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Aerobic Bacteriological Profile of Post-Operative Surgical Wound Infections and Their Antibiogram in A Tertiary Care Hospital

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Abstract

Background And Objectives: *Post-operative wound infections are considered as the commonest nosocomial infections after urinary tract infections and are responsible for the increasing cost, morbidity and mortality prolongs hospital stay.*

Materials And Methods: *Pus samples/ wound swabs were processed and identified by colony morphology, Gram's stain and biochemical reactions. The antibiotic susceptibility tests were performed by CLSI recommended by Kirby-Bauer disc diffusion method.*

Results*: A total of 112 pus samples from post-operative wound infection from various departments were collected and processed in the department of Microbiology, during the study period. The most common microorganism isolated was Staphylococcus aureus (31.3%), followed by E.coli (26.1%), Pseudomonas sp (18%), CONS (8.2%), Klebsiella spp.(4.5%), Proteus sp.(3.7%), Enterobacter sp (3%), Streptococcus sp (2.2%), Citrobater freundii (1.5%) and Enterococcus sp.(1.5%). Among Gram negative isolates they showed sensitivity to only few available options like Imepenem (92.1%) followed by Amikacin(85.5%) and Piperacillin-Tazobactum (80.3%) and were resistant to most commonly used antibiotics. All Gram positive isolates found to be sensitive to Amikacin(89.7%), Linezolid(100%) and Vancomycin(100%).*

Conclusion: *The incidence of multi-drug resistant pathogens as a cause of postoperative wound infection is rising. Hence routine monitoring of drug susceptibility pattern helps to identify the resistance trends to suggest empirical treatment options to the clinicians.*

Key Words: *Post-operative wound infections, Nosocomial infection, Antibiotic susceptibility pattern, multi-drug resistant*

INTRODUCTION

A wound is the result of physical disruption of the skin, one of the major obstacles to the establishment of infections by bacterial pathogens in internal tissues. Infections can occur when bacteria breach this barrier[1]. The infection of a wound can occur when the organisms invade the tissues following a breakdown of local and systemic host defences. Wound infection has probably been a major complication of surgery and trauma. It has been demonstrated for at least 4000-5000 years[2].

Postoperative wound infections are considered as the commonest nosocomial infections after urinary tract infections and are responsible for the increasing cost, morbidity and mortality related to surgical operations accounting for 14 – 16% cases[3,4]. Surgical wound infection is a most common post-operative complication and causes significant postoperative morbidity and mortality, prolongs hospital stay and adds between 10% - 20% to hospital costs[5]. Due to significant changes in microbial genetic ecology, as a result of indiscriminate use of anti-microbials, the spread of antimicrobial resistance is now a global problem. Hence the present study was conducted with an objective to evaluate the antimicrobial susceptibility pattern among the most common bacteria which are associated with post-operative wound infections.

MATERIALS AND METHODS

The study was conducted at Department of Microbiology, during the period January 2012 to December 2012. A total of 112 pus samples from the clinically suspected postoperative wound infections were collected with aseptic precautions and were transported to the laboratory without delay.

The samples were cultured on Blood agar, Mac Conkey's agar and Nutrient agar. The agar plates were incubated at 37^0 C aerobically and examined for the presence of any growth after overnight incubation. Those plates showing no growth were further incubated for another 24 hours[5]. The isolates were identified based on their cultural characteristics and their reactions in standard biochemical tests. Antimicrobial susceptibility testing was done on Mueller Hinton Agar by Kirby Bauer disc diffusion method as per CLSI guidelines[6].

Following antibiotic disc with concentration were used for performing antibiotic sensitivity testing. Plates were incubated at 37^oc for 18 to 24 hours. Zone of growth inhibition was measured.

ANTIBIOTICS (GPC)	ANTIBIOTICS (GNB)
Ampicillin (10µg)	Amikacin (30µg)
Amoxycillin/clavulanic acid (20+10µg)	Gentamycin (10µg)
Erythromycin (15µg)	Ceftriaxone (30µg)
Clindamycin (2µg)	Ceftazidime (30µg)
Doxycycline (30 µg)	Pefloxacin (5 µg)
Ciprofloxacin (5µg)	Amoxyclav(20+10µg)
Co-trimoxazole (25µg)	Piperacillin Tazobactum (100+10 µg)
Gentamicin (10µg)	Imepenem (10 µg)
Amikacin (30µg)	
Ceftriaxone (30µg)	

RESULTS

A total of 112 pus samples from the clinically suspected postoperative wound infection from various departments like surgery, orthopaedics, obstetrics& gynaecology was collected and processed in the department of Microbiology, during the study period.

Out of 112 cases 82 cases were male and 30 female cases. The percentage in present series is 73.2% for males and 26.8% for females. In this study majority of the patients belonged to the age group between 41-60 years (Table.1).

Table.1: Age-Wise Distribution Of Post-Operative Wound Infections

AGE GROUP (Years)	NUMBER OF CASES	PERCENTAGE
0-10	1	0.9
11-20	6	5.4
21-30	16	14.2
31-40	23	20.5
41-50	28	25
51-60	33	29.5
>60	5	4.5
TOTAL	112	100

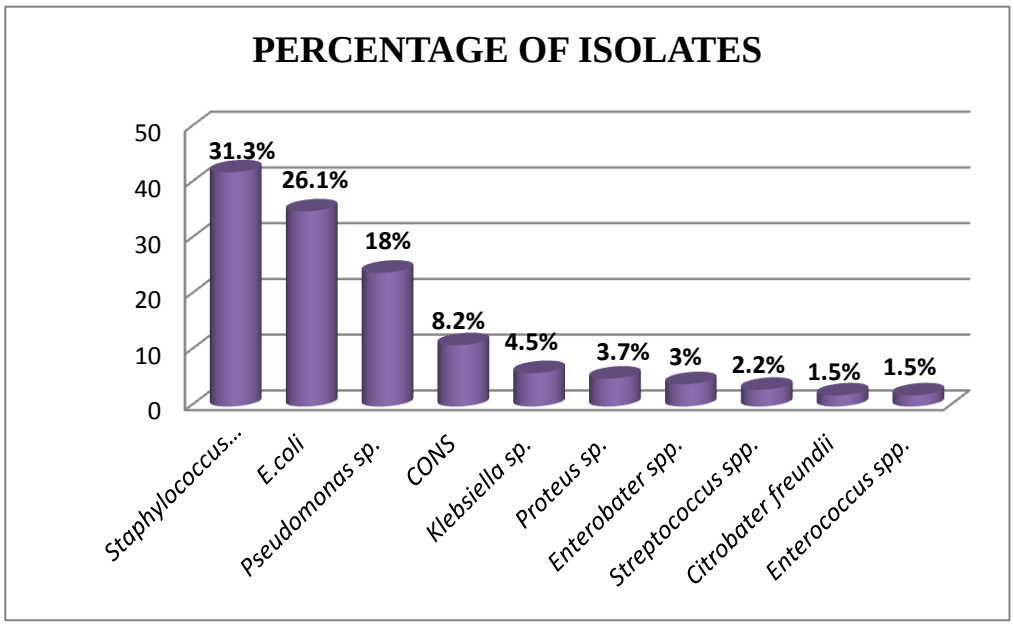
On direct microscopy of Gram stained smears of 112 samples, pus cells and organisms were seen in 92 samples and all of them were culture positive. In smears of 20 samples few pus cells and no organisms were seen but 12 yielded growth on culture. Out of 112 pus samples from surgical wound infections, culture yielded growth in 104 samples. Out of 104 culture positive samples, a total of 134 organisms were isolated, of which 58(43.3%) were Gram positive and 76(56.7%) were Gram negative. Out of 104 culture positive cases 30(28.8%) were polymicrobials and 74(71.2%) were monomicrobials.(Table.2)

Table.2 : Showing Gram Reaction And Direct Microscopy

		NUMBER OF ISOLATES	PERCENTAGE
GRAM REACTION	Gram positive	58	43.3
	Gram negative	76	56.7
	Polymicrobial	74	71.2
	Monomicrobial	30	28.8
		MICROSCOPY POSITIVE	CULTURE POSITIVE
DIRECT MICROCOPY	Pus cells+ GPC	28	28
	Pus cells+ GNB	39	39
	Pus cells+ GPC+GNB	25	25
	Pus cells + No organisms	20	12
	Total	112	104

Out of 134 bacterial isolates the most common was *Staphylococcus aureus* 42(31.3%), followed by *E.coli* 35(26.1%), *Pseudomonas sp* 24(18%), *CONS* 11(8.2%), *Klebsiella spp.*6(4.5%), *Proteus sp.* 5(3.7%), *Enterobacter sp* 4(3%), *Streptococcus sp* 3(2.2%), *Citrobater freundii* 2(1.5%), *Enterococcus sp.*2 (1.5%). (Graph.1)

Graph. 1: Organism-Wise Distribution Of Post-Operative Wound Infections



In this study, Gram negative isolates found to be susceptible to Imepenem (92.1%) followed by Amikacin(85.5%) and Piperacillin-Tazobactum (80.3%). All Gram negative isolates showed resistant to Pefloxacin (84.2%), Ceftriaxone (82.9%), Ceftazidime (80.3%), Amoxyclav (75%) and Gentamicin (52.6%). (Table.3)

Table. 3: Antibiotic Susceptibility Pattern Of Gram Negative Isolates (% Sensitivity)

Antibiotics	E.coli (n=35)	Pseudomonas spp.(n=24)	Klebsiella spp.(n=6)	Proteus spp.(n=5)	Enterobacter spp.(n=4)	Citrobater spp.(n=2)	Total n =76
Amoxyclav	9(25.7)	9(25)	1(16.7)	1(20)	1(25)	1(50)	19(25)
Ceftriaxone	8(22.9)	4(16.7)	1(16.7)	0	0	0	13(17.1)
Ceftazidime	9(25.7)	4(16.7)	0	1(20)	1(25)	0	15(19.7)
Gentamicin	18(51.4)	10(41.7)	3(50)	2(40)	2(50)	1(50)	36(47.4)
Amikacin	29(82.9)	21(87.5)	5(83.3)	4(80)	4(100)	2(100)	65(85.5)
Pefloxacin	7(20)	2(8.3)	2(33.3)	1(20)	0	0	12(15.8)
Imepenem	33(94.3)	33(94.3)	6(100)	5(100)	4(100)	2(100)	70(92.1)
Piperacillin-Tazobactum	26(74.3)	20(83.3)	5(83.3)	4(80)	4(100)	2(100)	61(80.3)

In this study, Gram positive isolates were found to be susceptible to Vancomycin (100%), Linezolid (100%), Amikacin (89.7%) and were resistant to Ampicillin (69%), Doxycycline(60.3%) and Erythromycin (55.2%) (Table.4)

Table. 4: Antibiotic Susceptibility Pattern Of Gram Positive Organisms (% Sensitivity)

Antibiotics	Staphylococcus aureus (n=42)	CONS (n=11)	Streptococcus sp.(n=3)	Enterococcus sp.(n=2)	Total n =58
Ampicillin	5(11.9)	8(72.7)	3(100)	2(100)	18(31)
Erythromycin	15(35.7)	6(34.5)	3(100)	2(100)	26(44.8)
Clindamycin	25(59.5)	10(90.9)	2(66.7)	2(100)	29(50)
Doxycycline	15(35.7)	5(45.5)	3(100)	0	23(39.7)
Ciprofloxacin	22(52.4)	7(63.6)	3(100)	0	32(55.2)
Co-trimoxazole	21(50)	9(81.8)	3(100)	2(100)	35(60.3)
Gentamicin	22(52.4)	5(45.5)	2(66.7)	2(100)	31(53.4)
Amikacin	37(88.1)	10(90.9)	3(100)	2(100)	52(89.7)
Ceftriaxone	19(45.3)	6(54.5)	3(100)	1(50)	29(50)
Amoxyclav	26(61.9)	9(81.8)	3(100)	2(100)	40(69)
Linezolid	42(100)	11(100)	3(100)	2(100)	58(100)
Vancomycin	42(100)	11(100)	3(100)	2(100)	58(100)

DISCUSSION

Post-operative surgical wound infections are common and consume a considerable portion of health care finances. Although surgical wound infections cannot be completely eliminated, a reduction in the infection rate to a minimum level could have significant benefits, by reducing postoperative morbidity and mortality and wastage of health care resources.

In our study it was found that males (73.2%) were more prone for post-operative wound infections than for females (26.8%). This could be due to increased mobility in male population. It was found that surgical wound infections are more common in patients above 50 years of age. It can be due to multiple factors like a low healing rate, malnutrition, mal-absorption, increased catabolic processes and low immunity[7]. Patel Sachin et al[8] and Narasinga et al[9] also recorded same trends. In our study majority of the patients belonged to the age group between 41-60 years.

In the present study of 112 clinically suspected postoperative wound infection 104 yielded aerobic bacterial growths accounting for a total of 134 organisms. Monomicrobial isolates were encountered in 74(71.2%) of the wounds. 30(28.8%) wounds yielded polymicrobials, Gram positive and Gram negative organisms were frequently involved in the mixed infections. *Staphylococcus aureus* and *E.coli* were commonest combination present in 8(26.7%) cases. According to Giacometti, et al[1], who isolated 1060 bacterial strains from 614 individuals. A single agent was identified in 271 patients (44.1%). Multiple agents were observed in 343 patients (55.9%). Polymicrobial infections frequently involved Gram positive and Gram negative organisms with *Staphylococcus aureus* and *Pseudomonas aeruginosa* being the most common association in 53 cases (15.7%). In a study done by Shruthi Malik et al[10], out of 202 postoperative wound swabs 194 showed bacterial

growth on culture and 8 were culture negative. Of the 194, 187 showed mono-microbial growth and 7 showed mixed infections with two bacterial isolates.

In the present study, *Staphylococcus aureus*, *Esherichia coli* and *Pseudomonas species* were the three commonest pathogens from postoperative wound infection, which is comparable to other studies like Jyothi Sonawane et al[11] and Mohanthy et al[12]

Most of our isolates were found resistant to the commonly used antibiotics. This is a matter of great concern because treatment of such infections warrants newer and costly antibiotics. In our study, Gram positive isolates were found to be resistant to Ampicillin (69%), Erythromycin (55.2%) and Ceftriaxone (50%). They were susceptible to Vancomycin (100%), Linezolid(100%), Amikacin (89.7%) followed by Co-trimoxazole (60.3%) and Ciprofloxacin (55.2%). Among Gram positive isolates, *Staphylococcus aureus* was found to be resistant to Ampicillin (88.1%), Erythromycin (64.3%), Doxycycline (64.3%), Ceftriaxone (54.7%). Most of the *S.aureus* strains isolated were sensitive to Linezolid and Vancomycin (100%), Amikacin 88.1% and Amoxyclav 61.9%. *Enterococcus* showed 100% resistant to Ciprofloxacin and Doxycycline.

In our study, Gram negative isolates showed resistant to Pefloxacin (84.2%), Ceftriaxone (82.9%), Ceftazidime (80.3%), Amoxyclav (75%) and Gentamicin (52.6%). Ceftriaxone, Ceftazidime and Pefloxacin were 100% resistant to *Citrobacter sp. Enterobater sp.* showed 100% resistant to Pefloxacin and Ceftriaxone. *Klebsiella sp.* showed 100% resistant to Ceftazidime. *Pseudomonas sp*. showed resistant to Pefloxacin (91.7%), Ceftriaxone and Ceftazidime (83.3%), Amoxyclav (75%) and Gentamicin (58.3%). *E.coli* showed resistant to Pefloxacin (80%), Ceftazidime and Amoxyclav (74.3%) and Ceftriaxone (77.1%). They were susceptible to Imepenem (92.1%) followed by Amikacin(85.5%) and Piperacillin-Tazobactum (80.3%).

In conclusion, the incidence of multi-drug resistant pathogens as a cause of post-operative surgical wound infection is rising. Here lies the importance of formulating an institutional antimicrobial policy and such a treatment policy if followed will lead to reduction in mortality, morbidity and health care cost associated with postoperative wound infection. Hence routine monitoring of drug susceptibility pattern helps to identify the resistance trends to suggest empirical treatment options to the clinicians.

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