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PREVALENCE AND ANTIMICROBIAL SUSCEPTIBILITY PATTERN OF METHICILLIN RESISTANT *STAPHYLOCOCCUS AUREUS* FROM HEALTHCARE AND COMMUNITY ASSOCIATED SOURCES

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Abstract

Methicillin resistant *Staphylococcus aureus* (MRSA) is an important nosocomial pathogen. We report the prevalence and antibiotic susceptibility pattern of MRSA in Amravati, Maharashtra state (India). A total of 150 healthcare-associated (HA) sources (doctors mobiles phone and wound/pus swabs), and 160 community-associated (CA) sources (hand swab) were screened for MRSA and their antibiotic resistance pattern was performed. Out of 41 isolated strains of *S. aureus,* 77% from HA and 50% CA samples were found to be methicillin resistant. There were high prevalence of MRSA in doctor's mobile phone (83%) and wound/pus (71%) (HA sources) than the hand swab. Almost all HA and CA MRSA strains were resistant to penicillin and penicillin V (100%) followed by cloxacillin and cephalexin, co-trimoxazole. About 56 - 67% HA and CA-MRSA strains were resistance to erythromycin, ceftazidime, lincomycin, ceftazidime, cephalexin, erythromycin and tetracycline indicating high degree of multi-resistance MRSA prevalence in the region. However, 67% strains of CA and 56% strains of HA were sensitive to vancomycin. The study showed high prevalence of MRSA in hospital setting indicating need of good control measures such as proper hand hygiene, avoiding mobile phone while wound dressing and treating patient, surveillance cultures and monitoring of susceptibility patterns of MRSA may also help in arresting the spread of infections in this part of India.

Key words: MRSA, Wound, Mobile Phone, Hands swab)

Introduction

Methicillin-resistant *Staphylococcus aureus* (MRSA) is a major healthcare-associated (HA-MRSA) as well as a community-associated (CA-MRSA) infection causing a wide range of diseases, including endocarditis, osteomyelitis, toxic-shock syndrome, pneumonia, food poisoning and carbuncles. These infections can occur in wounds or skin, burns and IV or other sites where tubes enter the body, as well as in the eyes, bones, heart or blood (Chamber, 2003). In India, MRSA is more in hospital population (patient and staff) as carrier than in the community (Vidhani *et.al.* 2001) and one of the common causes of hospital-acquired wound infections either after accidental injury or surgery and these strains generally show multiple drug resistance, which limits treatment possibilities (Anupurba et al., 2003, Nadig et al., 2006, Orrett and Land, 2006).

Now days, medical professionals extensively use mobile phones which may get contaminated through the hands or when used carelessly in ICU or surgical wards which may act as a source of MRSA to patients and may also pose a danger in spread of infection in the community (Khivsara et al., 2006, Deccan Herald, 2006). The postoperative nosocomial pyogenic MRSA infection is common in most of the surgical hospitals in India. The un-hygienic hand swab showed presence of MRSA and

improvement in hand hygiene, coinciding with a reduction of nosocomial infections and MRSA transmission (Pittet et al., 2000).

Therefore, the knowledge of prevalence of MRSA from HA (doctor's mobile phone, postoperative wound) and CA (hand swab) sources and their current antimicrobial profile become necessary in the selection of appropriate empirical treatment of these infections. We determined the prevalence of MRSA from different HA (doctor's mobile phone, postoperative wound/pus) and CA (hand swabs) samples and their *in vitro* susceptibility pattern to various antimicrobial agents to record the current status of MRSA response to commonly used anti *Staphylococcus* antibiotics.

Materials and Methods

A total of 310 swabs from wounds, doctor's mobile phones and hands were collected over a period of four months from July to October 2006 in Amravati city and processed for isolation of bacterial pathogens and MRSA. A total of 75 mobile phone swab samples of different speciality doctors (surgeons and non-surgeons) from Dr.P.D.M. Medical College, Amravati were collected in sterile vials by using sterilized cotton bud dipped in saline water (0.85%). Before taking swab samples, both hands were thoroughly washed with soap and disinfected with alcohol. The sterilized cotton bud was rotated onto the overall surface area of the mobile phone by keeping the mobile phone in two fingers. The cotton bud after swabbing the mobile phone was again kept in the respective sterile vials. A total of 75 wound/pus samples were collected from postoperative wound from various orthopedics and surgical wards of Dr.P.D.M. Medical College's hospital, Amravati. These specimens were either aspirated by disposable syringe or collected onto sterile cotton wool swabs. A total of 160 hand swabs were collected from school going students.

These collected samples were immediately transported to the microbiology laboratory and inoculated onto MacConkey agar and Mannitol Salt agar plates (Hi-Media Laboratories, Mumbai). These plates were incubated at 37^0C for 24-48 h. Plates were observed for growth and a Gram smear was performed from different types of colonies. Gram reaction, colony morphology, pigment formation, catalase, coagulase, urease and oxidase tests were performed and allocated to appropriate genera to the isolates. The cultural characteristics including lactose fermentation on MacConkey agar and golden yellow colored colonies of *S. aureus* on mannitol salt agar were noted. Further identification to species level was carried out on the basis of various specialized tests (Collee et al., 1996).

All the confirmed *S. aureus* strains were subsequently tested for methicillin resistance based on Kirby-Bauer disk diffusion method (1966) using oxacillin discs (1µg) obtained from Hi-Media Laboratories Pvt. Ltd, Mumbai (India). The isolates were considered methicillin resistant if the zone of inhibition was 10 mm or less. Further, the antibiotic susceptibility pattern of methicillin resistant *S. aureus* strains was determined on the day of their isolation by the Kirby-Bauer disk diffusion method (1966) on Muller Hinton agar using the criteria of standard zone sizes of inhibition to define sensitivity or resistance to different antimicrobials. Finally, the data were recorded and analyzed at the completion of the study as per recommendations of the NCCLS (2000). *S. aureus* MTCC 87 was used as reference strain for the standardization of antibiotic susceptibility testing.

Results and Discussion

MRSA is a major nosocomial pathogen causing significant morbidity and mortality (Dirk Vogelaers, 2006). The important reservoirs of MRSA in hospitals/institutions are infected or colonized patients and transient hand carriage is the predominant mode for patient-to-patient transmission. In India, the significance of MRSA had been recognized relatively late and epidemic strains of these MRSA are usually resistant to several antibiotics. During the past 15 years, the appearance and world-wide spread of many such clones have caused major therapeutic problems in many hospitals, as well as diversion of considerable resources to attempts at controlling their spread (Rajaduraipandi et al., 2006).

In this study, the prevalence and antibiotic susceptibility patterns of various MRSA isolates obtained from healthcare-associated doctors mobile phones, wound/pus and community-associated hand swabs were determined. Swab samples collected from the wounds/pus (75), doctor's mobile phones (75) and hands swab (160) of school going students were screened for *S. aureus* employing conventional microbiological methods. A total of 41 *S. aureus* were isolated including 35 from HA sources- wound/pus 17 (27%) and doctor's mobile phone 18 (25%) and 6 (5%) from CA (hands swab)

sources. Out of them 77% (27/35) from HA sources (71%=12/17 from wound, 83%= 15/18 from doctor's mobile phones) and 50% (3/6 hand swab) from CA sources (Table 1). The prevalence of MRSA was significantly different among various clinical specimens (p <0.001). The present study indicated high rate of isolation of MRSA (77%) from HA sources but Mehta et al. (1998) had reported isolation rate of 33% and Qureshi et al. (2004) from Pakistan reported a high isolation rate, up to 83% MRSA from pus and wound swabs.

Table 1: Number of swab, isolation of *S. aureus* and MRSA from HA and CA sources.

Type of Samples	HA Sources			CA Sources	Total
	Wound/ pus Swab	Doctor's mobile phone	Total HA Sources	Hands swab	
Number of Swabs	75	75	150	160	310
Bacterial Pathogen	64	71	135	128	263
S. aureus	17 (27%)	18 (25%)	35 (26%)	6 (5%)	41 (16%)
MRSA	12 (71%)	15 (83%)	27 (77%)	03 (50%)	30 (73%)

Table 2: Percent antibiotic resistance of *MRSA* isolated from HA (wound, doctor's cell phone) and CA (Hand swabs)

Antibiotics	Conc. (µg)	HA			CA
		Wound swab	Doctor's Cell Phone	Total HA	Hands Swab
Penicillin	2	100	100	100	100
Penicillin V	3	100	100	100	100
Cephalexin	30	83	93	89	100
Cloxacillin	5	75	100	89	67
co-Trimoxazole	25	58	87	74	100
Erythromycin	15	50	87	70	67
Ceftazidime	30	67	67	67	67
Lincomycin	2	42	87	67	67
Ceftriaxone	30	58	67	63	33
Cephotaxime	30	42	67	56	33
Tetracycline	10	33	73	56	67
Amoxycillin	10	67	27	44	67
Vancomycin	30	42	47	44	67
Amikacin	30	25	47	37	33
Netilmycin	30	25	40	33	33
Ofloxacin	2	17	27	22	33

The study showed high prevalence of MRSA in doctor's mobile phone (83%) and wound/pus (71%) (HA sources) than the hand swab (50%) (CA sources). Thus, risk of infection is high in individuals occupationally exposed to wounds or wound dressing or doctor's mobile phones indicating a need to screen individuals in hospitals for risk exposures and infections, to avoid outbreak and cross infections (Panlilio et al., 1992). In present study MRSA isolation rate was high, 77% (27/35), in HA sources (wound/pus and doctor's mobile phone) but Rajaduraipandi et al., (2006), Orrett and Land (2006), Perwaiz et al., (2007) reported it 31, 60 and 32% MRSA in their studies respectively and in CA sources it was 50% MRSA which is similar with findings of Orrett and Land (2006).

The drug resistance patterns of MRSA isolated from HA specimens and CA samples were found to be highly variable. Almost all HA and CA MRSA strains were resistant to penicillin and penicillin V (100%) followed by cloxacillin and cephalexin, Co-trimoxazole**.** About 56 - 67% HA and CA-MRSA strains were resistance to erythromycin, ceftazidime, lincomycin, ceftazidime, cephalexin, erythromycin and tetracycline indicating high degree of multi-resistance MRSA prevalence in this region of India. However, 67% strains of CA, 56% strains of HA were sensitive to vancomycin (Table

2). Majumder et al. (2001) from Assam, Anupurba et al. (2003) from Uttarpradesh and Vidhani et al. (2001) from Delhi in India also reported high percentage of multidrug MRSA but from high-risk patients admitted in burns and orthopedic units. The prevalence of MRSA strains isolated in the hospital setting is now more than in community setting (Ontengco, 2004). Almost all isolated MRSA strains were sensitive to amikacin, netilmicin and Ofloxacin (78-63%) indicating the good drug of choice. This is in consistence to other studies where higher susceptibility rate was observed among the strains obtained from carrier screening samples (Saxena et al., 2003). Nevertheless, we have observed low percentage of multidrug resistant MRSA from CA samples (Table 2).

The study showed a higher prevalence of MRSA in HA as compared to CA sources and indicated high risk of infection in individual exposed to hospital association. Thus, there is a need to screen individual in hospital for risk exposure and infection, to avoid outbreak and cross infection. There was higher degree antibiotic resistance observed in MRSA from HA sources. This may be due to indiscriminate use of multiple antibiotics, prolonged hospital stay, intravenous drug abuse, over counter availability of antibiotics, self-medication and inappropriate use of antibiotics are few important risk factors for MRSA acquisition. Moreover improper handling of mobile phone by doctors may spread MRSA through handling or treating the patients. Thus the control of MRSA is essential to curtail the introduction and spread of infection. This can be achieved by avoiding use of mobile phone by doctor while handling or treating patient and care must be taken while wound dressing and surveillance culture must be performed which help in arresting the spread MRSA in hospital settings. Proper hand hygiene also prevents the spread of MRSA in community setting. The pattern of MRSA may also help in decreasing the prevalence of MRSA and antibiotic resistance.

In conclusion, the study showed high prevalence of MRSA in hospital setting indicating need of good control measures such as proper hand hygiene, avoiding mobile phone while wound dressing and treating patient, surveillance cultures and monitoring of susceptibility patterns of MRSA may also help in arresting the spread of infections in this part of India.

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