Original article:

Prevalence of methicillin resistant staphylococcus aureus- A study in a tertiary care rural hospital

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Abstract:

Introduction: The present study was planned to determine the prevalence of Methicillin ResistantS. aureus (MRSA) from clinical specimens and to know the Antibiotic susceptibility pattern of MRSA

Methodology: The Study was carried out in the Department of Microbiology, MIMER Medical College, Talegaon (Dabhade), Pune from 1st April 2007 to 31st Dec. 2012. A total of 1217S.aureus strains were isolated fromclinical specimens like urine, pus, blood, sputum etc.All strains were identified by standard microbiological techniques.S.aureus strains were subsequently tested for Methicillin resistance by using Oxacillindisc [1mcg].The antibiotic susceptibility pattern of all MRSA strain was determined by Kirby-Bauer Disc Diffusion method.

Summary of Results: Out of 1217 S.aureus, 856 (70.33%) isolates were MRSA.The highest percentage of MRSA strains was obtained from urine sample (82.38%). More than 70% of MRSA strains were found resistant to Cefuroxime, Augmentin,and Ofloxacin &Ciprofloxacin (74%). The lowest rate of resistance was noted to Linezolid(21.22%)&Ampicillin-Sulbactum combination(24.12%).

Conclusion: S. aureus is the most important nosocomial pathogen seen in tertiary care hospitals. The worst feature of MRSA is simultaneous drug resistance to many antibiotics. Knowledge of prevalence and antibiotic sensitivity pattern of MRSA helps clinician.Linezolid and Ampicillin-Sulbactum combination are promising therapeutic option in an era of rapidly growingantibiotic resistance for treatment against MRSA infections.

Key words: MRSA- Prevalence & Antibiogram

Introduction:

In the genus Staphylococcus, S. aureus is the most important pathogenic organism. S. aureus is one of the most versatile nosocomial pathogen [1, 2].S. aureus has overcome most of the therapeutic agents that have been developed in recent years and hence antimicrobial chemotherapy for this species has always been empirical [3]. The most notable example was the MRSA which was reported just 1year after the launch of methicillin [4]. MRSA 1st reported in 1961 from the UK, have since then become major nosocomial pathogen worldwide. It is also called as

Oxacillin resistant S. aureus [Oxacillin Resistant S.aureus-ORSA]. It is responsible for serious skin infections, necrotizing fasciitis and endocarditis, sepsis, deep tissue abscesses and bone and joint infections [5].

MRSA is seen in tertiary care hospitals with special care units. The worst feature of MRSA is simultaneous drug resistance to many antibiotics, chronic carrier stage among the healthcare workers and greater resistance of the strain [6].

The possible predisposing factors of MRSA emergence are – [8, 9]

- Prolonged hospital stay   - Indiscriminate use of antibiotics
- Lack of awareness   - Emergency surgery
- Presence of other disease   - Admission in ICU/burns units
- Receipt of antibiotics before coming to the hospital

Hospital to hospital transmission may also be responsible for increasing the load of MRSA in referral hospitals. The development of resistance to multiple antibiotics and control of disease transmission by MRSA isolates in hospitals/-communities have been recognized as the major challenges. Hence the knowledge of prevalence and the antibiotic pattern of MRSA help the treating physicians for the first line of treatment in the hospitals. The present study was planned with an aim to determine the prevalence of MRSA from different clinical specimens . [urine, pus, blood, sputum and throat swab, miscellaneous(cervical and vaginal swabs, ear swabs, corneal scrapings/swab, rectal swab etc.)] and to know the current status of MRSA response to commonly used antibiotics

Material and Methods:

The study was carried out in the period from 1st April 2007 to 31st Dec. 2012.A total of 4373 clinical specimens [urine, pus, blood, sputum, throat swab and miscellaneous] were collected for S. aureus screening. All the samples were aseptically handled and processed. Morphotyping was done for all the samples based on the Gram staining method to determine the likely organism present. Subsequently the clinical specimens were inoculated on to Nutrient agar and Blood agar and incubated overnight at 37°C.

The colonies of Gram Positive Cocci (GPC) in clusters were further tested for the production of free coagulase enzyme and mannitol fermentation. All the confirmed S. aureus strains were subsequently tested for methicillin resistance based on Kirby-Bauer Disc Diffusion method by using oxacillin disc [1mcg] obtained from Hi-media Laboratories Pvt. Ltd. The Isolates were considered methicillin-resistant if the zone of inhibition was 10mm or less. Further, the antibiotic susceptibility pattern of methicillin resistant S. aureus (MRSA) strain was determined by Kirby-Bauer Disc Diffusion method on Muller Hinton Agar (MHA) using the criteria of standard zone sizes and inhibition to define sensitivity or resistance to different antimicrobials.

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The antibiotics used were-

Oxacillin [Ox] 1mcg	Cefoxitin [Cn] 30mcg
Ampicillin/Sulbactam [AS] 20mcg	Co-trimazazole [BA] 25mcg
Ciprofloxacin [RC] 5mcg	Ofloxacin [Of] 5mcg
Cephalexin [PR] 30mcg	Gentamycin [GM] 10mcg
Tetracycline [TE] 30mcg	Amikacin [Am] 30mcg
Cefotaxime [CF] 30mcg	Cefuroxime [Co] 30mcg
Linezolid [LZ] 30mcg	Erythromycin [Er] 15mcg
Clindamycin [Cy] 2mcg	Clarithromycin [Clr]
Augmentin [Au] 30mcg (20mcg+10mcg)	Cloxacillin [Cx] 1mcg

The data thus obtained was recorded and analyzed by using appropriate statistical methods.

Results:

The prevalence of MRSA was significantly different among various clinical specimens.

The prevalence rate of S. aureus and MRSA is shown in Table- 1.

Table- 1: Prevalence of S. aureus and MRSA

Clinical Specimen	Total Specimen	Total Isolates	S. aureus	MRSA	% of MRSA
	N = 4373	N= 2547	N = 1217	N = 856	
Urine	1007	631	210	173	82.38
Pus	1073	899	518	335	64.67
Blood	1056	451	120	163	62.69
Sputum & Throat swab	306	158	72	58	80.55
Miscellaneous	931	408	157	127	80.89
Total	4373	2547	1217	856	70.33

During the study period, we received 4373 clinical specimens, of which 2278 were culture positive. From 2278 culture positive specimens we could isolate 2547 bacterial isolates, of which 1217 (47.78%) were S.aureus. Out of 1217 S.aureus, 856 (70.33%) isolates were MRSA.

Table-2:- Drug Resistance Pattern of S.aureus & MRSA Isolates

Drug	S.aureus (1217 Nos.) %	MRSA (856 Nos.) %
Oxacillin-OX	70.33	
Cefoxitin-Cn	61.16	61.36
Linezolid-LZ	18.41	21.22
Ampi./Sulbactum-AS	25.49	24.12
Cloxacillin-CX	46.13	52.32

Cephalexin-PR	54.15	57.84
Cefotaxime-CX/CF	52.3	63.20
Cefuroxime-CO/CR	78.19	85.74
Gentamycin-G/Gm	44.24	52.57
Tetracyclin-Te	37.15	42.44
Co-trimaxazole-BA	55.92	61.91
Erythromycin-Er	61.53	67.55
Ciprofloxacin-Rc/Cp/Cip	62.69	74.06
Ofloxacin-OF	77.6	84.56
Clindamycin-Cy	44.98	52.50
Clarithromycin-Clr	65.67	71.14
Amikacin-An/Am	44.68	44.13
Augmentin-Au	78.1	85.53

The drug resistance pattern of MRSA isolated from various clinical specimens was found to be highly variable.

Discussion:

MRSA is a major nosocomial pathogen causing significant morbidity and mortality [10]. The important reservoirs of MRSA in hospitals/-institutions are infected or colonized patients. Transient hand carriage of health care workers is the predominant mode for patient to patient transmission [11]. In India, the significance of MRSA had been recognized relatively late and it emerged as a problem in the 80s and in the 90s. In the present study, the prevalence and antibiotic susceptibility pattern of MRSA isolates obtained from different clinical specimens was determined.

Out of 4373 clinical specimens, 2278 (52%) were culture positive. From 2278 culture positive specimens 2547 isolates were obtained. Of 2547, 1217 (47.78%) were S.aureus. Out of 1217 S. aureus, 856 (70.33%) isolates were MRSA. The prevalence of MRSA ranges between 30-80% in various studies [9, 12-18]. However, Tankhiwale et al [19] reported

low % (19.54) of MRSA strains from various clinical specimens. D. Majumder et al from Assam [14] noted the prevalence of 52.9% MRSA among patients & healthy carries. On further analysis, they showed that 23.6% Staphylococcal isolates from patients were methicillin resistant.A study from Indore [16] has shown the increased prevalence of MRSA at a greater pace since 1992 (12%) to 1999 (80.83%). S. Vidhani et al [20] reported 51.6% of MRSA amongst S. aureus isolates from burns & orthopedic units of LN hospital New Delhi.

In the present study, the highest percentage (82.38) of MRSA strains was obtained from urine sample. Followed by this, 80.89% MRSA strains were obtained from miscellaneous group of clinical specimens, 80.55% from sputum & throat swabs. From pus & blood respectively 64.67% & 62.69% of MRSA strains were isolated. Anupurba et al [12] reported a high percentage of MRSA strains from various clinical specimens. They reported 76% MRSA strain from urine, 56.5% from sputum/throat swabs, 52.5% from pus & wound swabs & 49.1% MRSA strains from blood. Similarly Quereshi et al

[4] and M. Mathur et al [17] reported high isolation rate of MRSA from pus & wound swabs as 83.24% & 74.28% respectively. However, M. Mathur et al [17] reported low percentage of MRSA strains from urine (14.4) & blood (15.1).

Table 3 shows the percentage of MRSA strains isolated from various clinical samples in our study and other studies.

Table 3. The percentage of MRSA Isolates from various Clinical Specimens

Sample	Present study	Ref. 4	Ref. 12	Ref. 13	Ref. 14	Ref. 15	Ref. 17	Ref. 19	Ref. 21	Ref. 22
	%									
Urine	82.38		76			28.4	14.4		14	
Pus	64.67	83.24	52.5	51.9			74.28	26.92	33.6	29
Blood	62.69	1.08	49.1	13.7		15.1	14.41		28.4	38
Miscell- aneous	80.89	15.33					47.61			
Sputum/ Throat swab	80.55		56.5		52.9	54.2	40.21		35.7	
MRSA Prevalence	70.33		54.85	37.12				19.52		

In the present study, MRSA strains showed the highest rate of resistance to Ofloxacin (84.56%), Cefuroxime (78.19%), Augmentin (78.1%), and Ciprofloxacin (74.06%). A Turkish University Hospital study [15] reported 88.8% resistance to Ofloxacin by MRSA strains while Rajaduraipandi et al [21] reported a very low percentage (5.1) resistance to Ofloxacin by MRSA strains. Mathur et al [17] and Dr. Arora et al [24] reported 98.9% & 82.2% MRSA strains resistant to Cefuroxime respectively. Various studies reported resistance to Ciprofloxacin ranging from 12.8% to 98.9% [4, 12, 14, 16, 17, 19, 21, 22, 23]. The present study reported 52.5% of MRSA strains as Clindamycin resistant while other studies reported the resistance to Clindamycin between 42.9% - 60.8% [15, 16, 24].

In the present study, lowest percentage of resistance was noted to Linezolid and Ampicillin-Sulbactum combination. Both S.aureus (18.41%) and MRSA (21.22%) showed lowest resistance to Linezolid. While, 25.49% of S.aureus isolates and 24.12% MRSA strains were resistant to Ampicillin-Sulba-ctum combination. Linezolid has good activity against Staphylococci, including strains resistant to methicillin. Thus, it is a promising therapeutic option in an era of rapidly growing antibiotic resistance [24]. Ampicillin-Sulbactum can be another good option for treatment against Staphylococcal as well as MRSA infections in our set up.

Table 4 shows the percentage of resistance to various antimicrobials by MRSA strains in our study and other study from India and abroad.

418

Table 4:- Percentage of Resistance to antimicrobials by MRSA strains

Drug	Our study	Ref. 4	Ref. 12	Ref. 14	Ref. 15	Ref. 16	Ref. 17	Ref. 18	Ref. 19	Ref. 20	Ref. 21	Ref. 22	Ref. 23	Ref.24
BA	61.91	77.29				63.84			97		35.9	88		100
E	67.55	89.7		33.9	71.8	52.89			68.68	82.3	20.5	76.4		75
G	52.57	97.8	89.7	70.3	90.1	65.08			6.6		20.5	92.8		
TE	42.44	88.6		54.2										71.5
AM	44.13		60.5				69.1	47.4		73.4	7.7			85.8
AU	78.1									87.4				
PR	57.84		88.7								23.1			
CF	52.3						97.3			78.5	17.9			
CR	78.19						98.9							82.2
CY	52.5				60.8	46.28								42.9
CP	74.06	98.9	84.1	22.8		52.2	96.2		33.33		12.8	61.6	56	
OF	84.56				88.8					33	5.1			
CX	46.13						99.4				23.1			

[BA- Co-trimaxazole, E- Erythromycin, G- Gentamycin, TE- Tetracyclin, AM- Amikacin, AU- Augmentin, PR- Cephalexin, CF- Cefotaxime, CR- Cefuroxime, CY- Clindamycin, CP- Ciprofloxacin, OF- Ofloxacin, CX- Cloxacillin]

Conclusion:

MRSA is a major nosocomial pathogen causing significant morbidity and mortality.

- The important reservoir of MRSA is the infected or colonized patient.
- The predominant mode of transmission of MRSA infection is the transient hand carriage on the hands of health care workers.
- The degree of resistance or sensitivity of MRSA towards commonly used antibiotics is diverse from region to region.
- It is imperative to explore alternate effective regime to eradicate MRSA from the hospital and avoid spread in the community.
- Effective prevention and control of infections due to MRSA depends on practice of infection control measures such as hand washing.
- Minimizing the risk factors and attention to alternate cost effective combination therapy may ease the problem of management of infection with MRSA.

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