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Prevalence of MRSA in various clinical samples and their antibiotic susceptibility pattern

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Abstract
Background & Objective: MRSA is major nosocomial pathogen that causes severe morbidity and mortality worldwide, they cause variety of infections like bacteremia, endocarditis, UTI, SSI. Objective of the study is to estimate the prevalence of MRSA in clinical specimens and to detect sensitivity pattern of these strains against various antibiotics.
Material & Method: Samples received to the Microbiology department for culture and sensitivity were inoculated on culture media like blood agar, MacConkey agar, nutrient agar. *S. aureus* was diagnosed on the basis of their growth characteristics on the respective media's and standard biochemical test. The antibiotic susceptibility testing was done by Kirby Bauer disk diffusion method and zone of inhibition was interpreted as per CLSI guidelines[9].
Results: Among 3452 samples received for a period of 6 months from May to October 2018, growth was seen in 2198 (63.67%) samples, Out of these 350 (15.92%) samples were of *Staphylococcus aureus*, from which 190 (54.28%) samples were MRSA. Majority of MRSA were isolated from pus sample 92 (48.42%) followed by blood 40 (21.05%), urine 34 (17.89%). MRSA were isolated more commonly in males 117 (61.57%) than in females 73 (38.42%). MRSA was most commonly reported in the age group of 10-30 years 89 (46.84%) followed by age group of 30 to 50 years 58 (30.52%), Least number of MRSA was reported in age group less than 10 years 06 (3.1%). Antibiotic susceptibility testing for MRSA showed maximum sensitivity to Vancomycin 100% followed by Gentamicin 86%, Clindamycin 49%, Ciprofloxacin 47%, Erythromycin 29%, Cotrimoxazole 38%.

Keywords: MRSA (methicillin resistant staphylococcus aureus), UTI- urinary tract infection, SSI-surgical site infection

Introduction

Staphylococci are normal inhabitant of human skin and nasal mucosa [1]. *Staphylococcus aureus (S. aureus)* is major pathogen responsible in both nosocomial as well as community acquired infection. Infection caused by *Staphylococcus aureus* have poor prognosis when the infecting strain is resistant to synthetic penicillin commonly known as MRSA [2].

Over the years it has been reported in many studies that *S. aureus* has become resistant to most of the available drugs. In the early 1950 due to acquisition and spread of beta lactamase producing plasmids the effectiveness of penicillin was hampered, thus making the strains resistant to penicillin. In 1960 semi synthetic penicillin, methicillin was introduced for treatment of *Staphylococcus* showing resistance to treatment by penicillin, but within few years' methicillin resistance emerged [3, 4]. The infections caused by *S. aureus* ranges from minor skin disease to life threatening infections like septicemia, endocarditis, osteomyelitis, septic arthritis, toxic shock syndrome and food poisoning [5, 6]. The mechanism for methicillin resistance is seen in *S. aureus* is production of altered penicillin binding protein (PBP2a) encoded by structural gene mec-A [4, 5]. Other mechanism includes hyper production of penicillinase enzyme [5, 6].

Although both community associated CA-MRSA and hospital associated HA-MRSA are resistant to commonly used beta lactam antibiotics, but the former is usually susceptible to wider spectrum of antibiotics as compared to HA- MRSA which are more resistant to common drugs and usually susceptible to vancomycin[7].Vancomycin is drug of choice in case of MRSA however it is expensive drug often associated with toxicity. With wide spread use of vancomycin for treatment it has led to emergence of vancomycin resistant *Staphylococcus aureus* (VRSA) [8]. Aim of the present study is to detect MRSA among various clinical samples and know its antibiotic susceptibility pattern in order to formulate effective hospital based antibiotic policy for the hospital.

Material and Method

The study was carried out for a period of 6 months from May to October 2018 in the Microbiology department of a tertiary care teaching hospital in Solapur, Maharashtra. Various clinical samples send for culture sensitivity was included in the study. Patients of all age group were included in the study. All samples were processed on blood agar, MacConkey agar, nutrient agar, *S. aureus* was diagnosed on the basis of their growth characteristics on the respective media's, gram stain was performed along with various biochemical tests like catalase, coagulase (slide and tube), and growth on mannitol salt agar. The antibiotic susceptibility testing was done by Kirby Bauer disk diffusion method and zone of inhibition was interpreted as per CLSI guidelines [9]. Screening for MRSA was done by using Cefoxitin 30 µg disc diffusion method as per CLSI guidelines [9]. For quality control standard ATCC positive and negative controls were used.

Result

Among 3452 samples received for a period of 6 months from May to October 2018, growth was seen in 2198 (63.67%) samples, while 1054 (36.32%) samples showed no growth.

Out of these 350 (15.92%) samples were of *Staphylococcus aureus*, from which 190 (54.28%) samples were MRSA. Majority of MRSA were isolated from pus sample 92 (48.42%) followed by blood 40 (21.05%), urine 34 (17.89%), vaginal swab 14 (7.36%) and others 10 (5.26%).

MRSA were isolated from more commonly in males 117 (61.57%) than in females 73 (38.42%). MRSA was most commonly reported in the age group of 10-30 years 89 (46.84%) followed by age group of 30 to 50 years 58 (30.52%), patient of more than 60 years age group were 37 (19.47%). Least number of MRSA was reported in age group less than 10 years 06 (3.1%).

MRSA strains were most commonly isolated from Surgery department of our hospital 82 (43.15%) followed by obstetrics & Gynecology 54 (28.42%), Medicine 32 (16.84%), Orthopedics 18 (9.47%), ENT 4 (2.10%).

Antibiotic susceptibility testing for MRSA showed maximum sensitivity to Vancomycin 100% followed by Gentamicin 86%, Clindamycin 49%, Ciprofloxacin 47%, Cotrimoxazole 38% and Erythromycin 29% as shown in table-1

Table 1: Antibiotic susceptibility pattern of MRSA strains from various clinical samples

Antimicrobial agent	Number of sensitive isolates	Percentage of sensitive isolates (%)	Number of resistant isolates	Percentage of resistant isolates (%)
Erythromycin 15µg	56	29	134	71
Clindamycin 2µg	94	49	96	51
Vancomycin 30µg	190	100	0	0
Gentamicin 10µg	164	86	26	14
Ciprofloxacin 5µg	90	47	100	53
Cotrimoxazole25µg	72	38	118	62

Discussion

In the present study 3452 samples received for a period of 6 months from May to October 2018, growth was seen in 2198 (63.67%) samples, while 1054 (36.32%) samples showed no growth. Out of these 350 (15.92%) samples were of *Staphylococcus aureus*, from which 190 (54.28%) samples were MRSA. Our study is in concordance to the study done by Anupurba S *et al*. [10] and Assadullah S *et al*. [11] however our study shows higher rates of MRSA isolation as compared to study done by J.V. Sathish *et al*. [3] and Tri vedi *et al*. [1] which was found to be 47.5% and 20.25% respectively. In India incidence of MRSA shows large variation from 6.9% to 81%. Variation in the prevalence of MRSA may be attributed to level of adherence to hospital infection control policy, hospital infection surveillance.

In the present study Majority of MRSA were isolated from pus sample 92 (48.42%) followed by blood 40 (21.05%), urine 34 (17.89%), vaginal swab 14 (7.36%) and others 10 (5.26%). Our study shows slight difference with the results of J.V. Sathish *et al*. [3] where MRSA were most commonly isolated from pus followed by urine and blood. Another study done by Amit Azimian *et al*. [12] shows majority of MRSA isolated from blood, followed by respiratory samples, cutaneous sample, urine and nasal swabs. The difference in the sample distribution may be due to difference in study population, socioeconomic status, environmental condition, literacy level and hygiene practices of an individual.

In the present study MRSA were isolated from more commonly in males 117 (61.57%) than in females 73 (38.42%). Result of the present study is comparable to the study done by Trivedi *et al* [1]. MRSA was most commonly reported in the age group of 10-30 years 89 (46.84%) followed by age group of 30 to 50 years 58 (30.52%), patient of more than 60 years age group were 37 (19.47%). Least number of MRSA was reported in age group less than 10 years 06 (3.1%). This may be because in rural India still males are predominantly responsible for earning livelihood so they are exposed to outside environment and more prone to infection as compared to female who look after children and do household chores, our hospital is a tertiary care hospital catering majority of rural population in and around Solapur so the gender and age group corresponds to the life style of the population here.

MRSA strains were most commonly isolated from Surgery department of our hospital 82 (43.15%) followed by obstetrics & Gynecology 54 (28.42%), Medicine 32 (16.84%), Orthopedics 18 (9.47%), ENT 4 (2.10%). We have done MRSA screening for all Staff members and doctors in these department and also conducted CME on hospital infection control methods along with hand hygiene and its importance, since than number of MRSA reported have declined regular screening & surveillance has led to significant decrease in number of MRSA in these departments.

Antibiotic susceptibility testing for MRSA showed maximum sensitivity to Vancomycin 100% followed by Gentamicin 86%, Clindamycin 49%, Ciprofloxacin 47%, Cotrimoxazole 38%, Erythromycin 29% as shown in table-1.Antibiotic susceptibility pattern shows variation even in different institutes, cities and countries which may be due to difference in the study population, geographical variation, availability of over the counter drugs, misuse and overuse of antibiotics, literacy level of the population.

Conclusion

A regular surveillance of hospital associated infection, strict adherence to hospital infection control policies, contact precaution, hand washing and following bundle protocols along with monitoring of antibiotic sensitivity pattern of MRSA is important to control spread of infection and prevent hospital associated outbreaks. Vancomycin should be given in reserved cases to prevent rise in VRSA strain which further limits treatment options.

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