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# Prevalence of MRSA and its antibiotic susceptibility pattern in Ujjain, MP

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**Abstract:** Background and objectives: MRSA is known to cause community and hospital acquired infections due to its multiple drug resistance. The objectives of this study were to elucidate the prevalence of MRSA among clinical cases of both community and hospital acquired infections and to evaluate the *invitro* susceptibility pattern of different antibiotics against isolated MRSA strains. Methods: Clinical samples were collected from both inpatients and outpatients including swabs from operation theatres and ICUs and were subjected to MRSA screening by the conventional methods. Thus isolated MRSA were subjected to antibiotic susceptibility. Results & interpretation: A total of 145 strains of *Staphylococcus aureus* were isolated. Among these 115 were from indoor patients, 21 from outdoor and 9 were of environmental sources. MRSA was 46% out of the total isolations and MSSA was 54%. The maximum isolation of MRSA was from inpatients (49.5%). The highest isolation rate of 92% of MRSA was reported from blood samples. Vancomycin was the most effective of all drugs used against MRSA strains in *invitro* susceptibility pattern. On the other hand moxifloxacin and gatifloxacin were the most effective against MSSA strains. Conclusions: MRSA is very much prevalent in this part of the country. A dip in the susceptibility of MRSA to vancomycin, prompts an immediate evolving of an alternate drug.

**Keywords:** MRSA, MSSA, SA, Methicillin, Environmental Sources

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## 1. Introduction

*Staphylococcus aureus* is known to cause a variety of diseases, ranging from benign skin infections to life threatening illnesses like sepsis, endocarditis and osteomyelitis, throughout the world (1, 2). It has been reported as a major cause of community and hospital acquired infections (3). The inherent capacity to develop multiple drug resistance by the organism makes it a challenge to combat nosocomial infections (4,5). Resistance to penicillinase resistant antibiotic like methicillin (MRSA) appeared first in 1961 (6). Since then MRSA has been reported from India and elsewhere (7, 8).

A constant surveillance for MRSA and vigorous treatment measures are required for controlling the endemics and epidemics of hospital acquired infections. This part of the country has not been investigated for MRSA before. So, this study has been undertaken to elucidate the prevalence of MRSA among various clinical cases and to evaluate their *invitro* susceptibility pattern against different antibiotics, in and around Ujjain, MP.

## 2. Materials and Methods

A total of 145 isolations of *Staphylococcus aureus* were made from various clinical samples, like, pus (which included swabs from blisters, breast abscesses and umbilical cord lesions), blood, throat swabs, urine, conjunctival swabs, aural swabs, nasal swabs, vaginal swabs and pleural aspirate, mostly, and also from swabs taken from operation theatres and neonatal intensive care units, from RD Gardi Medical College and Hospital in Ujjain, MP.

Of these total isolations, 115 were from clinical samples collected from patients admitted in the hospital for various ailments, 21 from specimens obtained outdoor patients and the remaining 9 from environmental sources as mentioned above. This work was carried out from August 2005 to July 2006.

The isolates were confirmed as *Staphylococcus aureus* by conventional methods, like, gram staining, mannitol fermentation and coagulase test (9). They were later subjected to antimicrobial susceptibility testing for methicillin (5 mcg/disc) by modified Kirby-Bauer diffusion

method on Mueller-Hinton agar by incubating for 24 hours at 35°C (10). All the methicillin resistant *S. aureus* (MRSA) strains were also tested with oxacillin (1mcg/disc) for further confirmation.

Thus confirmed MRSA strains were later subjected to the various antibiotics based on NCCLS to study their susceptibility pattern (10). The antibiotics used were penicillin (10 units), ampicillin (10 mcg), amoxicillin (20 mcg), piperacillin (10 mcg), cefprozil (30 mcg), cefuroxime (30 mcg), gentamicin (10 mcg), amikacin (30 mcg), doxycycline (30 mcg), tetracycline (30 mcg), erythromycin (15 mcg), ofloxacin (5 mcg), vancomycin (30 mcg), gatifloxacin (5 mcg), ciprofloxacin (5 mcg), moxifloxacin (5 mcg), chloramphenicol (30 mcg), cotrimoxazole (1.25 mcg) and azithromycin (15 mcg), from HIMEDIA, Mumbai.

### 3. Period and Place of Study

Work has been carried out between August 2005 and July 2006 at the department of Microbiology, RD Gardi Medical College and Hospital, Ujjain, MP.

### 4. Results

Out of a total of 145 strains of *Staphylococcus aureus* strains isolated, 67 (46%) were methicillin resistant (MRSA), and 78 (54%) were methicillin sensitive (MSSA). Among the 67 MRSA, 57 were from indoor patients (hospital acquired), 6 (9%) belonged to outdoor patients (community acquired) and the remaining 4 (6%) were isolated from hospital environment sources (operation theatres and neonatal intensive care units). Of the 78 isolates of MSSA, 58 (74%) were from indoor patients, 15 (19%) from outdoor cases and 5 (7%) from environmental sources (Table-I).

Clinical sample wise highest number of *S.aureus* strains isolated was from pus(81), followed by blood (24), urine (9), and throat swab and aural swab having 5 each, nasal and vaginal swab 4 each, conjunctival swab 3 and pleural aspirate 1. The total number of MRSA and MSSA strains isolated from the clinical samples is tabulated in Table-II.

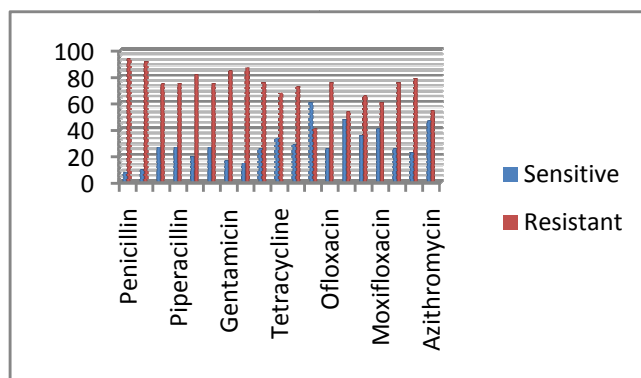
**Table 1.** Distribution of MRSA and MSSA among inpatients, outpatients and environmental sources

Sources	No. <i>S. aureus</i> isolated	MRSA	MSSA
Inpatients	115	57 (49.5%)	58 (50.5%)
Outpatients	21	6 (29%)	15 (71%)
Environmental sources	9	4 (44%)	5 (56%)
Total	145	67 (46%)	78 (54%)

**Table 2.** Distribution of MRSA and MSSA among various clinical samples

Samples	No. of <i>S. aureus</i> isolated	MRSA	MSSA
Pus	81	26 (32%)	55 (68%)
Blood	24	22 (92%)	2 (8%)
Throat swab	5	4	1
Urine	9	7	2
Conjunctival swab	3	0	3
Aural swab	5	1	4
Nasal swab	4	1	3
Vaginal swab	4	3	1
Pleural aspirate	1	0	1

On studying the antimicrobial susceptibility of MRSA, from indoor patients (57), it was found that the most number of MRSA strains, 34 (60%), were susceptible to vancomycin followed by gatifloxacin 27 (47%), azithromycin 26 (46%) and moxifloxacin 23 (40%). On the other hand the highest number of MRSA strains were resistant to penicillin 53 (93%) followed by ampicillin 52 (91%), amikacin 49 (86%) and gentamicin 48 (84%) (Figure 1).



**Figure 1.** Sensitivity pattern of MRSA

Among the 6 MRSA isolated from outdoor patients, the most effective antibiotics were vancomycin, azithromycin, ciprofloxacin, cefuroxime and piperacillin. The most number of strains resistant were to penicillin, ampicillin, cotrimoxazole, doxycycline, erythromycin, tetracycline, ceftiofime and chloramphenicol.

The antimicrobial susceptibility among a total of 58 isolations of MSSA from indoor patients, the most effective drugs were, gatifloxacin and moxifloxacin, 52 (90%) of each, followed by vancomycin 45 (78%) and cefprozil 44 (76%). The most number of MSSA resistant were to penicillin 58 (100%), followed by ampicillin 57 (98%) and erythromycin 56 (97%) (Figure 2).

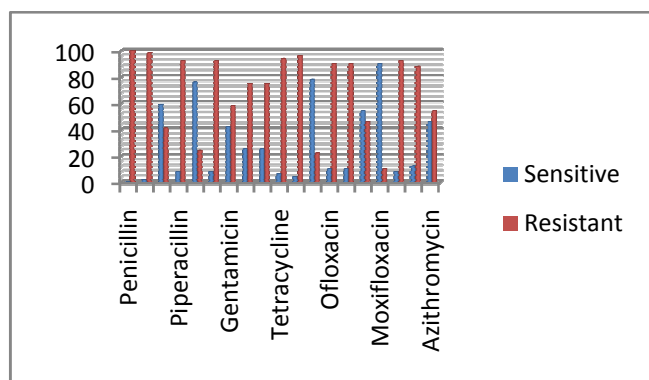


Figure 2. Sensitivity pattern of MSSA

Among the 15 MSSA outdoor isolations, the most effective antibiotic was cefprozil, followed by moxifloxacin and ciprofloxacin. The most number of strains were resistant to penicillin, followed by tetracycline and cefuroxime.

## 5. Discussion

There were no earlier reports of MRSA from this part of the country. Our study indicates a relatively a higher prevalence (46%) of MRSA among the total number of *S. aureus* strains isolated from various clinical cases. This observation is in correlation with the earlier studies in Assam and Karnataka (11, 12). Both outdoor and indoor patients were included in our study so as to understand the prevalence of MRSA among community acquired and nosocomial infections, respectively. The prevalence rate of MRSA among indoor isolations of *S. aureus* (49.5%), is more than as reported by SK Mathur *et al*, 1994, though the outdoor rate of 29% is in correlation with their study (13). The presence of 5 MRSA strains out of 9 *S. aureus* isolated from environmental sources (operation theatres and ICUs), further strengthens the view of MRSA spread of nosocomial infections. The highest isolation of MRSA from blood (92%) among all other clinical specimens is in the same view of Dalip K Kakru *et al*, 2003 (14). This may be attributed to the iatrogenic infection occurring among inpatients. Another interesting observation is the higher prevalence of MRSA among UTI, URTI and gynaecological cases as evidenced by their isolation from urine, throat swab and vaginal swab, respectively (Table II).

While studying the antibiotic susceptibility pattern among MRSA strains, we have included 19 antibacterials representing penicillins, cephalosporins, aminoglycosides, tetracyclines, macrolides, glycopeptides and quinolones, apart from chloramphenicol, cotrimoxazole and azithromycin as per NCCLS.

Though vancomycin is found to be the most effective drug (60%) as like the earlier investigations (K Rajadurai *et al*, 2006) (15), the number of MRSA strains responding to it has come down, which is a concern to evolve newer antibiotics to control the spread of infections due to MRSA.

While attempting to study the relative response of MSSA strains in comparison with MRSA, we found an increased susceptibility pattern. But, gatifloxacin and moxifloxacin have overtaken vancomycin as the most effective drugs, which is a variation from the earlier reports.

In conclusion, MRSA is very much rampant in this part of the country. Also the fact that decrease in the susceptibility of MRSA strains to vancomycin is a major concern to evolve a newer drug showing uniform sensitivity against these strains.

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