

Original Research Article

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Prevalence of Multidrug Resistant *Staphylococcus aureus* and its Antimicrobial Susceptibility Pattern in a Tertiary Care Hospital in Navi Mumbai, India

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ABSTRACT

Keywords

Multidrug resistant *Staphylococcus aureus* (MDRSA), Prevalence, Antimicrobial susceptibility, Pus, Vancomycin.

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Multidrug resistant *Staphylococcus aureus* (MDRSA) has become a global problem and it makes the patient management very difficult. Hence, the knowledge of current trend of MDRSA in hospital environment as well as in the community is necessary. The objective of this retrospective study was to isolate *Staphylococcus aureus* and to determine the prevalence rate of MDRSA in a tertiary care hospital in Navi Mumbai, India. The samples were collected from various departments. Standard microbiological procedures were carried out for isolation and culture. The overall prevalence rate of 18.6% MDRSA was observed among varied samples. The highest numbers of MDRSA were isolated from pus and wound swabs. We also analyzed antimicrobial susceptibility to various antibiotics in the isolated strains. We observed a lower rate of MDRSA prevalence in our study as compared to various other studies. The knowledge of prevalence and antimicrobial resistance will be helpful to select the appropriate antibiotic therapy, to detect the changing trends of antibiotic susceptibility pattern and for developing hospital antibiotic policy.

Introduction

Staphylococcus aureus (*S. aureus*) is one of the important hospital and community acquired pathogen. It is responsible for causing a broad spectrum of diseases ranging from mild superficial skin and soft tissue infections to life threatening infections such as infective endocarditis, septicemia, deep-seated abscess, pneumonia and toxic-shock syndrome (Onemu *et al.*, 2013; Fateh *et al.*, 2013).

S. aureus has been naturally susceptible to most of the antibiotics developed so far. However, it has been developing increased

resistance to antimicrobial agents. It is of greatest concern because of its intrinsic virulence and its ability to adapt to different antibiotics (Franklin, 2013). The two most remarkable antibiotic resistance achieved by *S. aureus* is methicillin (MRSA) and vancomycin resistance (VRSA and VISA). Methicillin resistance was achieved by interspecies transfer of *mecA* gene from an ancestral *Staphylococcus* species to *S. aureus*. Vancomycin resistance was achieved by gene mutations (VISA) and horizontal genes transfer (van A-gene) (Hiramatsu *et al.*, 2014).

Multiple Drug Resistance (MDR) is defined as acquired non-susceptibility to at least one agent in 3 or more antimicrobial categories (Magiorakos *et al.*, 2012).

The indiscriminate use of antibiotics could be regarded as the cause of emergence of Multiple Drug Resistant *Staphylococcus aureus* (MDRSA). Inadequate investigation facilities and lack of proper antibiotic policy in clinical practice are other factors responsible for emergence of MDRSA.

Knowledge of the antimicrobial resistance pattern is essential for a clinician to impart empirical and pathogen specific therapy.

The present study was carried out to have a better understanding towards the prevalence of MDRSA in our hospital and to study the antibiotic susceptibility pattern in MDRSA for improving the practices for judicious use of antibiotics in our hospital.

Materials and Methods

The present study was carried out in a tertiary care hospital in Navi Mumbai. We collected samples from IPD and OPD patients.

The retrospective study was carried out from March 2015 to February 2016.

A total number of 6010 samples were investigated. The various clinical specimens included were urine, pus, sputum, swabs, other body fluids, blood and miscellaneous. All the *S. aureus* isolates obtained during the study period were included in the study.

The samples were processed as per the standard protocol for isolation and identification of aerobic bacteria (Henry, 1988; Performance Standards for Antimicrobial Susceptibility Testing, 2015). The antibiotic susceptibility testing was

carried out for Erythromycin (15µg), Linezolid (30µg), Cotrimoxazole (1.25µg/23.75µg), Vancomycin (30µg), Penicillin (10units), Gentamicin (10µg), Cefoxitin (30µg), and Ciprofloxacin (5µg) by Kirby-Bauer disc diffusion technique.

Results and Discussion

A total 231 strains of *Staphylococcus aureus* were isolated. Out of which 43(18.6%) were multidrug resistant *Staphylococcus aureus*, 34 (14.72%) were MRSA and 188 (81.38%) were non-MDRSA (Table 1 and Figure 1).

The MDRSA were mostly isolated from pus and wound swabs (60.45%) followed by sputum, body fluids, blood, miscellaneous and urine specimens (Table 2).

Out of total *Staphylococcus aureus* strains 100%, were resistant to Penicillin, 19.48% were resistant to Erythromycin, 13.85% were resistant to Co-trimoxazole, and 12.12% showed resistance to Ciprofloxacin and 10.82% showed resistance to Gentamicin, respectively. Most of the MDRSA Isolates showed resistance to three or four antibiotics. There was no resistance observed against Vancomycin and Linezolid among the MDRSA and therefore they remain the treatment of choice in case of MDRSA infections (Table 3 and Figure 2).

S. aureus is the most important causative agent of pyogenic infections. The antimicrobial resistance seen in *S. aureus* isolates is accompanied by high morbidity and mortality in the hospital settings worldwide.

However, the prevalence of MDR infections varies across the regions and even in the different wards of the same hospital. It was observed that a prevalence rate of 18.6% MDRSA in our study.

In a study on prevalence of MDRSA in diabetics clinical samples by Raju *et al.*, (2010) 40% *Staphylococcus aureus* strains were found to be MDR. In a study conducted in healthy preschool children in Ujjain, India the Nasal Carriage and Antimicrobial Susceptibility of *S. aureus* among the 16 MRSA isolates 3 (19%) were MDR which is similar to our result (Ashish Pathak *et al.*, 2010). High percentage (63.6%) of MDRSA has been observed in a study conducted by

Rajadurai *et al.*, (2016) Summaiya *et al.*, (2007) found that a high rate of MRSA isolates (26.3%) from the clinical specimens also showed MDRSA. In their study, 6.8% MSSA isolates were resistant to all other antibiotics tested. Abdolmajid *et al.*, (2015) observed 30.6% MRSA prevalence in their study conducted in Tehran. Out of which 56.2% strains were MDRSA. Adegoke *et al.*, (2009) observed that 39.2% isolates showed resistant to at least 5 antibiotics.

Table.1 Total number of *S. aureus* isolates resistant to number of antibiotics

Number of antimicrobial agents	Total number of <i>S. aureus</i> isolates resistant to no. of antibiotics (n=231)	Percentage (%)
1	231	100
2	88	38.09
≥3	43	18.61

Table.2 Specimen wise distribution of multi drug resistant *S. aureus*

S. No.	Specimens	No. of MDRSA	Percentage of MDRSA (%)
1	Pus	14	32.55
2	Wound swabs	12	27.90
3	Sputum	7	16.27
4	Body Fluids	4	9.30
5	Blood	3	6.97
6	Urine	1	2.32
7	Miscellaneous	2	4.65

Table.3 Antimicrobial resistance pattern of *S. aureus*

S. No.	Antimicrobial agent and concentration	Total no. of <i>S. aureus</i> isolates (n=231)	Percentage of resistance (%)
1	Penicillin(10 units)	231	100
2	Ciprofloxacin (5µg)	28	12.12
3	Gentamicin (10 µg)	25	10.82
4	Cotrimoxazole (1.25/23.75 µg)	32	13.85
5	Erythromycin (15 µg)	45	19.48
6	Cefoxitin (30 µg)	34	14.71
7	Linezolid (30 µg)	0	0
8	Vancomycin (30 µg)	0	0

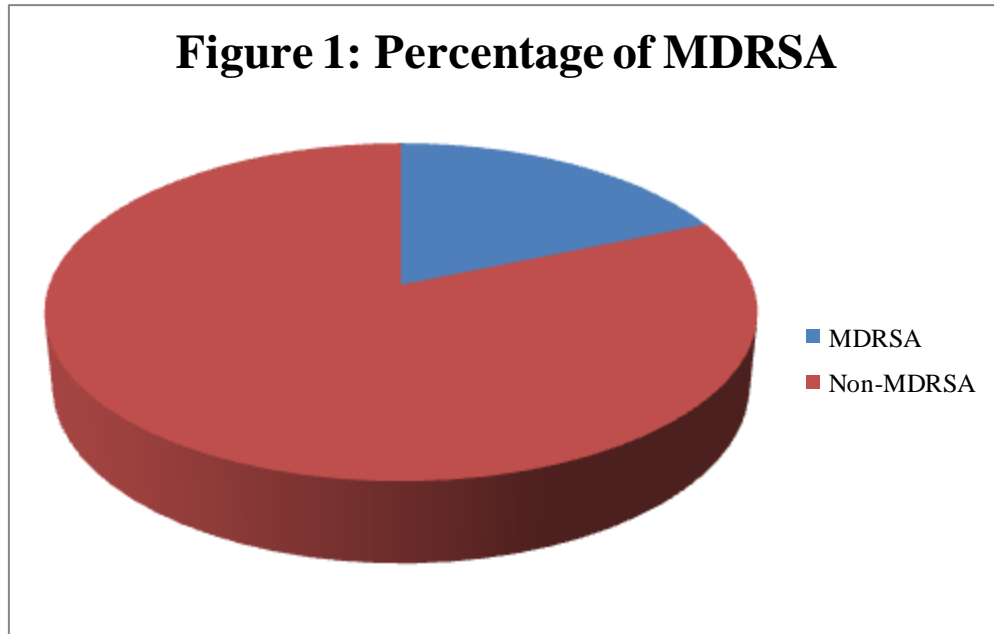


Figure 2: Distribution of Resistance Pattern of MDRSA

120
100
80
60
40
20
0

7

In a study conducted by Dar *et al.*, (2006) in Aligarh, Highest percentage of MRSA isolates was found in pus specimens, which is similar to our study and, zero resistance was found to vancomycin.

Sanjay *et al.*, (2012) observed 74.58% MDRSA prevalence in their study conducted in Solapur, Maharashtra.

In conclusion, prevalence of multidrug resistant *Staphylococcus aureus* is varied all over India and World. Surveillance studies should be carried out in every geographical region to detect the prevalence of MDRSA strains. Our study is a preamble to enable epidemiologists to understand the prevalence pattern of MDRSA in this part of India.

For maintaining such lower rate of antibiotic resistance we have to thoroughly follow the guidelines for antibiotic policy.

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