ORIGINAL ARTICLE

Antibiotic Susceptibility Pattern of Bacterial Isolates from Wound Infections in a Tertiary Care Hospital

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ABSTRACT

Introduction: The human skin and soft tissue infections (SSTIs) caused by microbial pathogens during or after trauma, burn injuries, and surgical procedures result in the production of pus. Wound infections which commonly occur under hospital environment result in significant morbidity, prolonged hospitalization, and huge economic burden. The emergence of antibiotic resistance and its rapid spread among bacterial isolates are considered as grave threats to the public health worldwide. The objective of this study was to characterize the pyogenic bacteria from pus samples and to determine their antibiotic susceptibility

Materials and Methods: Various samples received from inpatients of different surgical wards over a period of one year from January 2016 to December 2016 were included in study, Samples were processed for Gram staining and culture. The samples were aseptically inoculated on blood agar and MacConkey agar plates, incubated aerobically at 35°C–37°C for 24–48 h. Identification and characterization of isolates were performed using standard microbiological methods. Antibiotic susceptibilities of bacterial isolates were determined according to the method recommended by the Clinical and Laboratory Standards Institute.

Results: Of the 2045 samples received, a total of 1028 isolates were obtained. Culture positivity of pus samples was 50.2%. *E. coli* (33.8%) was the most frequent pathogen followed by *K. pneumoniae* (20.4%), *S. aureus* (19.2%), *P. aeruginosa*(9.3%). Gram-negative isolates were predominant isolates as compared to Gram-positive isolates. Antibiogram results showed that *E. coli* and Klebsiella spp. were more resistant to cephalosporins, ciprofloxacin while being least resistant to imipenem, tigecycline. *P. aeruginosa* was more susceptible to piperacillin tazobactam, amikacin, imipenem. All isolates of *S. aureus* were susceptible to vancomycin (100%) & linezolid (100%).

Conclusion *E. coli* was the commonest isolate followed by *K. pneumoniae, S. aureus, P. aeruginosa,* Bacterial isolates exhibited high to moderate levels of resistance against different classes of antibiotics. The susceptibility data may be helpful in implementing empiric treatment strategies for pyogenic infections.

KEYWORDS: Wound infection, Gram positive, Gram negative, Susceptibility

INTRODUCTION

Skin abrasions due to surgical procedures, trauma, burns, diseases, and other factors affect this first line of defense and leads to microbial contamination resulting in infections.[1]

The human skin and soft tissue infections (SSTIs) caused by microbial pathogens during or after trauma, burn injuries, and surgical procedures results in the production of pus, a white to yellow fluid produced during an inflammatory pyogenic infection due to bacteria which is comprised of dead WBCs, cellular debris, and necrotic

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tissues.[2-4]

In spite of advances in control of infections, wound infections have not been completely controlled due to many reasons. The overall incidence of wound sepsis in India is from 10% to 33%.[5,6]

Both aerobic and anaerobic bacteria have been implicated in wound infections which commonly occur under hospital environment and result in significant morbidity, prolonged hospitalization, and huge economic burden.[7]

Knowledge of these causative agents of wound infection has proven to be helpful in the selection of appropriate antimicrobial therapy and on infection control measures taken in health institutions.[8]

Fairly consistent studies have always been done all over the world to show a predictable bacterial profile and the antibiogram in their respective areas. This makes an important observation for a clinician who intends to give empirical treatment to his patients while laboratory culture reports are awaited.[9]

But despite advances in methods to control infections, wound infections have not been completely prevented due to the problem of drug resistance.[10] 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.[11] But on account of erratic use, malpractices or for natural causes, in recent years, drug resistance to many human pathogenic bacteria is being commonly reported from all over the world.[12]

During the last few decades, multidrug-resistant Gram-negative bacterial strains such as *Acinetobacter baumannii, E. coli, Klebsiella pneumoniae, Pseudomonas aeruginosa,* and Gram-positive methicillin-resistant *Staphylococcus aureus* (MRSA) were increasingly associated with pus infections under hospital settings due to extensive misprescription and inadequate dose regimen of antibiotics.[13-15] Rapid emergence of multidrug-resistant bacteria poses a serious threat to public health globally due to the limited treatment options and lukewarm discovery of new classes of antibiotics.[15,16]

The objective of this study is to characterize the pyogenic bacteria from wound samples and to determine their antibiotic susceptibilities to various antibiotics commonly used.

MATERIAL AND METHODS

Pus, necrotic tissue and swabs from wound infections received from inpatients of different surgical wards over a period of one year from January 2016 to December 2016 were included in study. The samples were processed for Gram staining and culture. The samples were aseptically inoculated on blood agar and MacConkey agar plates, incubated aerobically at 35°C–37°C for 24–48 h. Identification and characterization of isolates were performed using Gram staining, motility and various biochemical reactions.[17]

Antibiotic susceptibility of bacterial isolates was determined according to the method recommended by the Clinical and Laboratory Standards Institute. Inoculum (0.5 McFarland) was prepared and lawn culture was done on Muller-Hinton agar plates. Antibiotic discs were placed and plates were incubated at 37°C for 24 h. The zones of inhibition were measured. Isolates were classified as sensitive, intermediate, and resistant according to CLSI guidelines.(18). Isolates were characterized into MDR and XDR.

RESULTS

Of the 2045 pus samples received, a total of 1028 isolates were obtained. Culture positivity of pus samples was 50.2%. Gram-negative isolates (77.2%) were predominant isolates from pus samples as compared to Gram-positive isolates (22.8%). *E. coli* (33.8%) was the most frequent pathogen followed by *K. pneumoniae* (20.4%), *S. aureus* (19.2%), *P. aeruginosa* (9.3%). (Fig. 1) Antibiogram results showed that *E. coli* and Klebsiella isolates were more resistant to cephalosporins, ciprofloxacin while being least resistant to imipenem, tigecycline. *P. aeruginosa* was more susceptible to piperacillin tazobactam, amikacin, imipenem. (Fig. 2) Majority of Gram negative isolates were MDR (83.5%), 25.3% isolates were XDR. All isolates of *S. aureus* were susceptible to vancomycin (100%) and linezolid (100%), followed by 87.2% susceptibility to gentamicin, >70% to erythromycin & clindamycin, 55.6% to ciprofloxacin, 50 % to amikacin & cotrimoxazole and 21.4 % to penicillin. Out of 196 *S. aureus* isolates, 52 (26.5%) were MRSA (Table 1)

DISCUSSION

In our study, a total of 1028 isolates were obtained from 2045 samples received. Gram-negative isolates were predominant isolates from pus samples as compared to Gram-positive isolates. *E. coli* (33.7%) was the most frequent pathogen followed by *K.pneumoniae* (20.4%), *S. aureus* (19.1%), *P. aeruginosa*(9.3%).

A study from Andhra Pradesh reported 40% Gram-positive cocci and 60% Gram-negative isolates in their study. *E. coli* followed by Klebsiella was also the most common Gram-negative bacteria isolated from the pus samples in their study.[19]

Such Gram-negative bacterial dominance in the

Table 1 Antibiotic Susceptibility profile of bacterial isolates(n=1028)

Antibiotic susceptibility profile of isolates from wound infections

Gram Negative org. (n=793)	Total	%	AMP	AMK	GEN	COT	CPM	CTX/ CAZ	CIP	TZP	IPM	ERT	MEM	AZT	TGC	COL
E.coli	374	33.7	-	86.4	62.5	60.2	33.7	18.7	21.3	63.4	85.8	48.9	68	-	98.5	100
Klebsiella ssp.	210	20.4	-	50	39.5	44.7	26.19	13.8	23.3	44.7	74.2	31.4	60	-	90.4	62.3
Pseudomonas spp.	96	9.3	-	79.1	60.4	-	76	60.4	57.2	77	75	-	64.5	52	-	65.6
Acinetobacter	75	7.3	-	13.3	10.6	10.6	9.3	8	8	21.3	36	9.3	21.3	-	94.6	65.3
Others	65	6.3														
Gram positive org. (n=793)	**Total**	**%**	**PEN**	**AMK**	**GEN**	**COT**	**CIP**	**TET**	**STR**	**AMC**	**ERY**	**CLI**	**FOX**	**TEC**	**VAN**	**LZ**
S. aureus	**196**	**19.1**	21.4	50	87.2	50	55.6	-	-	-	74.4	75.5	73.4	100	95.4	98.4
Enterococcus	**39**	**3.7**														

(Ampicillin-AMP, Amikacin-AMK, Gentamicin-GEN, Cotrimoxazole-COT, Ceftazidime-CAZ, Cefepime-CPM, LEVO-Levofloxaxin, MIN-Minocycline. Ciprofloxacin-CIP, Piperacillin/tazobactum-TZP, Cefoperazone/Sulbactam-CSL, AMC-Amoxiclav, Imipenem-IPM, Meropenem-MEM, Ertapenem-ERT, DOR=Doripenem, Aztreonam-AO, Tigecycline-TGC, Penicillin-PEN, Daptomycin-DPT, GHL-Gentamycine (High), Tetracycline(TET)

aerobic growth in pus culture has been highly seconded by studies reported by Ghosh et al.[18] and Zubair et al.[21] Another study by Basu et al.[22] also reported Pseudomonas and *E. coli* spp. to be the most commonly occurring pathogens in wound infections, in that order. Raza et al.[23] found *E. coli* to be the most common pathogen with similar observations by studies conducted in Nigeria.[24]

Antibiogram results of Gram negative isolates from the present study showed that *E. coli* and Klebsiella isolates were more resistant to cephalosporins and ciprofloxacin while being least resistant to imipenem, tigecycline. *P. aeruginosa* was more susceptible to amikacin, piperacillin- tazobactam and imipenem.

A similar study from Andhra Pradesh revealed high resistance by Gram-negative bacteria to even fourth-generation cephalosporins. Whereas, carbapenems were still sensitive though increasing resistance was observed to meropenem. Resistance was seen by most of the isolates to quinolones. Combination drugs such as piperacillin+tazobactam and cefoperazone+sulbactum showed good amount of sensitivity.[19] Similar studies by Javeed et al.,[25] Rao et al.,[9] and Anguzu and Olila[21] corroborated our findings.

S. aureus isolates in our study were most susceptible to vancomycin (100%) and linezolid (100%) and least susceptible to penicillin (21.4%). Similar high susceptibility was shown by *S. aureus* to high-end drugs such as linezolid and vancomycin in a study from Andhra Pradesh.[19] These findings are similar to those of Rao et al.,[9] who also found *S. aureus* to be resistant to penicillin (84.62%), erythromycin (84.62%), and sensitive to clindamycin (65.38%) and vancomycin (100%). Out of 196 *S. aureus* isolates, 26.5% were MRSA Unfortunately, this only shows that Staphylococcus has become highly resistant to the first and second lines of treatment.

CONCLUSIONS

Pyogenic wound infections were found prevalent and *E. coli* isolates were predominant followed by *K. pneumoniae*. Bacterial isolates exhibited high to moderate levels of resistance against different classes of antibiotics. The susceptibility data may be helpful in implementing empiric treatment strategies for pyogenic infections. Strict health policies should also be implemented to restrict the unsupervised antibiotic use as well as continuous monitoring and reporting of antibiotic resistance.

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