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Research Article

PREVALENCE PATTERN, MICROBIAL SUSCEPTIBILITY AND TREATMENT OF MRSA IN A TERTIARY CARE HOSPITAL

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A R T I C L E I N F O

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MRSA, MSSA, Multidrug resistance.

A B S T R A C T

Aims: The purpose of this study was to look into the recent prevalence of MRSA in clinical samples from a hospital and to assess their antibiotic resistance pattern.
Design and Settings: This study was carried out over a 12-month period in the Department of Microbiology, School of Medical Sciences & Research, Sharda University and Sharda Hospital, Greater Noida. It was a research study that was carried out in the future.
Material and Methods: From February 2019 to February 2020, 258 coagulase-positive staphylococci (COPS) were isolated from a total of 25059 clinical specimens (such as pus, blood, urine, sputum, vaginal swab, and so on) of patients in the hospital. The bacteriological investigation followed standard laboratory procedures, and antimicrobial susceptibility testing was carried out.
Statistical analysis used: Nil
Results: During this time, 258 S. aureus samples were isolated. A total of 111 isolates were cefoxitin resistant (MRSA), while the remaining 147 isolates were cefoxitin sensitive (MSSA).
Conclusion: MRSA is one of the most common causes of therapeutic problems in many hospitals. MSSA isolates were more common than MRSA isolates, and MRSA was more drug-resistant than MSSA. Vancomycin and linezolid can be used to treat multidrug-resistant MRSA infections as well as life-threatening infections.

INTRODUCTION

In the 1960s, the introduction of methicillin and outbreaks of Methicillin-resistant Staphylococcus aureus (MRSA) were reported [1]. Later on, in 1961, MRSA was described. According to the CDC, MRSA is a cause of staphylococcus infection that is difficult to treat because of resistance to some antibiotics [2]. Methicillin resistance is mediated by PBP-2a, which is a penicillin-binding protein that helps to grow and divide the organisms in the presence of methicillin and other beta-lactam antibiotics [1]. S. aureus, which has a high resistance pattern against a good number of antibiotics but sensitive to methicillin, considered as methicillin-sensitive S. aureus (MSSA) as well as multidrug-resistant strains of S. aureus(MDRSA) [3]. One of the main responsible agent of infections like septicemia, pneumonia, skin and soft tissues infection is Staphylococcus aureus [4] and also may cause infection range from minor diseases to life-threatening infections [5]. The prevalence of MRSA in hospital environment infections as well as in community infections has become a greatchallenge[4]. Resistance to penicillin, ampicillin, amoxicillin, azlocillin, carbenicillin, mezlocillin, piperacillin, and ticarcillin indicates positive β-lactamase test [6]. Methicillin resistance refers to which are resistance to the anti-staphylococcal, penicillinase-stable penicillin [6]. Resistant to drugs like cephalosporins and other beta-lactam makes the MRSA strain difficult to treat [6]. The knowledge of the prevalence of MRSA and their susceptibility pattern is a must for the appropriate treatment of these infections [5]. There are very few and expensive drugs like teicoplanin, vancomycin, and linezolid that are the current choice of drugs for the treatment of MRSA infections [6]. The preferred treatment for MRSA are glycopeptides and linezolid [6]. The main source of transmission of infection is hospital staff, infected and colonized patients which disseminate the MRSA strains [5]. The predisposing factors which increase the emergence and spread of MRSA are prolonged and repeated hospitalization, indiscriminate use of antibiotics, lack of awareness, intravenous drug abuse, and presence of indwelling medical devices [5]. The present study was aimed to investigate the recent prevalence of MRSA S. aureus from clinical samples in a hospital and to evaluate their antibiotic resistance pattern.

MATERIAL AND METHODS

The study included 258 coagulase-positive staphylococci (COPS) isolated from a total of 25059 clinical specimens (such

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as pus, blood, urine, sputum, vaginal swab, and so on) of patients admitted between Feb 2019 tillJan 2020 in the hospital.

Bacteriological investigation

For initial screening, a loop of each sample was inoculated into blood agar, chocolate agar, and MacConkey agar and special media in some special situations. Culture plates were then incubated at 37^0C overnight. The organisms which are grown in the form of colonies were processed according to standard procedures for the identification of organisms.

Antimicrobial susceptibility test to various drugs

The standard Kirby-Disc Bauer's Diffusion method was used to identify methicillin resistance and to analyse the sensitivity pattern of MRSA isolates in accordance with CLSI guidelines that are updated each year [7]. Penicillin, Levofloxacin, Clindamycin, Amoxyclav, teicoplanin, cefoxitin, erythromycin, ciprofloxacin, gentamicin, linezolid, vancomycin, norfloxacin, and nitrofurantoin were all tested (Hi-Media Mumbai). Nitrofurantoin and Norfloxacin were only used in urine samples. MRSA isolates resistant to cefoxitin (30g) and MSSA isolates susceptible to cefoxitin (30g) were identified.

RESULTS

This study was conducted from February 2019 to February 2020. A total of 25,059 clinical samples were collected from various wards. Culture growth revealed the occurrence of the highest bacterial infection from the various wards, as shown in Table II. E. coli was the most common isolate from all clinical specimens, followed by other bacteria as detailed in Table III and in Figure I. A total of 258 cases of Staphylococcus aureus were isolated, with the Pus specimen having the highest number of S. aureus occurrences than the swab specimen, as shown in Table IV, Figure II.Table V and Figure III illustrated the antibiotic susceptibility pattern of S. aureus specimens, which revealed the highest number of resistance to Penicillin, followed by Ciprofloxacin and Erythromycin antibiotics, whereas Sensitivity pattern was higher with Vancomycin (100 percent), Nitrofurantoin (98.8 percent), Linezolid (97.6 percent), and Norfloxacin (97.6 percent). Table VI shows that 111 isolates (43.02 percent) were cefoxitin resistant (MRSA) and 147 isolates (56.98 percent) were cefoxitin sensitive (MSSA).The most common age group for MRSA was 11-40 years, accounting for 47.75 percent of cases, followed by 41-70 years, accounting for 32.43 percent of cases. Similarly, the most common age group for MSSA was 11-40years, followed by 41-70years, with 53.74 percent and 27.23 percent, respectively (Table VII and Figure IV).

Table I Table I and II Showing the growth of total sample from IPD & OPD

Samples	OPD (n=15,532)	IPD (n=9,527)	Total Number (n=25,059)
Total Growth	963(6.3%)	3195 (33.53%)	4158(16.59%)
No Growth	14569 (93.7%)	6332 (66.47%)	20901 (83.41%)

Table II

Culture Growth	OPD	IPD
Bacterial Growth	651 (67.60%)	2064 (64.61%)
Candida	6 (0.63%)	60 (1.87%)
Mix Growth	188 (19.52%)	388 (12.15%)
Non-Pathogenic	118 (12.25%)	683 (21.37%)

Table III Distribution of different types of isolates from different wards

Types of isolates	OPD (n= 652)	IPD (n= 2,074)
Escherichia coli	283 (43.40%)	583 (28.14%)
Klebsiella spp.	62 (9.50%)	215 (10.36%)
Enterococcus spp.	35 (5.36%)	148 (7.15%)
CONS	85 (13.05%)	375 (18.08%)
Staphylococcus aureus	80 (12.26%)	178 (8.58%)
Proteus spp.	22 (3.37%)	32 (1.55%)
Enterobacter spp.	11 (1.68%)	18 (0.86%)
Citrobacter spp.	25 (3.85%)	106 (5.15%)
Acinetobacter spp.	10 (1.55%)	146 (7.03%)
Pseudomonas spp.	39 (5.98%)	240 (11.57%)
Stenotrophomonasmaltophilia	0	3 (0.14%)
Elizabethkingiameningoseptica	0	1 (0.04%)
Sphingomonaspaucimobilis	0	14 (0.67%)
B-haemolytic streptococcus	0	1(0.04%)
Bulkholderiacepacian	0	1(0.04%)
Micrococcus	0	7 (0.33%)
Salmonella typhi	0	3(0.14%)
Streptococcus pneumonia	0	1(0.04%)
Aeromonassalmonicida	0	2 (0.09%)

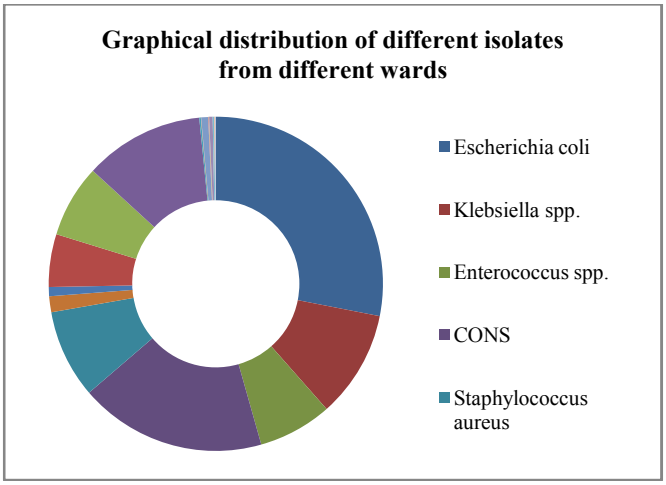

Figure I Graphical distribution of different isolates from different wards

Table IV Number of *Staphylococcus aureus* (258) isolated from different Clinical samples

Clinical samples	OPD (n= 89)	IPD (n= 169)
Pus	62	119
Swab	13	17
Sputum	5	4
Urine	5	5
Tracheal secretion	4	2
BAL fluid	0	1
ETT	0	1
Catheter Tip	0	1
Pleural fluid	0	2
Semen	1	0
Blood	0	17

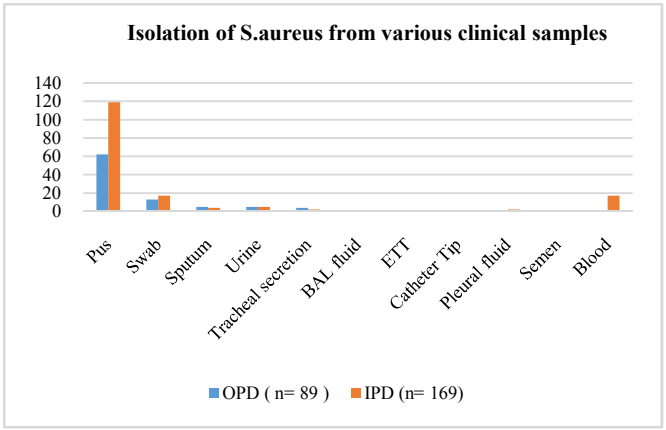

Figure II Isolation of *S.aureus* from various clinical samples

Table V Antibiogram Pattern of Percentage of *Staphylococcus aureus*

Antibiotic	Resistance (n=258)	Sensitivitiy (n= 258)
Levofloxacin	104(40.4%)	154(59.6%)
Cefoxitin	111(43%)	147(56.9%)
Penicillin	205(79.4%)	53(20.5%)
Clindamycin	54(20.9%)	204(79%)
Vancomycin	0(0%)	258(100%)
Ciprofloxacin	185(71.7%)	73(28.2%)
Linezolid	6(2.3%)	252(97.6%)
Amoxclave	97(37.5%)	161(62.4%)
Erythromycin	134(51.9%)	124(48%)
Teicoplanin	9(3.4%)	249(96.5%)
Gentamicin	62(24%)	196(75.9%)
Nitrofurantoin	3(1.1%)	255(98.8%)
Norfloxacin	6(2.3%)	252(97.6%)

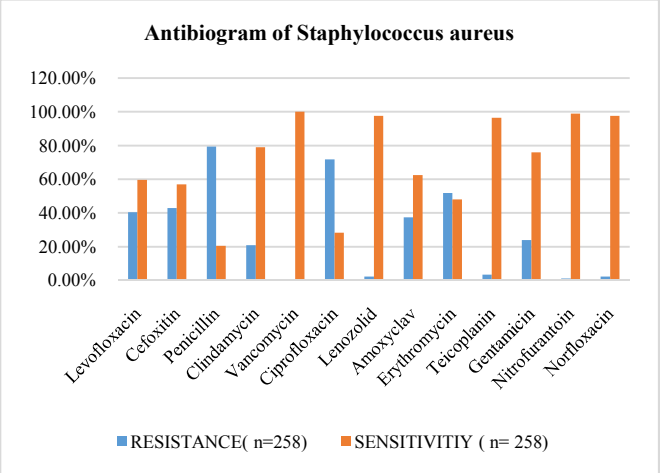

Figure III Antibiogram of Staphylococcus aureus

Table VI Prevalence of MRSA and MSSA isolates from clinical samples

Total number of S. aureus isolates	Methicillin-resistant S. aureus(MRSA)	Methicillin-sensitive S. aureus (MSSA)
258	111 (43.02%)	147 (56.98%)

Table VII Age groups distribution of MRSA and MSSA isolates

Age	Total number of MRSA isolates	Total number of MSSA isolates
≤ 10 years old	15 (13.51%)	23(15.6%)
11-40 years old	53(47.75%)	79(53.74%)
41-70 years old	36(32.43%)	40(27.23%)
≥ 71 years old	7(6.31%)	5(3.42%)
Total	111	147

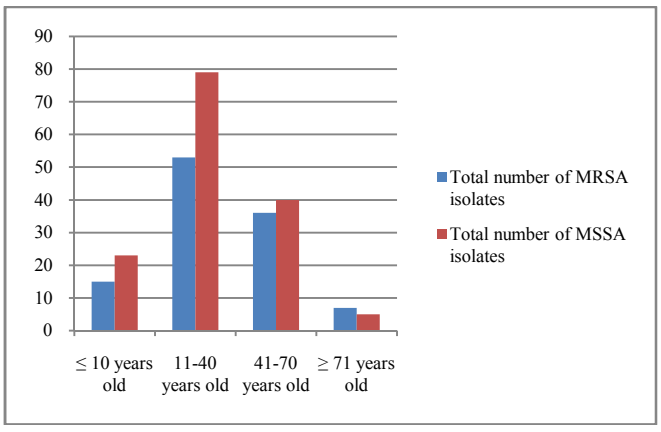

Figure IV Graphical representation of age groups distribution of MRSA and MSSA isolation

Table VIII Distribution of MRSA and MSSA on Clinical samples

Clinical Samples	Number of MRSA isolates	Number of MSSA isolates
Urine	9 (8.10%)	21 (14.28%)
Pus	75 (67.56%)	52 (35.37%)
Swab	16 (14.44%)	43 (29.25%)
Blood	11 (9.90%)	31 (21.1%)

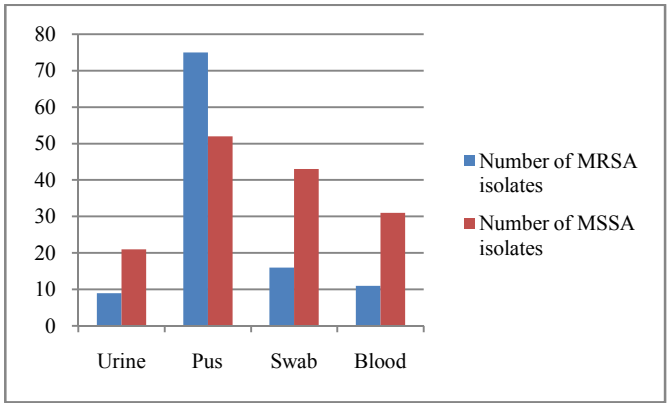

Figure V Graphical representation of distribution of MRSA and MSSA on Clinical samples

DISCUSSION

MRSA is the most common and prominent pathogen that causes HA and CA acquired infections. MRSA prevalence ranges from 25% in western India to 50% in southern India[8].Diverse MRSA epidemiology is regarded as a major public health concern in clinical and community settings. The prevalence rate in this study was 43 percent in a total of 258 isolated S.aureus organisms. In this study, HA-MRSA accounted for 65 percent (169 of 258) of MRSA strains, while CA-MRSA accounted for 34.4 percent (89 of 258). This finding is consistent with the findings of Sit S P et al, who discovered that 59 percent of MRSA were HA-MRSA and 31 percent were CA-MRSA[4]. The majority of MRSA infections were isolated from adults aged 41 to 70, with patients aged 11 to 40 coming in second. Adults and the elderly suffer the greatest number of infections as a result of their greater frequency of exposure to excessive manipulation. This finding was corroborated by Rodrigues A M et al's study, in which the highest number of MRSA was isolated from 11-40 and 41-70-year-old age groups[6]. When compared to MRSA, the percentage of total MSSA isolates was (56.97 percent) (43.02 percent). This result was similar to that of Pirko Y E et al, who found that MSSA was 57.5 percent of the time and MRSA was 42.5 percent of the time [9]. MRSA isolates were higher than MSSA in pus (67% vs. 35.37%), whereas MSSA isolates were higher than MRSA in urine (14.2% vs 8.10%), blood (21.1% vs 9.09%) and swab (29.25% vs 14.41%). This result was comparable with the study done by Pirko Y E et al, in which also MSSA isolates were higher than MRSA in urine (38% vs 17%), blood (29% vs 22%), and ear specimens (1% vs 0%) [9]. The antibiotic susceptibility test in this study revealed that all MRSA isolated were 100% sensitive to Vancomycin, followed by Nitrofurantoin (98.8 percent), Linezolid (97.6 percent), and Teicoplanin (97.6 percent). This finding was consistent with the findings of Arunkumar V et al, who discovered that all MRSA isolates were susceptible to Vancomycin and teicoplanin[6]. Approximately 79.4 percent of MRSA isolates were resistant to penicillin, 71.7 percent to ciprofloxacin, 51.9 percent to erythromycin, and 43 percent to cefoxitin. This

result was comparable to Ameer Abbas' study, which concluded that MRSA isolated were resistant to erythromycin in approximately 61.19 percent of cases and 52.73 percent of cases to ciprofloxacin[10].

CONCLUSION

According to this study, the prevalence of MRSA is high enough to warrant immediate infection awareness. MRSA is one of the most common causes of therapeutic problems in many hospitals. MSSA isolates were more common than MRSA isolates, and MRSA was more drug-resistant than MSSA. Though the findings are alarming and suggest an extensive use of antibiotics, they may not be used as the sole indicator of antibiotic overuse. Vancomycin and linezolid can be reserved drugs for life-threatening infections and also for treating multidrug-resistant MRSA infections. To prevent the spread of MRSA infections, all clinical and paramedical staff must be trained and educated on control measures, and to reduce MRSA prevalence, regular hospital infection surveillance and antibiotic sensitivity pattern monitoring is required.

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Conflicts of interest: Nil

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