Original research article

Bacteriological Profile and Antimicrobial Susceptibility Pattern of Pus Culture Isolates from a Tertiary Care Hospital, SMS Medical College Jaipur

Shivra Batra[1], Veena Balothia[2], Sunita Agarwal[3], Rajni Sharma[4]

[1] Assistant Professor, Department of Microbiology, Sawai Man Singh Medical College, Jaipur - 302004, Rajasthan, India
[2] Associate Professor, Department of Microbiology, Sawai Man Singh Medical College, Jaipur - 302004, Rajasthan, India
[3] Assistant Professor, Department of Microbiology, Sawai Man Singh Medical College, Jaipur - 302004, Rajasthan, India
[4] Senior Professor, Department of Microbiology, Sawai Man Singh Medical College, Jaipur -302004, Rajasthan, India
Corresponding Author: Veena Balothia

Abstract

Objective: This study was aimed to assess bacterial isolates and their drug susceptibility patterns from patients with pus and/or wound discharge .In spite of advances in control of infections, the widespread uses of antibiotics, together with the length of time over which they have been available have led to major problems of resistant organisms contributing to morbidity and mortality.

Methods: A retrospective study was conducted at SMS medical college Jaipur where samples from all individuals who present with pus and/or wound discharge was collected and processed, from March 2019 to 7502February 2021.

Result: A total of 2237 study subjects were included in the study with bacterial isolation rate of 1902 (85.02%). Of all, 1116 (58.6%) were males.448 (23.56%) of the isolates were gram positive and 1454 (76.44%) were gram negative. Among the isolates ,Pseudomonas was 33.59%, Klebsiella spp. 19.72% ,Esherichia coli 11.82% , Staphylococcus aureus 10.15%, Coagulase Negative staphylococci 10.05% and enterococcus spp. 3.36%.

Conclusion: High prevalence of bacterial isolates were found; PSEUDOMONAS being the dominant. Most of the isolates were resistant to many of the antibiotics tested Antibiotic susceptibility test is necessary for effective control of wound infections.

Keywords: Pus isolates, Bacteriological profile, Antibiotic sensitivity patterns

Introduction

Pus formation is one of several cardinal indicators of suppurative infections caused by pyogenic bacteria, resulting in aggregation of dead leukocytes, bacteria and tissue debris.[1]Pyogenic infection is caused by several local Inflammatory factors. It usually presents with formation of pus. Pyogenic bacteria are most common cause of pus.[2] Pyogenic infections may be endogenous or exogenous. Pyogenic infections are a significant group of infections caused by pathogens, exogenously or endogenously, during or after trauma, burns and surgical procedures.[3]These result in the production of pus[3]. A break in the skin can provide entry to the surface bacteria which thereby start multiplying locally. The body's defence mechanism includes bringing immune cells into the area to fight against bacteria. Eventually, accumulation of these cells produces pus which is a thick whitish liquid.[4]Both aerobic and anaerobic bacteria have been implicated in wound infections which occur under hospital environment and they result in significant morbidity, prolonged hospitalization and huge economic burden.[5] Antibiotic resistance among bacteria is becoming more and more serious problem throughout the world. Antibiotic resistance emerges commonly due to irrational use

of empiric antimicrobial drugs. Monitoring of resistance patterns has become essential in the hospital to overcome these difficulties and to improve the early treatment of serious infections in hospital.[6] Though the bacterial profile from pus samples remain similar in various studies, but there is a considerable variation in the antibiotic susceptibility pattern of theses isolates highlighting the increasing threat of emergence of resistant bacteria and hence a need for a continuous surveillance of such changing trends. The present study was undertaken to know the bacteriological profile and antibiotic susceptibility patterns of pathogens causing pyogenic infections in our hospital in order to help clinician formulate an empirical treatment for the patients.

Aims and Objectives
1. To identify and characterize aerobic bacterial pus isolates .
2. To determine antimicrobial sensitivity patterns of the isolates.

Materials and Methods
This retrospective study was conducted in the Department of Microbiology at SMS Medical College, Jaipur from March 2019 to February 2020 for a period of one (01) year. All patients who presented with skin and soft tissue infection were selected as study population. The pus samples were collected from the patients who visited in outpatient department or those admitted at IPD in SMS Medical College, Jaipur. Pus samples were collected from skin (furuncles, pustules, and abrasions), nasal wounds, ears, legs. Pus samples were processed for Gram staining and culturing. The samples were aseptically inoculated on Blood agar and Mac Conkey agar plates, incubated aerobically at 35°C–37°C for 24–48 h. Identification and characterization of isolates were performed on the basis of Gram staining, microscopic characteristics, colony characteristic, and biochemical tests using standard microbiological methods. Antiobiotic discs containing Amikacin (30mcg), Ampicillin(10mcg), Ceftazidime(30mcg), Ciprofloxacin(5mcg), Clindamycin(2mcg), Erythromycin(15mcg), Gentamicin(10mcg), Imipenam(10mcg), Polymyxin(300 U), Linezolid(30mcg), Trimethoprim sulphamethoxazole(1.25/23.75), Cefoperazone sulbactum(75/10), Clindamycin(2mcg),Doxycyline(10mcg),Cefepime(30mcg)Cefoxitin(30mcg),Teicoplanin(30 mcg),Tobramycin(10mcg), piperacillin tazobactum(100/10), and vancomycin (30mcg) were obtained from Himedia Laboratories and used as per manufacturer's instructions. Antibiotic susceptibilities of bacterial isolates were determined by disc diffusion test recommended by the Clinical and Laboratory Standards Institute[13]

Statistical analysis   Data was analysed by descriptive statistical analysis methods, Frequency distribution,Chi square test and significant p value <0.05

Results
A total number of 2237 patients presented with wound infection or pus were recruited for this study. Among 1902 culture positive patients(85.02%),majority were in the age group of 21 to 30 years which was 341 cases followed by 31-40 years and than 11- 20 years which was 287   and 229 cases respectively .Interestingly male was predominant than female which was 1116 (58.6%) and 786(41.4%) cases respectively .The male and female distribution in the most common age group of 21 to 30 Years was 207 and 134 cases respectively (Table 1). Out of 2237 cases, aerobic culture was positive in majority cases which were 1902 (85.02%)cases and the rest of 335 (14.98%) cases were growth negative. Therefore culture positive was more than no growth which was shown in this result and reflected the laboratory authenticity. Pseudomonas was the most common isolated bacteria(33.59%) from pus which was followed by klebsiella(19.72%) and Esherichia coli (11.82%).(Table2)

Table 1: Age and gender distribution of study population

AGE GROUP	MALE	FEMALE	TOTAL
0-10	108	73	181
11-20	129	100	229
21-30	207	134	341
31-40	172	115	287
41-50	123	83	206
51-60	121	95	216
61-70	113	65	178
71-80	74	62	136
80-90	69	59	128
Total	1116(58.6%)	786(41.4%)	1902(100%)

Figure within the parenthesis indicates percentage.

Table 2: Rate of isolated bacteria after Aerobic culture

BACTERIAL ISOLATED	FREQUENCY	PERCENTAGE
Pseudomonas	639	33.59%
Klebsiella	375	19.72%
Escherichia Coli	225	11.82%
Coagulase Positive Staphylococcus	193	10.15%
Coagulase Negative Staphylococcus	191	10.05%
Enterobacter cloacae	90	4.73%
Acinitobacter	72	3.79%
Enterococcus	64	3.36%
Proteus Mirabilus	47	2.48%
Proteus Vulgaris	6	0.31%
TOTAL	1902	100%

Table 3: Percentage Sensitivity pattern of various Gram negative bacilli

Antibiotics	Acinitobacter % Sensitive	E.Coli % Sensitive	Enterobacter % Sensitive	Kleibsiella % Sensitive	Proteus Vulgaris % Sensitive	Proteus Mirabillis % Sensitive
Amikacin	23.6	46.2	28.9	22.7	27.7	16.7
Ampicillin	6.9	6.3	5.6	2.4	2.3	0.0
Ceftazidime	6.9	7.3	5.0	6.3	2.7	20
Ciprofloxacin	15.3	10.2	22.2	15.4	19.1	33.3
Gentamicin	25.0	41.6	28.4	21.6	21.3	33.3
Imipenem	25.6	15.1	25.2	25.4	24	26.7
Polymyxin	100	94.2	96.6	94.1	---	--
Trimethoprim sulphamethoxazole	31.0	17.4	19.1	18.8	17.0	20.0
Tigecycline	100	100	100	100	100	100
Piperacillin Tazobactum	25.7	37.5	33.7	26.5	74.5	66.7

Table 4: Sensitivity pattern of Pseudomonas

Antibiotics	Pseudomonas % sensitive
Amikacin	19.9
Aztreonam	21.7
Ceftazidime	8.7
Ciprofloxacin	20.1
Colistin	98.3
CefoperazoneSalbactum	100
Gentamicin	16.8
Imipenem	12.5
Tobramycin	25.2
PiperacillinTazobactum	35.3

Table 5: Sensitivity pattern of various Gram positive COCCI

Antibiotics	Coagulase Positive Staphylococcus % Sensitive	Coagulase Negative Staphylococcus % Sensitive	Enterococcus % Sensitive
Ampicillin	0.0	0.5	50.0
Ciprofloxacin	15.1	35.1	68.8
Clindamycin	46.2	41.7	-
Doxycycline	92.6	-	54.1
Erythromycin	15.8	20.7	1.6
Cefepime	11.4	17.1	-
Cefoxitin	7.4	17.6	-
Gentamicin	72.2	73.7	-
Linezolid	100	100	80.6
Trimethoprim sulphamethoxazole	31.7	53.7	31.7
Teicoplanin	91.5	94	82.3
Vancomycin	100	100	93.9

Discussion

Existence of high drug resistance bacterial infection of wounds is a serious problem in the hospital, especially in surgical practice.[7,8] In this study, culture positivity is 85.02% which correlates well with Mita D etal[9](85.5%) but is different as compared to M.Subha etal[10] (56.6%).In this study highest occurrence were observed in male (58.6%)as compared to female(41.4%). Findings were similar to other authors like Rashida Akter Khanam et al[11] and Rozina Arshi Khan etal[12] showed occurance in males 56.1% and 56.6% respectively. In the present study Gram-negative bacteria were the dominant isolates 76.44% from pus samples

compared to Gram-positive bacteria 23.56%, which are in agreement to several earlier studies. Our findings correlate with Zhang et al[13] who reported predominance of E. coli , K. pneumoniae, and P. aeruginosa in pus samples. In another study, S. aureus was the dominant bacterial species from wounds followed by P. aeruginosa, P.mirabilis, E. coli, and Coryne bacterium spp. L. J. Bessa et al[14] According to Dryden[3], S. aureus is the major cause of soft tissue infections in hospitalized patients. Antimicrobial sensitivity profile showed most of the gram negative isolates as multi-drug resistance. Among gram positive cocci, 92.6% isolates of Staphylococcus aureus were resistant to Cefoxitin (MRSA) but all were sensitive to Vancomycin. These finding were in agreement with those in Nepal, and Italy where, 60.6%, 74.2% of Staphylococcus aureus were found to be Methicillin resistance, respectively (Khanal LKetal[15],Giacometti Aetal[16]). Staphylococcus aureus also showed a 100% sensitivity to linezolid which correlated with Rozina Arshi Khan etal.[12] Pseudomonas. was the most predominant organism 33.59% followed by klebsiella but other workers like Dr. R. Sarathbabu etal. (2012)[17], KrituPanta etal(2013)[18] , Rajeshwar Raoetal. (2014)[10] K.N.Ravichitra (2014) [19] and Rozina Arshi Khan etal(2018)[12] have found Klebsiella spp. as the predominant organism present in wound infection. Other workers like A.Ananth and S. Rajan (2014)[20], has shown Pseudomonas as second most disease causing organism. However many workers have found Pseudomonas as the most predominant organism in their studies like Farzana R etal. (2013)[21], and SoumyaKaup and Jaya Sankarankutty (2014)[22]. Pseudomonas aeruginosa is   12.5% sensitive to Imepenem, and 19.9% to Amikacin ,35.3% sensitivity to PiperacillinTazobactum , 8.7% to Ceftazidime, 20% to Ciprofloxacin but 98.3% sensitivity to colistin and 100% sensitivity to cefoperazone salbactam. Staphylococcus aureus has been reported as a predominant organism by Mita D etal[9], M.Subha etal[10]and Rashida Akter Khanam etal.[11]

        Klebsiella pneumoniae the next common isolate is 25.2% sensitive to Imepenem, 22.7% toAmikacin and 6.3% to Ceftazidime, 15.4% to Ciprofloxacin,94% sensitive to polymixin 100% sensitive to Tigecycline .Escherichia coli 11.82% in the present study was conspicously found to be resistant to ampicillin (93.7%), Cephalosporins (92.7%) and co-trimoxazole (82.6%) cases. Similar results were also shown by other studies nationwide (BiradarAetal[23], Roopa etal[24], Rugira Trojan etal[25]) These MDR strains were found to be sensitive mainly to Tigecycline and Polymyxin. Multidrug resistant bacteria are emerging worldwide which causes major public health problems and challenges to health care.. Staphylococcus aureus is 100% sensitive to vancomycin, 100% to Linezolid, 72.2% to gentamicin, 15.1% to ciprofloxacin, 15.8% to erythromycin and 31.7% sensitive to Cotrimoxazole.. Enterococcus showed 80.6% sensitivity to linezolid and 93.9% sensitivity to vancomycin The prevalence and antibiotics resistance patterns of pyogenic bacterial isolates usually exhibit variability according to geographic areas and climate conditions. Existence of high drug resistance to multiple antibiotics in E. coli, S. aureus, K. pneumoniae, and P.aeruginosa isolates from pus samples in this study and several other related reports points towards negligence on patients part, incomplete treatment schedules, antibiotics misuse, selfprescription, misprescription, lack of regional antibiogram data, and limited knowledge about multidrug-resistant isolates and antimicrobial resistance among clinicians. Updated knowledge of antimicrobial susceptibility profiles of clinical isolates will not only assist in designing the most appropriate dose-regimen and treatment schedule against wound infections but also help in curbing the alarmingly expanding menace of drug resistance

        The risk factors associated with infection by multidrug resistant organisms were commonly age, sex, previous antibiotic therapy, previous hospitalization, increased length of stay in the hospital, patient comorbidities like immunosuppression, chronic liver disease, heart disease etc. and general medical condition..Increase in the number of resistant

organisms through the years may be due to the spread of the resistant genes among the organisms. As our Institute is a tertiary care center majority of the patients get admitted after being treated from outside hospitals where most of the patients had severe infections and they were treated with higher class of antibiotics in other hospitals which may lead to the growth of multidrug resistant pathogens. Proper control over usage of antibiotics and infection control measures starting from primary health care centers to tertiary levels would help in the control of infection with resistant pathogens.

Conclusion

This study emphasizes to understand the common organisms isolated from wound infections and it helps in empirical treatment of patients based on antibiotic susceptibility patterns. Although wound infections cannot be eradicated completely, proper wound care, and its management and above all implementation of infection control measures by following strict hand hygiene practices, education about the spread of bacteria through contaminated hands and environment would lead to a decrease in infections with resistant organisms which would be a burden to both the hospital and the patient. Antimicrobial susceptibility of microorganisms varies from time to time and from place to place. Hence regular monitoring of bacterial susceptibility to antibiotics is essential. Antibiograms should be prepared regularly and made readily available to the clinicians to guide them in therapy.

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