

Study of MRSA Isolates from Patients of Tertiary Care Hospital

Gajbhiye P S¹, Damle A S²

^{1,2} Department of Microbiology, Government Medical College, Aurangabad, Maharashtra, India.

Abstract : MRSA is an important hospital pathogen the incidence of which is increasing every year specially in high risk groups. The present study was performed in patients admitted to a tertiary care hospital in Maharashtra, India. The proportion of MRSA isolates among *Staphylococcus aureus* was 28.37% Isolation rate of MRSA was found highest in IRCU/ICCU (78.57%), MICU (70.97%)

Keywords – Methicillin resistant *Staphylococcus aureus* (MRSA), Methicillin sensitive *Staphylococcus aureus* (MSSA), ceftazidime.

I. Introduction

MRSA was first reported in 1961. Since then MRSA has become widespread worldwide. Infections caused by *S. aureus* used to respond to beta lactam antibiotics. However with emergence of MRSA; treatment of these infections has become problematic¹. Indiscriminate use of multiple antibiotics, prolonged hospital stay, intravenous drug abuse, carriage of MRSA in nose are important risk factors for MRSA acquisition. This has been underlined by the finding that MRSA does not just replace MSSA (methicillin sensitive *S. aureus*) as a causative agent for infections, but frequently adds to the latter's disease burden, leading to a net increase in the incidence of *S. aureus* infections. Monitoring the epidemiology and the burden of MRSA infections is crucial.² Control of MRSA is essential to curtail the introduction and spread of infection. This can be achieved by practicing universal precautions and conducting regular epidemiological studies like the present one to know the changing trends.

II. Material And Methods

Total 17,185 specimens like pus, wound swab, blood, endotracheal aspirate, body fluids, urine, stool etc were received in the Microbiology Laboratory during Jan 2011 to October 2012. The samples were processed as per standard procedures.³

Direct smear of each specimen (except blood) was stained with Gram's stain and findings noted. Each sample was cultured on Blood agar, MacConkey's agar and MeReSa agar aerobically, overnight at 37°C. Colony morphology & Gram stained smear of the colonies was observed. Organisms having following colony characters were considered to be suggestive of *Staphylococcus* sp.: Blood agar colony – 1-3mm in diameter, circular, white to golden yellow in colour, smooth, low convex, glistening, opaque with or without β haemolysis. Appearance of bluish green colony on MeReSa agar were considered as MRSA. These colonies from blood and Chromogenic agar were picked for Gram's staining. Gram staining was done by using Hucker's modification³ to observe Gram positive cocci approximately of 1µm diameter in size, arranged in clusters. Colonies suggestive of staphylococci were subjected to slide catalase and tube coagulase test.³

All *Staphylococcus aureus* were tested for routine antibiotic susceptibility testing including ceftazidime which is one of the methods used for detection of methicillin resistance.⁴

Discs were applied in collaboration with the clinicians, keeping in mind the antibiotics preferred in our clinical settings, and CLSI guidelines. Antibiotic susceptibility was interpreted according to CLSI guidelines.

III. Results

In our study total 17558 samples were received out of which 1258 strains of *S. aureus* were isolated from patients belonging to various wards. (Table 1)

Table: 1 Staphylococcus aureus (n=1258) isolated from clinical specialties

Specialty	S. aureus	MSSA	%MSSA	MRSA	%MRSA
IRCU/ICCU	14	3	21.43	11	78.57
MICU	62	18	29.03	44	70
OBGY	75	24	32	51	68
Orthopedics	29	20	68.97	9	31.03
Surgery	699	512	73.25	187	26.75
Medicine	58	44	75.86	14	24.14
ENT	49	42	85.71	7	14.29
Pediatrics	212	194	91.5	18	8.5
NICU	48	44	91.7	4	8.33
Total	1258	901	71.17	357	28.83

Table 2: Staphylococci isolated from various clinical specimens

Specimen	S. aureus	MSSA	%MSSA	MRSA	%MRSA
Pus	820	541	65.98	279	34.02
Tracheal aspirate	35	26	74.28	9	25.72
Sputum	64	49	76.67	15	23.33
Body fluid	138	106	76.81	32	23.19
Blood	129	113	87.61	16	12.39
Urine	16	14	87.5	2	12.5
Stool	56	52	92.86	4	7.14
Total	1258	901	71.17	357	28.83

Table 3: Comparison of antibiotic resistance pattern of MSSA and MRSA to other antibiotics

Antimicrobial agent	S. aureus % Resistance (n=1258)	MSSA % Resistance (n=901)	MRSA % Resistance (n=357)
Penicillin	76.88	76.88	100
Erythromycin	56.25	47.3	84
Clindamycin	28.13	10.8	50.5
Cefoxitin	28.3	0	100
Trimethoprim-Sulfamethoxazole	37.5	37	73
Linezolid	0	0	0
Ciprofloxacin	56.95	63.55	69.9
Tetracycline	42.3	38.77	56.24
Gentamicin	46.14	25.18	65.23
Nitrofurantoin (urine sample= 16)	0	0	0

IV. Discussion

The distribution of MRSA varies according to factors such as population, areas studied, use of different culture techniques and different interpretation of guidelines. In our study 1258 strains of *S. aureus* were isolated from patients belonging to various wards. (Table 1)

Maximum number of *Staphylococcus aureus* was isolated from surgery wards. However isolation rate of MRSA was found highest in IRCU/ICCU (78.57%), MICU (70.97%) followed by OBGY (68%). Hussain et al⁵ found 65% of MRSA isolates from surgical ICU patients. Narzekina et al⁶ reported the rates of MRSA in general medical/surgical wards, ICUs, traumatic/orthopedic surgery wards were 11.1%, 41.3%, and 41.6% respectively. In our study, MRSA isolation rate from other clinical specialties was in range of 24-32 % (Medicine 24.14%, Surgery 26.75%, Orthopedics 31.03%). Higher prevalence in ICUs might be due to prolonged antibiotic treatment of severely sick patients, who generally have longer hospital stay, resulting in enhanced selection pressure. This reflects the fact that critically ill patients have a greater chance of getting infected. The pediatric ward (8.5%) and NICU (8.33%) showed lesser percentage of MRSA isolation. In these wards clinicians were found to be aware about the risk of MRSA. Adherence to strict hygienic practices was followed in these wards by clinical as well as para-clinical personnel.

The various specimens from which *S. aureus* were isolated are shown in Table 2. Considerable differences were observed when the distributions of MRSA isolates in different specimens were compared. In our study, the prevalence of methicillin resistance was highest among pus samples i.e. 34.2%. Similar observation was made by Mehta et al⁷, who in their study on control of MRSA in a tertiary care center, had reported an isolation rate of 33% from pus and wound swabs. Tyagi et al⁸ found it to be 44%. Pus and wound swabs accounted for the majority of MRSA isolates (76.3%) by Pai et al.⁹ However, Navneetkumar et al reported only 12.72% MRSA from pus sample.¹⁰ In our study tracheal aspirate yielded 25.72% MRSA followed by sputum 23.33%, body fluids 23.19%, blood 12.39%, urine 12.7% and stool 7.14%. However Rubeena et al¹¹ found the yield of MRSA was highest from endotracheal secretions (100%) & Navneetkumar et al¹⁰ from Blood.

The prevalence of MRSA varies considerably from one Geographic region to other. In India, the prevalence of MRSA was low 6.9% in 1988, which gradually increased in next decade mostly ranging between 33 ± 5%. Our data is also within this range. We studied total 1258 *Staphylococcus aureus* samples, out of which 357 were cefoxitin resistant. This makes prevalence of MRSA 28.37% in our study. We compared our data with various studies from India.

Sr. No.	Author	Year	MRSA%
1	Pullimod et al.(Vellore) ¹³	1988	6.9%
2	Verma et al, Indore ¹⁴	2000	80.89%
3	Majumder et al, assam ¹⁵	2001	23.2%
4	Tahnkiwale et al, Nagpur ¹⁶	2002	19.56%
5	Anupurba et al Uttar Pradesh ¹⁷	2003	54.8%

6	Khande et al Maharashtra ¹⁸	39.1%	2003
7	Mohanty et al Delhi ¹⁹	38.56%	2004
8	Rajaduraiipandi et al, Tamilnadu ²⁰	31.1%	2006
9	Mehta et al , Chandhigarh ²¹	24%	2007
10	Pai V. et al , Manglore ⁹	29.7%	2008
11	Tyagi A et al , AIIMS Delhi ⁸	42%	2008
12	Lahari S. et al , Assam ²²	34.78%	2009
13	Arora S et al Amritsar ²³	46%	2009
14	Anila et al Coiambtor ²⁴	34%	2010
15	Navneetkumar, Anand, Gujrat et al ⁹	16.27%,	2010

Currently, majority of *S. aureus* strains are beta-lactamase producers, hence resistant to penicillin. Our study reports 76.88% resistance to penicillin. A study from Solapur, Maharashtra has reported that more than 90% isolates have been found resistant to penicillin, ampicillin also to erythromycin, gentamicin, and tobramycin.¹⁸ In India MRSA emerged as a big problem in 1980s to 1990s.²⁵ MRSA is often multidrug-resistant. Multidrug resistance among MRSA strains was higher than those that were sensitive to methicillin.²¹ Our study showed considerable difference in sensitivity pattern in MSSA and MRSA except for drug ciprofloxacin. Resistance for ciprofloxacin was almost similar in MSSA (63.55%) & MRSA (69.9%). It might be due to over-usage of this antibiotic.²⁶ Gentamicin, trimethoprim–sulfamethaxazole & tetracycline resistance in MSSA isolates was 25.18%, 37%, 38.77% respectively. However MRSA isolates showed high degree of resistance to these other drugs viz gentamicin 65.23% trimethoprim – sulfamethaxazole 73% & 56.24%. This is somewhat in concordance with various studies.^{27,5,9,10} On basis of this observation of high degree of resistance in MRSA as compared to MSSA, we can say that in our institute MSSA has yet to be replaced by MRSA strains. Care must be taken not to let this happen because fewer therapeutic options are available for treatment. Vancomycin and linezolid are drugs of choice for MRSA infection. However, fearing MRSA, clinicians may exploit vancomycin and linezolid, especially when a sensitivity study is not performed.

Vancomycin is a notable exception to development of resistance. We found our all isolates including MSSA and MRSA to be 100% sensitive to Vancomycin.

However occasional reports of emerging resistance are making headlines in medical journals.²⁸ Linezolid resistance has also been reported.²⁹ Our all isolates were sensitive to linezolid.

V. Conclusion

Total 1258 staphylococcus aureus strains were included in the study from different wards coming to our laboratory during the period January 2011 to October 2012. Cefoxitin disc diffusion detected 357 MRSA strains, thus making prevalence of MRSA 28.37%. Maximum MRSA was found in pus samples 34.2% followed by tracheal aspirate 25.72%. Maximum isolates of MRSA belonged to ICCU/IRCU 78.57% followed by MICU 70.97%. MRSA isolates showed high degree of resistance to other drugs viz. clindamycin 50.5%, gentamicin 65.23%, trimethoprim – sulfamethaxazole 73%, erythromycin 76.88%, tetracycline 56.24%. Monitoring the epidemiology and the burden of MRSA infections is crucial to control of MRSA and its spread of infection.

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