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Original Research Article

Microorganisms causing wound infection and their antibiotic susceptibility pattern

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ABSTRACT

Background: Pyogenic infection is one of major causes of morbidity and increasing medical expense. Multiple organisms can cause wound infection. Drug resistant bacteria are the most important therapeutic challenge.
Methods: A prospective study was carried out from July 2021 to October 2021and pus samples were collected from suspected OPD and indoor patients with wound infection. The pus specimen after appropriate aerobic culture, the bacteria grown was identified by colony morphology, staining reaction and different standard biochemical tests. Modified Kirby Bauer disc diffusion method was used for the antimicrobial susceptibility testing.
Results: Out of 140 pus samples from wound infection of suspected patients, 88 (62.9%) showed bacterial growth and most of them were from male patients, 66 (64.70%). Most of the isolates were isolated from in-patient (52, 59.1%). *Staphylococcus aureus* was the most prevalent pathogen (38.6%) followed by *Klebsiella spp*. (22.7%). Most of the *S. aureus* were MRSA (32.4%) and sensitive to vancomycin, linezolid and teicoplanin. *Klebsiella spp*. and other Gram-negative bacteria isolates were mostly sensitive to imipenem and they were highly resistant to co-trimoxazole, cephalosporins.
Conclusions: The organisms mainly attributing for pyogenic wound infections are *S. aureus*, *Klebsiella* species. High level of drug resistance was seen for both Gram positive and Gram-negative bacteria. Continuous surveillance is necessary. As the microorganisms isolated were mostly resistant to different antibiotic classes, so effective surveillance and proper implementation of local antibiotic policy is needed.

Keywords: Antibiogram, Bacterial isolates, Drug resistance, MRSA, Pus

INTRODUCTION

Infections of hospital-acquired wounds are among the leading nosocomial causes of morbidity and increasing medical expense. Multiple organisms can cause wound infection ranging from bacteria to fungi and parasites as well as virus.[1] The most common organisms are *S. aureus*, *P. aeruginosa*, *E. coli*, *Klebsiella spp.* and *Acinetobacter spp.*[2,3] For the treatment of infection, it is ideal to give proper antibiotic after culture and sensitivity of the wound swab, pus or infected tissue. The timing of administration, choice of antimicrobial agent, durations of administration of antibiotics is of much importance in reducing wound infections.[4] But improper and irrational use of antibiotics and genetic and non-genetic drug resistant mechanisms of bacteria lead to drug resistance of which MRSA and ESBL producing gram negative bacteria are the most important therapeutic challenge in the field of infectious diseases.[5, 6]

So, the objective of this study is to know the prevalence and antibiotic susceptibilities patterns of bacterial isolates from pus samples.

METHODS

A prospective study was carried out from July 2021 to October 2021 in Department of Microbiology at Government Medical College, Jagdalpur, Chhattisgarh and samples were taken from the patients came for treatment to the surgery department.

Inclusion criteria

A total of 140 suspected OPD and Indoor patients with wound infection, prior to antibiotic treatment pus samples were collected after taking proper consent from patients and Institute ethical clearance.

Exclusion criteria

The patients who had not given voluntary consent to take the sample or those having antibiotic treatment were excluded from this study group.

The pus specimen was streaked on MacConkey agar and blood agar plates and incubated at 37ºC for 24 to 48 hours. The isolates grown on culture were identified by colony morphology, staining reaction, catalase test, coagulase test, motility, oxidase test and the standard biochemical tests. Modified Kirby Bauer disc diffusion method was used for the antimicrobial susceptibility testing. Statistical software SPSS version was used to study the computer data. Chi-square test was used to calculate probabilities and determine significance. A p-value of less than 0.05 was considered to be statistically significant.

RESULTS

Out of 140 pus samples from wound of patients with suspected pyogenic infection, 88 (62.9%) showed bacterial growth whereas 52 (37.1%) were growth negative. Out of 80 samples from in patient department (IPD), 52 (65%) showed bacterial growth and among 60 samples from outpatient department (OPD), 36 (60%) samples showed bacterial growth (Table 1).

Table 1: Distribution of culture positive cases in OPD and IPD.

Patient type	Culture positive (%)	Culture negative (%)	Total
IPD	52 (65)	28 (35)	80
OPD	36 (60)	24 (40)	60
Total	88 (62.9)	52 (37.1)	140

Among 102 (72.85%) male patients and 38 (27.15%) female patients, 66 (64.70%) and 22 (57.89%) were found growth positive respectively. The result was statistically significant (Table 2). Among 88 positive cases the highest positive cases 30 (34.09%) was found in the patients of age group 41-50 years.

Table 2: Age and gender wise distribution of samples.

Age group (years)	Male		Female		Total cases	
	Total	Positive	Total	Positive	Total	Positive (%)
1-10	2	0	2	0	4	0 (0)
11-20	10	6	8	6	18	12 (13.63)
21-30	24	14	12	4	36	18 (20.45)
31-40	16	8	8	4	24	12 (13.63)
41-50	30	24	6	6	36	30 (34.09)
51-60	14	10	2	2	16	12 (13.63)
Total	102	66	38	22	140	88

Table 3: Distribution of isolates among in-patient and outpatient.

Organisms	In patient		Out patient		Total	
	Frequency	%	Frequency	%	Frequency	%
S. aureus	20	58.8	14	41.2	34	38.6
CONS	2	50	2	50	4	4.6
Enterococcus spp.	4	66.7	2	33.3	6	6.8
Proteus	8	100	0	00	8	9.1
Klebsiella spp.	14	70	6	30	20	22.7
E. coli	0	00	2	100	2	2.3
Pseudomonas spp.	2	33.3	4	66.7	6	6.8
Citrobacter spp.	2	25	6	75	8	9.1
Total	52	59.1	36	40.9	88	100

Table 4: Antibiotic sensitive pattern of Gram-positive isolates.

Antibiotics	*S. aureus* (34)		CONS (4)		*Enterococcus* (6)	
	Sensitive		Sensitive		Sensitive	
	No.	%	No.	%	No.	%
Amoxy-clav	22	64.7	2	50	4	66.7
Erythromycin	16	47.1	2	50	-	-
Penicillin	11	32.4	1	25	3	50
Ceftriaxone	15	44.1	1	25	4	66.7
Cefoxitin	23	67.6	3	75	-	
Teicoplanin	28	82.4	4	100	6	100
Vancomycin	34	100	4	100	6	100
Amikacin	29	85.3	4	100	4	66.7
Ciprofloxacin	17	50	1	25	4	66.7
Linezolid	32	94.1	4	100	6	100

Table 5: Antibiotic susceptibility pattern of Gram negative isolates.

Antibiotics	*E. coli* (2)		*Klebsiella* (20)		*Proteus* (8)		*Citrobacter* (8)		*Pseudomonas* (6)	
	S	%	S	%	S	%	S	%	S	%
Imipenem	2	100	17	85	6	75	6	75	5	83.3
Gentamycin	1	50	15	75	5	62.5	6	75	4	66.7
Cotrimoxazole	0	0	5	25	3	37.5	4	50	1	16.7
Ceftazidime	1	50	7	35	3	37.5	3	37.5	2	33.3
Cefotaxime	1	50	8	40	4	50	3	37.5	3	50
Ciprofloxacin	2	100	10	50	5	62.5	4	50	3	50
Cefoperazone+sulbactam	2	100	10	50	4	50	5	62.5	3	50
Amoxicillin+clavulanic acid	2	100	9	45	4	50	4	50	2	33.3

Among 88 bacterial isolates, Gram negative bacilli and Gram-positive cocci contributed equally with 44 numbers and 50% each of the total isolates. All together 8 different bacterial species were isolated, among which *S. aureus* (38.6%) was the predominant one followed by *Klebsiella spp*. (22.72%). Of the 88 isolates, most of them were isolated from IPD (52, 59.1%) and rest were from OPD (36, 40.9%) (Table 3).

S. aureus strains were mostly sensitive to vancomycin (100%), linezolid (94.1%) and teicoplanin (82.4%); 32.4% of them were cefoxitin resistant (MRSA stains). All CONS and Enterococci were sensitive to vancomycin, teicoplanin and linezolid (Table 4).

Klebsiella spp. and other Gram-negative bacteria isolates were mostly sensitive to imipenem and they were highly resistant to co-trimoxazole, cephalosporins (Table 5). The non-β-lactam antibiotics imepenem, fluoroquinolones and aminoglycosides showed better sensitivity to these organisms.

DISCUSSION

Wound infection is regarded as the most common nosocomial infection among surgical patients.[7] It has been associated with increased trauma care, prolonged hospitals stay and treatment.[8] In this study the incidence of wound infection was more common in men (72.9%) than in women (27.1%) and is similar to result as reported by another worker.[9] Isolation rate was also higher in males (66, 64.70%) than in females (22, 57.89%) as reported by other workers.[9,10] This can be explained by the fact that male persons are mainly involved in non-domestic occupations such as farming, construction, transportation or industry work where the potentiality for trauma is common.

As per various studies, the predominant bacteria attributing for pyogenic infection varied. Gram positive bacteria have been described as the major cause for pyogenic wound infections in several literatures (57.4%, 61%).[11,12] In contrast, in this study both Gram positive cocci and Gram-negative bacilli had contributed equally (44, 50% each). In other studies, Gram-negative bacteria were the dominant isolates (60-77%).[13-16] Among the isolates, in the present study *S. aureus* (38.6%) were predominant pathogen followed by *Klebsiella spp*. (22.72%). Similar finding was also observed by another Indian study where *S. aureus* was the main isolate (32%) and then the *Klebsiella spp*. (13%).[17] Other workers had also similar finding with *Staphylococcus aureus* as the predominant isolate (30.9-60.6%).[11-13] Since *Staphylococcus aureus* is the normal flora of nostrils, the

high prevalence of *S. aureus* infection may be because it is an endogenous source of infection. Infection with this organism may also be due to contamination of surgical instruments. With the disruption of natural skin barrier *S. aureus* easily find their way into wounds. In this study, *Staphylococcus aureus* was the most prominent pathogenic bacteria and *Klebsiella spp*. was the second common microorganism isolated. But in some studies *E. coli* was the predominant pathogen among the Gram-negative bacteria.[13,14]

Most of the *S. aureus* were sensitive to vancomycin (100%), linezolid (94.1%), and teicoplanin (82.4%) which is in consistent with study by other workers[13,17]and 32.4% were cefoxitin resistant MRSA strains.[13,17] It was 48.9% in one Indian study.[15] But MRSA was 13.3% in another study.[16]

Klebsiella spp. and other Gram-negative bacteria isolates were mostly sensitive to imipenem and they were highly resistant to co-trimoxazole, cephalosporins.

As reported by other worker, in this study also existence of high drug resistance to multiple antibiotics in various isolates from pus samples.[17] This may be due to negligence on patients' side, irrational use of antibiotics, self-prescription and limited awareness among clinicians about drug resistant strains. So, adherence to strict antibiotic policy along with local antibiogram data can strengthen the proper use of appropriate antibiotics and can overcome the challenge of multidrug resistance.

This study has some limitations. More number of studies is required. Molecular characterization of MDR bacterial isolates would have generated more useful epidemiological results.

CONCLUSION

The objective of this study is to identify the antimicrobial susceptibility pattern. AMR monitoring is not performed regularly in different hospitals, so data on AMR is minimal, thus creating a knowledge gap. So, studying the antimicrobial resistance patterns can be helpful for knowing an antibiogram that will be used in hospital. Pyogenic wound infections were mainly caused by *S. aureus*, *Klebsiella spp*, and *Citrobacter* and *Proteus species*. High level of drug resistance was seen for both Gram positive and Gram-negative bacteria. Continuous surveillance is necessary to provide the most appropriate dose regimen and treatment schedule against pyogenic wound infections and to limit the expanding menace of drug resistance.

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