

# DRUG RESISTANCE PATTERN OF METHICILLIN RESISTANT STAPHYLOCOCCUS AUREUS

N. Pal  
A. Ayyagari

## ABSTRACT

A total of 404 methicillin resistant *Staphylococcus aureus* (MRSA) isolated from pus, CSF, blood and sputum of various hospitalized cases were analyzed. The resistance pattern of these strains were gentamicin (51.8%), erythromycin (80.1%) and co-trimoxazole (89.6%). All these strains were sensitive to vancomycin. The isolation rate was maximum from various surgical specialities (General surgery—28.5%; Neurosurgery—16.3% and Cardio-thoracic unit—10.5%) followed by Children Ward, Premature Nursery and Gynecology Ward, respectively. Use of cloxacillin needs to be restricted since vancomycin, the drug of choice is not available in our country.

**Key words:** *Staphylococcus aureus*, Methicillin resistance, Antibiotic resistance.

From the Department of Medical Microbiology, Postgraduate Institute of Medical Education and Research, Chandigarh 160 012.

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Soon after methicillin became available, resistance to it was reported in *Staphylococcus epidermidis* and *Staphylococcus aureus*(1). With the increasing spread of methicillin resistant *Staphylococcus aureus* (MRSA) in various parts of the world, microbiologists have sought typing systems which distinguish new epidemic strains from endemic ones(2). New *Staph. aureus* strains are usually detected by their different pattern of antibiotic resistance. The spread of these strains may be monitored by antibiograms, biochemical tests or by bacteriophage typing(3). Indiscriminate use of various drugs in modern clinical practice made us to assess the prevalence of MRSA isolated from patients admitted in various wards in our hospital and their resistance pattern to various routinely used antibiotics.

## Material and Methods

One thousand seven hundred seventy seven strains of *Staph. aureus* were isolated from pus (n=700), CSF (n=500), blood (n=370) and sputum (n=200) of various patients admitted in Nehru Hospital, Postgraduate Institute of Medical Education and Research, Chandigarh from January, 1988 to March, 1990. Different specialities from where samples were collected were Male Surgical (n=14864), Special Male Surgical (n=4845), Neuro-Surgery (n=17880), Cardio-Thoracic (n=10028), Pediatrics (n=33850), Premature Nursery (n=3318) and Gynecology (n=6582). Of 1770 *Staph. aureus* positive cases, 700 were children and 1070 were adults. All these strains were identified as *Staph. aureus* by conventional methods(4,5). Antibiotic sensitivity testing (except methicillin) of these strains were done by modified Stokes technique of Agarwal(6), using Oxford *Staph. aureus* (NCTC 6571) as reference standard

strains. The antibiotics used were penicillin (1 unit/disc), tetracycline (10 µg/disc), erythromycin (10 mg/disc), gentamicin (10 µg/disc), co-trimoxazole (25 µg/disc) and also ciprofloxacin (50 µg/disc), cefotaxime (30 µg/disc) and cefuraxime (10 µg/disc) recently (January-March, 1990). All the antibiotic discs were commercially available from Hi Media, Bombay, India.

Testing of methicillin sensitivity was done as per Stoke's method. A filter paper strip (80 mm × 8 mm) was soaked in methicillin solution (100 µg/strip). Twelve strains of Staphylococci were streaked at right angles on both sides of methicillin strip kept on 5% salt agar plates. Methicillin sensitive and resistant control strains were also put up. The plates were incubated at 30°C after 30 minutes of prediffusion. The strain was reported resistant if it grew upto a distance of 3 mm from the edge of the filter paper. A sensitive strain gave an inhibition zone of 10 mm or more from the edge of the filter paper.

## Results

The results of the sensitivity pattern is shown in *Table I*. Of 1770 *Staph. aureus* strains, 404 were resistant to methicillin. The resistance pattern of these 1770 strains to co-trimoxazole, gentamicin and erythromycin were: 80.7, 34.1 and 29.9%, respectively. When scrutinised thoroughly, it was found that of 404 MRSA strains, all (100%) were resistant to penicillin and tetracycline, 89.6% to co-trimoxazole, 80.1% to erythromycin and 51.8% to gentamicin. Out of 39 MRSA strains (January-March, 1990) isolated from blood, CSF and sputum, all were resistant to cefuraxime, 32 were resistant to Cefotaxime and 30 to ciprofloxacin.

*Table II* shows the patterns of resis-

tance of the MRSA strains to various antibiotics.

## Discussion

The appearance of MRSA strains which have become endemic in hospital acquired infections is more closely related to total antibiotic usage than to specific usage of penicillinase resistant penicillins(7,8). It is always accompanied by resistance to penicillin, isoxazolyl penicillin, nafcillin and cephalosporins(8,9). According to Lacey(10) heterogenous resistance is known to methicillin and all other penicillinase resistant penicillins as has been confirmed in this study. Chakravarty *et al.*(11) found most of the MRSA strains to be multiresistant, penicillinase producers and enterotoxin producers. Therefore, MRSA strains are more virulent than the sensitive one.

The resistance of MRSA strains to a particular drug is mediated exclusively by a diverse family of plasmids or is chromosomally encoded phenotypes(12-15). Traditional methods as bacteriophage typing or biotyping sometimes fails to differentiate among the MRSA strains(12,16). So by seeing the particular antimicrobial sensitivity pattern of the MRSA strains we can guess the source of the strain and subsequently the identity may be confirmed by plasmid or chromosomal DNA analysis.

From *Table I*, it is clear that the isolation rates of MRSA were maximum from various surgical specialities compared to the less number of strains isolated from Children Ward-31 (7.8%), Premature Nursery-23 (5.8) and Gynecology Ward-10 (2.7%). So careful usage and proper monitoring in the administration of various antibiotics can reduce the prevalence of these strains in these specialities. Though

resistance of these strains to cotrimoxazole is quite high (89.6%), the resistance to erythromycin and gentamicin are still less (80.1 and 51.8%), respectively. Thus, sometimes the combination of ery-

thromycin and gentamicin will also help to treat these cases and misuse of these drugs also should be checked. As the resistance pattern of 244 (67%) strains were PTCEGM followed by PTCEM 13% and

TABLE I—Details of 404 MRSA Strains

Specialities	Total No. of samples studied	No. of <i>Staph. aureus</i> strains resistant to			
		Methicillin	Cotrimoxazole*	Erythromycin*	Gentamicin*
1. Male surgical	14864	157 (39.0)	143 (90.9)	124 (78.8)	81 (51.5)
2. Special male surgical	4845	75 (18.7)	66 (87.5)	62 (83.3)	34 (45.8)
3. Neurosurgery	17880	66 (16.3)	63 (95.2)	47 (71.4)	36 (54.8)
4. Cardiothoracic	10028	42 (10.5)	39 (92.6)	34 (81.5)	20 (48.2)
5. Pediatrics	33850	31 (7.8)	29 (95.0)	24 (80.0)	14 (45.0)
6. Premature Nursery	3318	23 (5.8)	18 (80.0)	18 (80.0)	14 (45.0)
7. Gynecology	6582	10 (2.7)	8 (85.7)	8 (87.5)	5 (57.1)

Figures in parentheses indicate percentages.

\*Out of the total MRSA strains in a particular speciality.

TABLE II—Patterns of Drug Resistant of MRSA Strains

Resistance to	Number
*PTC <sub>o</sub> EGM	244 (66.8)
*PTC <sub>o</sub> GM	40 (11.1)
*PTEGM	7 (1.9)
*PTGM	10 (2.8)
*PTEM	10 (2.8)
*PTC <sub>o</sub> M	7 (1.9)
**PTC <sub>o</sub> EGCi Cefu Cefo M	30 (76.9)
**PTC <sub>o</sub> EG Cefu Cefo M	3 (7.7)
**PTC <sub>o</sub> GCi Cefu Cefo M	2 (5.1)
**PTC <sub>o</sub> EG Cefu Cefo M	2 (5.1)
**PTC <sub>o</sub> G Ci Cefu M	2 (5.1)

Figures in parentheses indicate percentages.

\* Total No. of strains = 365

\*\* 39 strains of MRSA from blood, sputum and CSF (January - March, 1990)

P = Penicillin;

E = Erythromycin;

Ci = Ciprofloxacin;

T = Tetracycline;

G = Gentamicin;

Cefu = Cefuraxime;

C<sub>o</sub> = Co-trimoxazole;

M = Methicillin;

Cefo = Cefotaxime

PTCGM 11%, so these MRSA strains are usually multiresistant.

From the *Table II*, it is evident that even the newer generations of cephalosporins like cefotaxime and cefuraxime are not effective in treating the MRSA strains and one of the quinolone derivative ciprofloxacin is also resistant in most of these cases. In fact high level resistance to quinolones in several unrelated clinical isolates of MRSA has been reported in New York city(17). Though rifampicin is highly effective in treating these cases, as resistance develops rapidly, we have reserved this drug only for tuberculosis.

Once introduced, the eradication becomes difficult because vancomycin, the drug of choice is costly one and even not available in our country. Constant surveillance in the form of isolation, prompt identification and later search for environmental and personal sources are needed to control spread of the strain in community. We hope that this study will form a useful reference for clinical microbiologists and others attempting to monitor the spread of EMRSA and for those who wish to devise protocols for the identification of new or endemic strains of *Staph. aureus*.

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## NOTES AND NEWS

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### PAKISTAN PEDIATRIC ASSOCIATION

#### XIth International Pediatric Conference

The XIth Biennial International Pediatric Conference is scheduled to be held in Karachi from February 4-7, 1992 at the College of Physicians and Surgeons, Pakistan, Karachi. The conference is expected to host more than 700 national and international delegates. In addition to leading Pediatricians of Pakistan and the SAARC region, we expect participation by over a dozen international authorities.

An interesting comprehensive programme of a wide ranging scientific, content is being drawn up. In addition there will be a full social and cultural programme for participants and accompanying spouses. Overseas visitors may also be able to avail a wide variety of breathtaking sightseeing tours that Pakistan offers.

Registration Fee:  
(including Banquet and variety programme)

	by 30.11.1991	Late fee
Consultants	Rs. 750/-	900/-
Overseas Registrants	US\$ 150/-	200/-
(Accompanying spouses)	US\$ 75/-	

For further details, please contact:

**Prof. A.G. Billoo,**  
Chairman,  
Organizing Committee,  
Department of Pediatrics,  
Dow Medical College,  
Karachi, Pakistan.

**Dr. Zulfiqar A. Bhutto,**  
Secretary,  
Organizing Committee,  
Department of Pediatrics,  
The Aga Khan University,  
Karachi, Pakistan.