Bacteriological Profile of Burn Wound Infection in a Tertiary Care Hospital in North India with Special Reference to Methicillin Resistant *Staphylococcus aureus*

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Abstract— *Methicillin-resistant Staphylococcus aureus (MRSA) poses a great risk to burn patients with potential to cause significant morbidity and mortality. This study aimed to find out the prevalence of MRSA and its susceptibility, in burn wound infection/colonization in a Tertiary Care Hospital in North India. A retrospective study was conducted among patients admitted in burn ward of our hospital, between January to December 2012. All the patients irrespective of age, sex, duration of hospital stay, percentage and degree of burn were included in our study. Wound swabs from 1294 patients hospitalized in burn ward were analysed for bacteriological examination. Swabs were inoculated on Blood agar, MacConkey agar and Brain heart infusion broth. Isolates were examined for colony characteristics, Gram staining and biochemical tests. Antimicrobial susceptibility testing was done by modified Stokes disc diffusion method. Detection of MRSA was done by cefoxitin (30μg) disc diffusion method. Among the Staphylococcus aureus (S.aureus) isolates, 56.7% (80/141) were found to be MRSA while 43.3% (61/141) were Methicillin Susceptible S.aureus (MSSA). All the MRSA isolates were resistant to penicillin, cephalexin and cefazolin. Resistance to erythromycin, clindamycin, ofloxacin, ciprofloxacin, gentamicin, amikacin, rifampicin, chloramphenicol was found to be 74%, 97.4%, 96%, 100%, 97.4%, 84.6%, 11.5%, 10.3%. All MRSA isolates were found to be sensitive to vancomycin and teicoplanin while 1.3% were resistant to linezolid. Although survival rates for burn patients have improved substantially over the years, nosocomial infections still remain a major challenge in burn care. This concludes that there is high prevalence of nosocomial infections specially the presence of multidrug resistant bacteria like Methicillin Resistant Staphylococcus aureus among burn patients suggest continuous surveillance of burn wound infections and development and stringent implementation of antibiotic policy.*

Key-words: Methicillin Resistant Staphylococcus aureus (MRSA), Methicillin Susceptible Staphylococcus aureus (MSSA), Antimicrobial susceptibility testing, burn wound infection.

I. INTRODUCTION

Burns remain a significant public health problem causing high morbidity, long-term disability and mortality throughout the world, especially in economically developing countries. Burns induce a state of immunosuppression that predisposes patients to infectious complications. Surface cultures are useful for identifying the organisms present on the burn wound and the predominant members of the burn wound flora.[1]

Burn wards within hospital have become a major reservoir for Methicillin Resistant *Staphylococcus aureus* (MRSA) that have special characteristic of spreading quickly in hospital environment and causing outbreaks of infection that result in serious problem in the management of burn patients.[2]

Another major concern is that majority of these MRSA isolates are increasingly becoming multidrug-resistant (MDR) i.e. resistant to more than 2 class of antimicrobials.[3] Recently there have been several reports of glycopeptide resistance as well.[4-7] Thus surveillance on MRSA in hospitals is essential to control the problem.

In the light of available literature, this study was conducted to find out the prevalence of MRSA and its susceptibility, in burn wound infection/colonization in a Tertiary Care Hospital in North India.

II. METHODOLOGY

This hospital based retrospective study was carried out in the department of Microbiology of a tertiary care hospital in New Delhi, India. Wound swabs from 1294 patients hospitalized in burn ward, between January to December 2012, were analyzed for bacteriological examination. All the patients irrespective of age, sex, duration of hospital stay, percentage and degree of burn were included in our study. Swabs were inoculated on Blood agar (Nutrient agar[HIMEDIA Catalogue Number-M001] plus 10% sterile sheep blood), Mac Conkey agar (HIMEDIA Catalogue Number-M081B) and Brain heart infusion broth (HIMEDIA Catalogue Number-M1037). Plates and the broth were incubated at 37^0C for 24 and 48 hours respectively. All bacterial isolates were examined for colony characteristics, Gram staining, motility and biochemical tests.

Staphylococcus aureus isolates were identified on the basis of Gram stain, catalase test, coagulase (slide, tube) test & by inoculation on Mannitol Salt Agar plates (MSA) (HIMEDIA Catalogue Number-M118).

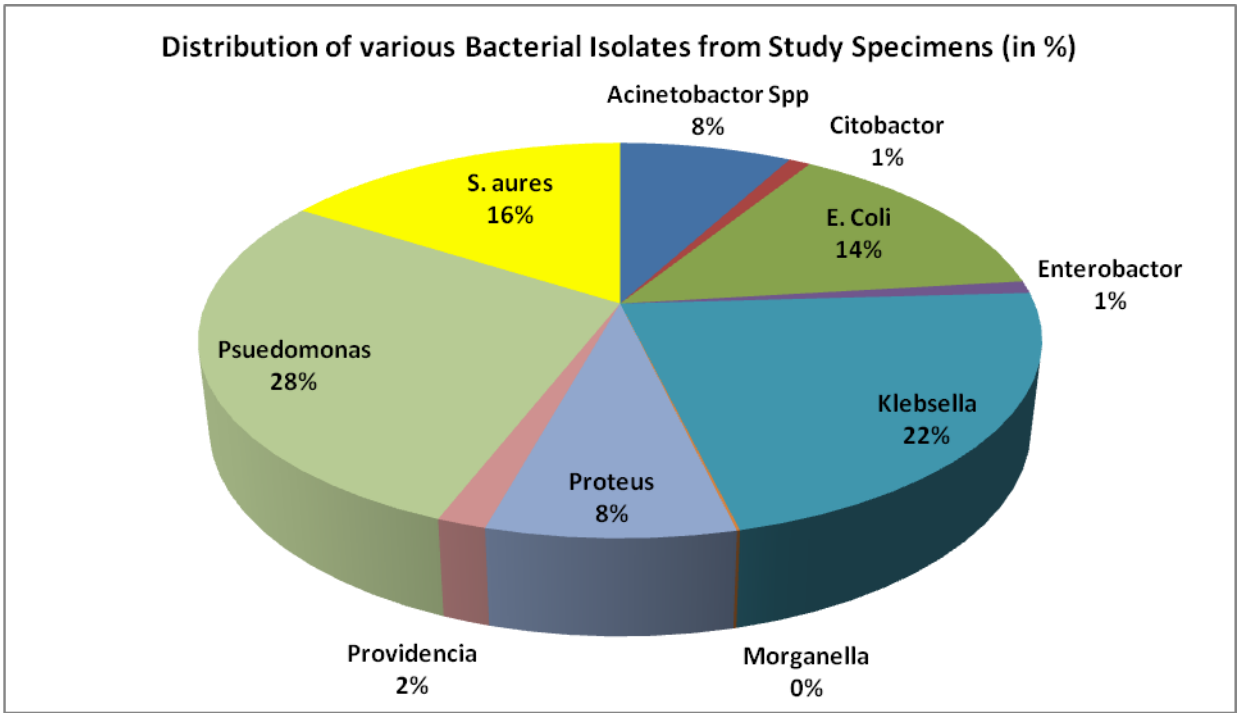
Antimicrobial Susceptibility testing was done by modified Stokes disc diffusion method. A suspension of 0.5 McFarland standard was prepared from colonies of the isolated organism and was inoculated along with control strains on Mueller Hinton agar (MHA) plates (HIMEDIA Catalogue Number-M1084) with sterile cotton swabs. Antimicrobial discs were applied on MHA and kept for overnight incubation. All Staphylococcal isolates were tested for susceptibility to penicillin (10U), cephalexin (30μg), cefazolin (30μg), erythromycin (15μg), clindamycin (2μg), gentamicin (10μg), amikcin (30μg), ofloxacin (5μg), ciprofloxacin (5μg), vancomycin (30μg), teicolanin (30μg), linezolid (30μg) and chloramphenicol (30μg) and rifampicin (5μg) (HIMEDIA Laboratories Pvt. Ltd., Mumbai, India). *Staphylococcus aureus* standard strain (NCTC 6571) was used as control. However, vancomycin MIC could not be performed. Isolates of *S. aureus* were further tested for methicillin susceptibility by standard cefoxitin disc (HIMEDIA Laboratories Pvt. Ltd., Mumbai, India) diffusion method.

III. RESULTS

Out of these total 1294 wound swab specimens, from patients admitted in burn ward, were received in Microbiology laboratory during the year 2012. Age of the admitted patients varied from 8 months to 55 years with male to female ratio was 2:1.

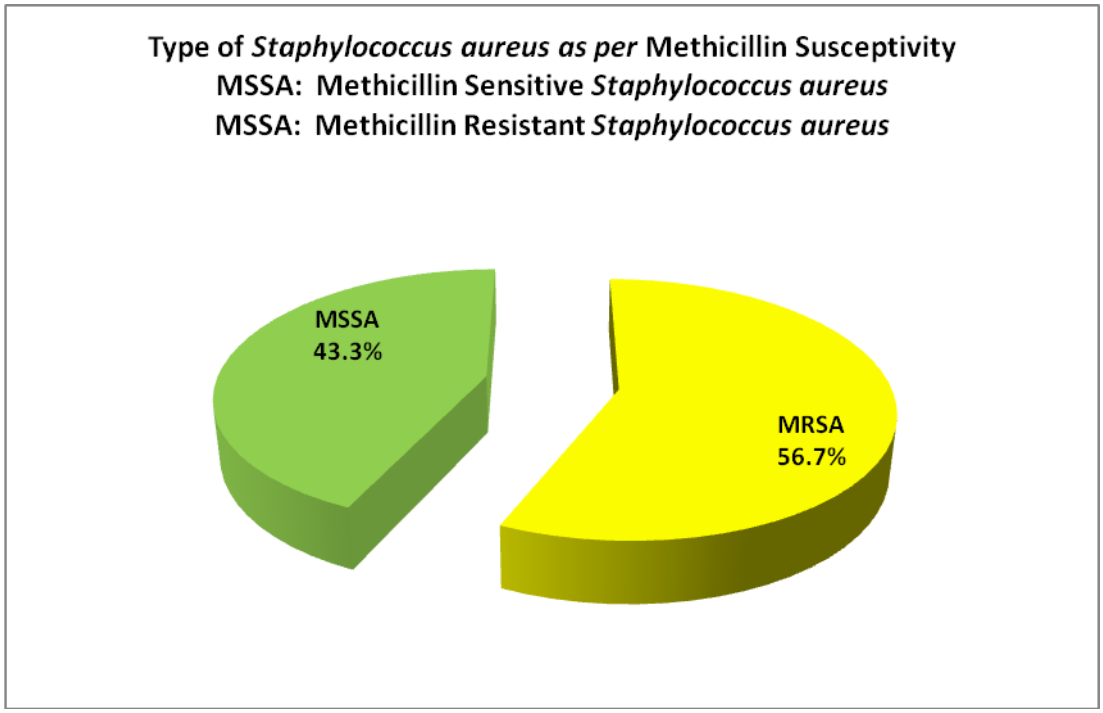
Out of total 1294 wound swab specimens isolates were obtained in 883 (%). Out of these 883 isolates, 141 (16%) grew *S. aureus.* Other isolates included *Pseudomonas spp, Klebsiella spp., Escherichia coli, Acinetobacter spp., Proteus spp., Providencia spp., Morganella spp.* and*Citrobacter spp*. (Figure 1)

Figure 1



And among the *S.aureus* isolates, 56.7% (80/141) were found to be MRSA while 43.3% (61/141) were MSSA. (Figure 2)

Figure 2



When antimicrobial susceptibility profile of the MRSA isolates was seen it was found that all the isolates were resistant to more than 2 type of antimicrobials and thus majority were Multi Drug Resistant (MDR). All of these *S. aureus* were resistant to Penicillin, Cephalexin, Cefazolin and Ciprofloxacin. More than 80% of *S. aureus* were resistant to majority of antimicrobial under study

except Vancomycin, Teicoplanin, Linezolid, Chloramphenicol and Rifampicin. All of these *S. aureus* were sensitive to Vancomycin and Teicoplanin . Penicillin, Cephalexin, Cefazolin and Ciprofloxacin. More than 80% of *S. aureus* were sensitive to Linezolid, Chloramphenicol and Rifampicin. (Table 1 & Figure 3)

Table 1

Antimicrobial susceptibility profile of MRSA isolates from burns patients

S. No.	Antimicrobial	Susceptibility Status (N=141)					
		Sensitive		Intermediate Sensitive		Resistant	
		No.	%	No.	%	No.	%
1	PENICILLINE	0	0	0	0	141	100
2	CEPHALEXIN	0	0	0	0	141	100
3	CEFAZOLIN	0	0	0	0	141	100
4	ERYTHROMYCIN	0	0	2	1.3	140	98.7
5	CLINDAMYCIN	0	0	4	2.6	137	97.4
6	GENTAMYCIN	0	0	4	2.6	137	97.4
7	AMIKACIN	0	0	22	15.4	119	84.6
8	OFLOXACIN	0	0	5	3.8	136	96.2
9	CIPROFLOXACIN	0	0	0	0	141	100
10	VANCOMYCIN	141	100	0	0	0	0
11	TEICOPLANIN	141	100	0	0	0	0
12	LINEZOLID	137	97.4	2	1.3	2	1.3
13	CHLORAMPHENICOL	121	85.9	5	3.8	15	10.3
14	RIFAMPICIN	125	88.5	0	0	16	11.5

IV. DISCUSSION

In this study out of total of 1294 pus swab specimens, from patients admitted in burn ward, were received in our Microbiology laboratory during a period of 1 year. Thus in comparison to other studies[8,9,10], this study had a fairly large sample size, which is beneficial for more accurate interpretation of results. In this study age of patient ranged from 8 months to 55 years with male to female ratio 2:1. This is well in resonance with another Indian study conducted among burn patients.[8] Almost similar results were also obtained in another study which reported male to female ratio of 1.45:1.[11]

In this study the proportion of MRSA was found 9% (80/883) among the isolates obtained from burn patients. Infection with MRSA varies widely from one geographical location to another, from hospital to hospital and over time.[2,12,13] Study conducted by Prasanna M et al[14] was well in resonance with this

study. But in contrast to this study conducted by Song et al in Korea reported the proportion of MRSA to be 98% within a burn center, however this is markedly higher than those reported from other countries.[15] In another study in the United States the rate of MRSA in a burn center was 33%.[16] This variations may be due to differences in local conditions, prevention protocols, antibiotic policy as well as duration of study.[17]

In present study very high level of resistance among MRSA isolates was found, where all the isolates were found to be MDR. Similar high level resistance has been reported in other studies.[3,9] In another study conducted in Rohtak, India, 67.64% MRSA isolates were found to be MDR.[8]This high level resistance could be due to continuous usage of broad spectrum antimicrobials and non-adherence to hospital antibiotic policy.

All the MRSA isolates in this study were resistant to beta-lactams tested (Penicillin, Cephalexin, Cefazolin & Cefoxitin). Ninety eight point seven percent were resistant to Erythromycin, 97.4% to Clindamycin, 96% to Ofloxacin while all were resistant to Ciprofloxacin (100%). Among the aminoglycoside group of antimicrobials, 97.4% of MRSA isolates were resistant to Gentamicin and 84.6% to Amikacin. In an another study among burn ward patients resistance bacteria were found to be 81.2%, 81% & 64.3% to Ciprofloxacin, Amikacin and Gentamicin respectively.[19] In another study conducted in Pakistan among burn patients, only 17% of the MRSA isolates were sensitive to ciprofloxacin, 37% to Amikacin and 30% to Gentamicin.[9] In this study very few isolates were found to be resistant to Rifampicin (11.5%) and Chloramphenicol (10.3%). Excellent activity with Rifampicin and Chloramphenicol was observed in another similar study.[9] Only 1.3% of our MRSA isolates were resistant to Linezolid. Much higher percentage of resistance was reported in other study.[9]

Vancomycin is the Drug of Choice (DOC) to treat serious infections with MRSA. But few studies reported isolation of Vancomycin-intermediate and resistant *S. aureus with* Vancomycin from many countries including India.[4-7, 20-22] However in this study all the MRSA isolates were sensitive to both Vancomycin and Teicoplanin. Although MIC testing for Vancomycin could not performed, this could be one of the reasons for apparent low prevalence of Vancomycin-intermediate/resistant isolates reported in this study.

V. CONCLUSION

It can be concluded that burn units have become a major reservoir for *S. aureus*, which were all multidrug resistant (MDR). Owing to the high level of resistance of MRSA, choice of antimicrobial is either Vancomycin or Teicoplanin. For choice of antimicrobial for MRSA requires the need for *in vitro* susceptibility testing. The current study is highly important and informative for the high level of resistance among MRSA isolates in burn patients and thus guiding its antimicrobial therapy

CONFLICT OF INTEREST

None declared till now.

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