.7%

With increase of antibiotic resistant strains such as MRSA and overuse and misuse of over the counter available antibiotics has direct effect on the rate of SSI.

Table.1 Gender wise case distribution of SSI

S. No	Gender	Number	Percentage (%)
1	Male	89	72.95
2	Female	33	27.04
		122	

SSI was seen to be more in males (72.95%) than females (27.04%).

Table.2 Age wise distribution of cases of SSI

S. No	Age	Number	Percentage (%)
1	< 10	4	03.27
2	11-20	12	9.83
3	21-30	15	12.29
4	31-40	18	14.75
5	41-50	21	17.21
6	51-60	27	22.13
7	61-70	25	20.49
	Total	122	

51-60 years was the most common age group with most number of SSI i.e. 22.13% was observed in our study.

Table.3 Distribution of cases among types of wound seen in SSI

S. No	Type of wound	Number	Percentage (%)
1	Clean	10	8.19
2	Clean contaminated	30	24.59
3	Contaminated	36	29.50
4	Dirty	46	37.70
	Total	122	

37.70 % of cases of SSI were Dirty wound type of SSI predominant in our study.

Table.4 Distribution of cases and Comorbidities

S.No	Comorbidities	Number	Percentage (%)
1	Diabetes mellitus	36	29.50
2	Hypertension	27	22.13
3	Patients on steroids	18	14.75
4	Smokers	17	13.93
5	Malignancies	11	9.01
6	Alcoholics	13	10.65
	Total	122	

36 patients with diagnosed SSI had Diabetes mellitus and 27 had hypertension as majority of predisposing factors.

Table.5 Organisms isolated from SSI

S. No	Organism isolated	Number	Percentage (%)
1	*Staphylococcus aureus*	28	38.35
2	*Klebsiella pneumoniae*	17	23.28
3	*Pseudomonas aeruginosa*	10	13.69
4	*Escherichia.coli*	07	09.58
5	*Proteus spp.*	04	05.47
6	CoNS	04	05.47
7	Enterococci	02	02.73
8	Acinetobacter	01	01.36
	Total	73	100

CoNS= Coagulase Negative Staphylococci

Table.6 Antibiotic sensitivity patterns of Gram-positive microorganisms

Antibiotics	*Staphylococcus aureus* 28(100%)	CoNS 04 (100%)	Enterococci 2 (100%)
Ampicillin	14(50)	2(50)	-
Gentamicin	25(89.82)	4(100)	2(100)
Cefotaxime	16(57.14)	3(75)	2(100)
Amoxicillin-clavulanic acid	23(82.14)	4(100)	Nil
Cotrimoxazole	21(75)	2(50)	2(100)
Cefoxitin	21(75)	3(75)	-
Clindamycin	12(42.85)	2(50)	-
Ciprofloxacin	24(85.71)	4(100)	2(100)
Amikacin	26(92.85)	4(100)	2(100)
Tetracycline	17(60.71)	2(50)	Nil
Vancomycin	28(100)	4(100)	2(100)
Teicoplanin	26(92.85)	4(100)	2(100)

Table.7 Antibiotic sensitivity patterns of Gram-negative microorganisms

Antibiotics	*Klebsiella* 17 (100%)	*Pseudomonas* 10 (100%)	*Escherichia coli* 7 (100%)	*Proteus* 4 (100%)
Ampicillin	Nil	-	3(42.8)	-
Gentamicin	17(100)	-	6(85.7)	2(50)
Ceftazidime	8(47.05)	3(30)	5(71.4)	4(100)
Cefepime	8(47.05)	-	6(85.7)	3(75)
Amikacin	8(47.05)	8(80)	6(85.7)	4(100)
Piperacillin	17(100)	8(80)	5(71.4)	2(50)
Cotrimoxazol	-	-	3(42.8)	-
Ciprofloxacin	17(100)	8(80)	5(71.4)	2(50)
Cefotaxime	8(47.05)	-	6(85.7)	4(100)
Amoxycillin clavulanic acid	Nil	3(30)	3(42.8)	-
Aztreonam	8(47.05)	6(60)	3(42.8)	4(100)
Piperacillin-tazobactam	17(100)	10(100)	7(100)	4(100)
Imipenem	17(100)	10(100)	7(100)	4(100)

In the Present study showed that aerobic bacterial pathogens and their antibiogram, the incidence of SSI was 14.01%, diabetes mellitus was most common comorbidity, *Staphylococcus aureus* was most common isolate 38.35%, most of the isolates were susceptible to commonly used antibiotics, MRSA was 9.85%, so from present study it can be inferred that SSI is caused by both gram positive and gram negative organism with newer drug resistant forms emerging day to day.

SSI is still one of the major cause for increased mortality and morbidity and also increases financial burden on the patients family. So proper measures to reduce SSI to be learnt to prevent SSI, hand hygiene between the patients by health care workers being one of the major preventive measure, and other strict infection control measures, appropriate and judicious use of antibiotics, implementation of antibiotic policies and antimicrobial stewardship is vital.

Limitation

The present study was done on aerobic bacterial profile, anaerobic and fungal profiles were not done.

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