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Bacteriological profile of surgical site infections and their Antibiogram in surgical wards at tertiary care teaching hospital in Solapur, Maharashtra

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Abstract
Background: Surgical site investigations (SSI) is second most common cause of nosocomial infection, due to emergence of resistance among isolates commonly encountered in hospital environment, infection by such microorganisms have resulted in increase in morbidity and mortality among patients, increase hospital stays and increase financial burden on patient. Aim of the study is to determine the bacteriological profile and antibiogram of surgical site infection.
Material & Method: The study has been carried out for a period of 3 months from August 2018 to November 2018. All pus samples of clinically suspected of SSI were immediately processed by standard bacteriological techniques. Antibiotic susceptibility testing was done as per CLSI guidelines.
Results: Total of 418 samples of patients suspected of SSI was received in Microbiology department. Out of which growth was seen in 296 (70.81%) samples, polymicrobial flora was seen in 21 (5.02%) samples, while 101 (24.2%) were sterile. Most commonly males 178 (60%) were found to be affected by SSI as compared to females 118 (40%). Most common age group affected in both the sexes were elderly patient of more than 60years. Out of 296(70.81%) samples with growth, majority of isolates were gram negative bacilli 196 (66.21%) while gram positive bacteria were 100 (33.78%). Among gram negative bacteria (n=196) most common bacteria isolated was *Pseudomonas aeruginosa* 50 (25.51%), *E. coli* 50 (25.51%) followed by *Klebsiella pneumonia*e 36 (18.4%), *Citrobacter koseri* 23 (11.73%), *Acinetobacter baumannii* 22 (11.22 %) *Proteus vulgaris* 15 (7.65%).Among gram positive bacteria (n=150) 33.78%. Most common bacteria isolates were MRSA were 60 MSSA 28 and *Enterococcus faecalis* 12(12%). Among gram negative bacteria maximum sensitivity was seen for imipenem 59% followed by Amikacin 58.2%, Piperacillin-tazobactam 43.4%, Ciprofloxacin 41.32%, Cefotaxime 38% and Ceftazidime 34%. Among gram positive bacteria *Staphylococcus aureus* showed high resistance to Cefoxitin (68.18%), followed by Erythromycin 57%, Clindamycin 47%, Ciprofloxacin 36.4%, Gentamicin 23.86%. while 100% sensitivity was seen for Vancomycin and Linezolid respectively. Among gram negative bacteria 81 (41.32) isolates were imipenem resistant of which 54 (27.55%) were MBL (Metallo beta lactamases) producers which was confirmed by EDTA disc synergy test and Modified hodge test, while 60 (52.2%) isolates were ESBL producer confirmed by combined disc test and 30 (26.1%) isolates were Amp-c producers confirmed by Amp-c disc test, While 12 (10.43%) isolates were both ESBL and Amp-C producers.

Keywords: bacteriological, surgical site investigations (SSI), antibiogram

Introduction

Surgical site investigation (SSIs) are known to be one of the most common cause of nosocomial infections worldwide and accounts nearly 20% to 25 % of all nosocomial infections [1]. SSI is third most commonly reported nosocomial infection and they account for approximately a quarter of all the nosocomial infections [2]. There are various factors such as poor surgical techniques, degree of contamination, age, immune status, nutrition, hygiene practices that play important role in etiology of post-operative surgical site infections [3, 4].

SSI is usually caused by exogenous and/or endogenous microorganisms that may enter the operative wound either during surgery or after surgery. Primary infections that occur during surgery tends to be more serious with acute onset between 5 to 7 days [4], SSI may be either uncomplicated involving skin and subcutaneous tissue, they may even progress to necrotizing infections where patient may complain of pain with erythema and swelling along with pus formation [5, 6]. Despite improvement in prevention, SSIs remain as a significant clinical problem as they are associated with substantial mortality and morbidity and impose severe demands on the health care resources. Hence the present study has been undertaken with the aim to isolate different microorganisms from post-operative wound infection and to determine the rate of SSI along with antibiotic susceptibility pattern of these isolates.

Materials and Method

The study has been carried out for a period of 3 months from August 2018 to November 2018. All pus samples from patients clinically suspected of SSI were send for culture and sensitivity. Sample collection was done using all aseptic precautions. Sample were received from surgical wards (General Surgery, Obstetrics & Gynaecology and Orthopaedics department)

Two sterile cotton swabs were used for collection of sample from each patient suspected of having SSI. One swab was subjected to gram stain for provisional diagnosis, while the other swabs was used to inoculate blood agar and

MacConkey agar and incubated at 37℃ for 18-24 hours before being reported as sterile. Growth on culture plate was identified as per standard protocols [7]. Antibiotic susceptibility testing was done by Kirby bauer disk diffusion method on Mueller Hinton agar as per CLSI guidelines [8]. For MRSA detection, Cefoxitin disk diffusion method was used. For ESBL detection combined disk test was done. For MBL (Metallo beta lactamases) detection EDTA disc synergy test and Modified Hodge test was done. For Amp-c detection Amp-c disc test was done. All sample received in microbiology department for culture and sensitivity from patients suspected of SSI were included in the study. However, all the infections other than post-operative wound and growth of 3 or more different types of growth were not included in the study.

Results

A total of 418 samples from suspected case of SSI were received in microbiology department August 2018 to November 2018 out of which growth was seen in 296(70.81%) samples. So culture positivity rate is 70.81%., polymicrobial flora with 3 or more different types of growths was seen in 21 (5.02%) samples, while 101(24.16%) were reported as sterile if no growth was seen after 24 hours of incubation.

Males 178 (60%) were more commonly affected by SSI then females 118(40%) has shown in graph1.

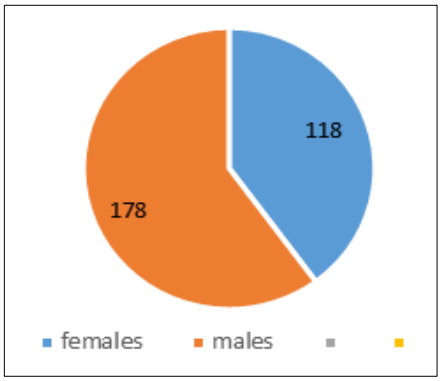

Fig 1: Showing Male & Female distribution in SSI's

Age wise & gender wise distribution showed majority of SSIs were seen in patients with age group more than 60 years (elderly patients) as shown in table 1

Table 1: Age & Gender Wise distribution in SSI's

Age (in year)	Male	Female	Total
1-14	14	15	29(9.7%)
15-30	30	18	48(16.21%)
31-45	51	20	71(24%)
46-60	28	17	45(15.2%)
More than 60	55	48	103(34.5%)
Total	178	118	296

Table 2: Bacteriological Profile of SSI's

Gram Negative Bacteria			Gram Positive Bacteria		
Organisms	**Total no (n=196)**	**Percentage (%)**	**Organisms**	**Total no (n=100)**	**Percentage (%)**
Klebsiella pneumoniae	36	18.4	*Staphylococcus aureus*	88	88
E. coli	50	25.51			
Acinetobacter baumannii	22	11.22	*Enterococcus faecalis*	12	12
Pseudomonas aeruginosa	50	25.51			
Proteus vulgaris	15	7.65			
Citrobacter koseri	23	11.73			
Total	196			100	

Among *Staphylococcus aureus* n=88. MRSA were 60, while MSSA were 28.

Table 3: Antibiotic susceptibility pattern among gram positive bacteria in SSI's

Drugs (µg)	*Staphylococcus aureus* (n=88)		*Enterococcus faecalis* (n=12)	
	S	**R**	**S**	**R**
Cefoxitin 30µg	28	60	NT	NT
Erythromycin 15µg	38	50	NT	NT
Clindamycin 2 µg	47	41	NT	NT
Vancomycin 30µg	88	0	12	2
Gentamicin 10µg	67	21	2	10
Ciprofloxacin 5µg	6	32	6	6
Penicillin 10µg	NT	NT	2	10
Tetracycline 30µg	NT	NT	3	9
Linezolid 30µg	88	0	12	0

(NT-Not tested, S- Sensitive, R- Resistant)

Table 4: Antibiotic susceptibility pattern among gram negative bacteria in SSI's.

Antimicrobial agents	*Acinetobacter Baumannii* (n=22)		*E. coli* (n=50)		*Klebsiella pneumoniae* (n=36)		*Citrobacter Koseri* (n=23)		*Proteus vulgaris* (n=15)		*Pseudomonas aeruginosa* (n=50)	
	S	**R**	**S**	**R**	**S**	**R**	**S**	**R**	**S**	**R**	**S**	**R**
Amikacin	7	15	37	13	18	18	8	15	6	9	38	12
Imipenem	11	11	42	8	12	24	5	18	5	10	40	10
Ciprofloxacin	3	19	18	32	16	20	3	20	9	6	32	18
Piperacillin tazobactam	6	16	22	28	14	22	5	18	8	7	30	20
Ceftazidime	3	19	9	41	14	22	4	19	8	7	30	20
Cefotaxime	2	20	11	39	7	29	18	5	11	4	25	25

Table 5: Antibiotic resistance in Gram negative bacteria in SSI's

Types of resistance	Total Nos.	Percentage (%)
ESBL	60	52.2
MBL	54	27.55
Amp-c	30	26.1

Discussion

In the present study out of 418 samples received 296(70.81%) showed growth, however polymicrobial flora with 3 or types of growth was considered inappropriate and advised for repeat sample with proper asepsis, so in the present study culture positivity rate is 70.81%. Studies done by Kanwalpreet Kaur *et al*. [9] reported 58% rate of SSI. While study done by Vikrant Negi *et al*. [10] reported 17.8% rate of SSI and Sandeep Bhaskarrao Kokate *et al*. [11] reported 49.57% rate of SSI. The present study shows high rate of SSI which may be attributed to the prolonged pre-operative stay, with exposure to hospital environment, instrumentation, duration of surgery and presence of co morbid illness. The present study reflects that there is major lapse towards infection control measures, inappropriate hand hygiene practices. We have conducted workshop on effective ways to prevent nosocomial infections along with importance of hand hygiene, and we have demonstrated steps of hand washing and importance of adhering to these practices among health care workers including doctors, nurses and other staff member further the study in under process about the rate of nosocomial infection after the workshop to evaluate effectiveness of workshop which will be indicated by fall in the rate of hospital acquired infection.

In the present study male patients 178(60%) were more commonly affected than female 118 (40%) from SSI which is in concordance with study done by Vikrant Negi *et al*[10]. however studies done by (5,6) have contrasting results as compared to the present study. The present study shows majority of cases of SSI in both genders were reported from age group of more than 60 years. Advancing age in an important factor of SSI, as in old patient low healing rate, decrease immunity and other co-morbid illness predispose to SSI. The present study is in concordance with study done by Vikrant Negi *et al*, [10] and Khan AKA *et al*, [13].

In the present study majority of isolates obtained from SSI were gram negative Bacteria n=196 (66.21%) as compared to gram positive bacteria n=100(33.78%). The most common organism isolated from SSI cases from present study was *Pseudomonas aeruginosa* 50 (25.51%), *E. coli* 50(25.51%) followed by *Klebsiella pneumoniae* 36(18.4%), *Citrobacter koseri* 23(11.73%), *Acinetobacter baumannii* 22(11.22%) and *Proteus vulgaris* 15(7.65%).

Among gram positive bacteria n=100(33.78%) MRSA were 60 while MSSA were 28. *Enterococcus faecalis* 12 were also isolated. The high incidence of gram negative organisms in SSI can be attributed to patients normal endogenous microflora [14].

Antibiotic susceptibility testing among gram negative bacteria showed high resistance among gram negative isolates obtained from SSI with sensitivity of 59% for Imipenem followed by Amikacin 58.2%, Piperacillin tazobactam 43.4%, ciprofloxacin 41.32%, cefotaxime 38% and ceftazadime 34%.

Multidrug resistance is dreadly problem in nosocomial infections. In the present study 81 (41.32%) isolates were resistance to Carbapenems (Imipenem) out of which 54 (27.5%) isolates were MBL producers while about 60(52.2%) isolates were ESBL producers and 30 (26.1%) isolates were Amp-c producers.

In the present study *Klebsiella pneumoniae* and *Acinetobacter baumannii* were found to be most multidrug resistance followed by *Citrobacter koseri* and *Proteus vulgaris*.

Among gram positive bacteria 100 % sensitivity was seen for vancomycin and Linezolid, among *Staphylococcus aureus* MRSA were 60 while MSSA were 28, sensitivity to Erythromycin was 57% Clindamycin 47%, ciprofloxacin 36.4%, Gentamicin 24%.

In Enterococcus faecalis high resistance was seen for penicillin and gentamicin as shown in table-3. Antibiotic sensitivity pattern may vary from country to country, between cities and even institutions which can be attributed to patient under study, local prescribing habits and misuse/overuse of drugs. Availability of over the counter drugs.

Conclusion

A better surveillance system is required to check if all infection control measures are followed failure to adhere to these measures may contribute to nosocomial infections therefore all guidelines and protocol should be followed along with bundle practices.

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