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## A Study of Community-Acquired Methicillin-Resistant *Staphylococcus Aureus* Infections among College Students

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### Abstract

*Introduction:* *Staphylococcus Aureus* (*S. aureus*) is a leading cause of gram positive bacterial infections and produces a wide spectrum of diseases. Although *S. aureus* infections were historically treatable with common antibiotics, emergence of Methicillin-resistant *Staphylococcus Aureus* (MRSA) in 1960 in hospital-associated settings, and later in community settings imposed a great burden on health care resources. Several reports have documented MRSA outbreaks in hostels, dormitories and military barracks among inmates. Present study was undertaken in April-May 2015 to investigate an outbreak of CA-MRSA among hostel inmates in Mangalore. *Material and Methods:* Present study was carried in a nursing college hostel in Mangalore, after its first student was admitted on 04 April 2015 with severe skin infection caused by MRSA. Subsequently, 291 suspected hostel inmates were examined and their nasal and skin swabs were sent to hospital laboratory for culture and sensitivity. *Results:* Out of 291 swabs sent for culture, 51(17.52%) were found to be MRSA positive. Out of these, 34 (66.66%) were nasal and 17 (33.34%) were skin swabs. All isolates were found to be resistant to penicillin, ampicillin and erythromycin, but susceptible to ciprofloxacin, clindamycin, doxycycline, tetracycline, cotrimoxazole and vancomycin. These had the drug-resistance pattern of CA-MRSA strains. *Conclusion:* Community-based surveillance studies are required to understand how MRSA is transmitted in the community. Besides, development of an epidemiologic surveillance system would further identify CA-MRSA prevalence and the associated risk factors.

**Keywords:** CA-MRSA; Culture; Resistance; Outbreak; Prevention.

### Introduction

The world is headed for a post-antibiotic era, in which common infections and minor injuries which have been treatable for decades can once again kill," says Dr Keiji Fukuda, WHO's Assistant Director-General for Health Security. Unless significant actions are taken to prevent the misuse of antibiotics, the implications may be devastating [1]. *Staphylococcus Aureus* (*S. aureus*) is a leading example. Although *S. aureus* infections were historically treatable with common antibiotics, emergence of Methicillin-resistant *Staphylococcus Aureus* (MRSA) in 1960 in hospital-associated settings, and later in community settings imposed a great burden on health care resources [2]. It has been observed that people with MRSA (methicillin-resistant *Staphylococcus aureus*) infection are 64% more likely to die than people with a non-resistant form of the infection [3]. Jeanine Thomas a survivor of MRSA sepsis in USA, was instrumental in passing of resolution in 2009 officially designating 02 October as "World MRSA Day" and October as "World MRSA Awareness Month" [4].

Though MRSA began as a hospital-acquired infection (HA-MRSA), it later developed limited access to the community (CA-MRSA) as well. These infections often occur at sites of cuts or scrapes in the skin, as well as in areas of the body covered with hair. Some CA-MRSA strains display enhanced virulence, spreading more rapidly and causing illness much more severe than traditional HA-MRSA infections, and they may affect vital organs and lead to widespread infection (sepsis), toxic shock, necrotizing pneumonia and even death.<sup>5</sup> Even though CA-MRSA may affect anyone, but it is more common among athletes, prisoners, and other groups of people who live in

crowded settings and/or routinely share contaminated items. Poor hygiene practices, such as lack of hand washing, may spread the bacteria more easily [6]. Outbreaks have generally been seen among military recruits, day-care attendees, injection-drug users and gay men [7].

There has been an outbreak of CA-MRSA in Nursing College hostel inmates of AJIMS & RC, Mangalore in April- May 2015. The outbreak was investigated and measures to control it were promptly instituted.

### Material and Methods

Present study was carried in nursing college of Laxmi Memorial Education Trust, Mangalore, after its first student was admitted on 04 Aril 2015 with severe skin infection caused by MRSA. Subsequently, 291 suspected hostel inmates were examined and their nasal and skin swabs were collected and sent to hospital laboratory.

Two samples were collected from each student from two body sites i.e. nose and hand. For nasal sample collection, a sterile cotton swab was moistened by inserting into sterile saline solution and then inserted into both anterior nares, one at a time with the same swab, and rotated gently against the inner surface. Skin samples from hand were collected with a moist swab prepared as described for nasal sampling, by gently rubbing the fingertips of one hand. Nasal and skin samples were collected from 291 students. Antibiotics tested included penicillin, ciprofloxacin, clindamycin, erythromycin, doxycycline, tetracycline, trimethoprim/sulfamethoxazole, and vancomycin.

### Results

The index case, a nursing student was admitted on 09 Aril 2015 in the hospital with severe skin infection caused by MRSA while the last case was reported on 24<sup>th</sup> May 2016 (Figure 1 A & B).

Out of 291 swabs sent for culture, 51(17.52%) were found to be MRSA positive. Out of these, 34 (66.66%) were nasal and 17 (33.34%) were skin swabs. All isolates were found to be resistant to penicillin, ampicillin and erythromycin, but susceptible to ciprofloxacin, clindamycin, doxycycline, tetracycline, co-trimoxazole and vancomycin. These had the drug-resistance pattern of CA-MRSA strains (Table 1).

The main lesions reported by the patients were Furuncle (33.00 %) ,Impetigo (29.62%),abscess (22.22%) and cellulitis (14.81 %) (Figure 2).

Hospital records of preceding three years i.e. 2012 – 2014 were also analysed and it was observed that highest number of cases were recorded in the month of July i.e. 07; while maximum number of cases were reported during 2012 (33),followed by 2014 (21) while the lowest number of cases were admitted during 2013(19) (Figure 3).

All students found positive for MRSA were given appropriate treatment. Swabs were repeated 48 hours after the completion of treatment and thereafter at weekly intervals for three consecutive weeks. All other hostel inmates were de-colonized. Hand hygiene practices by the staff and students were stepped up. Hand rubs were provided in portable sizes. The Staff was sensitized about the outbreak and its nature.

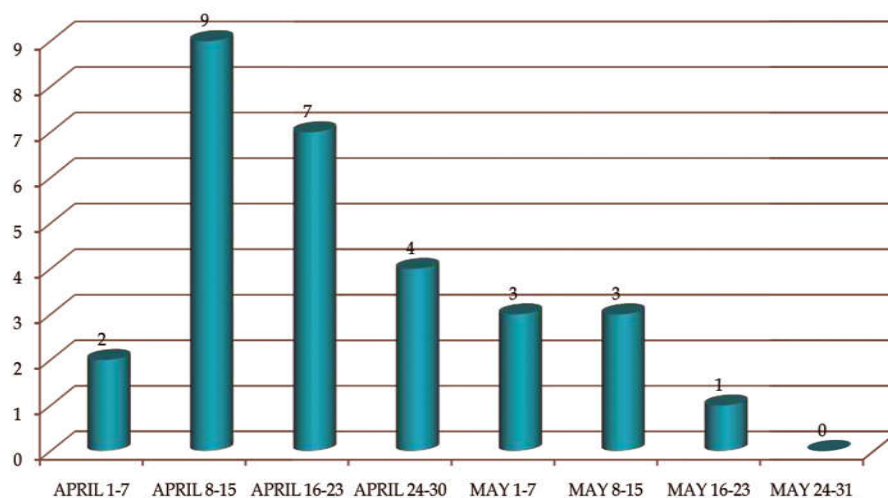


Fig. 1a: Distribution of cases during the month of April-may: 2015

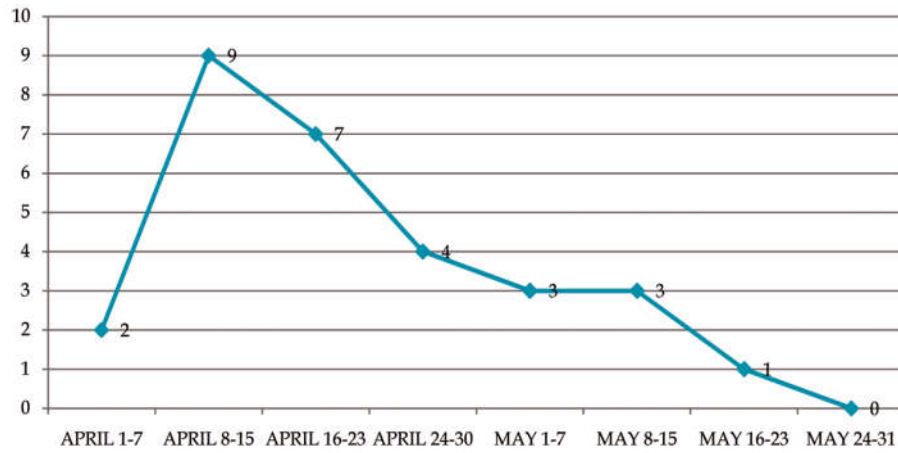


Fig. 1b: Distribution of cases during the month of April-May: 2015

Table 1:

MRSA: CULTURE AND ANTIBIOTIC SENSITIVITY								
PE	CI	CL	DO	TE	TS	AMP	VA	ER
R	S	S	S	S	S	R	S	R

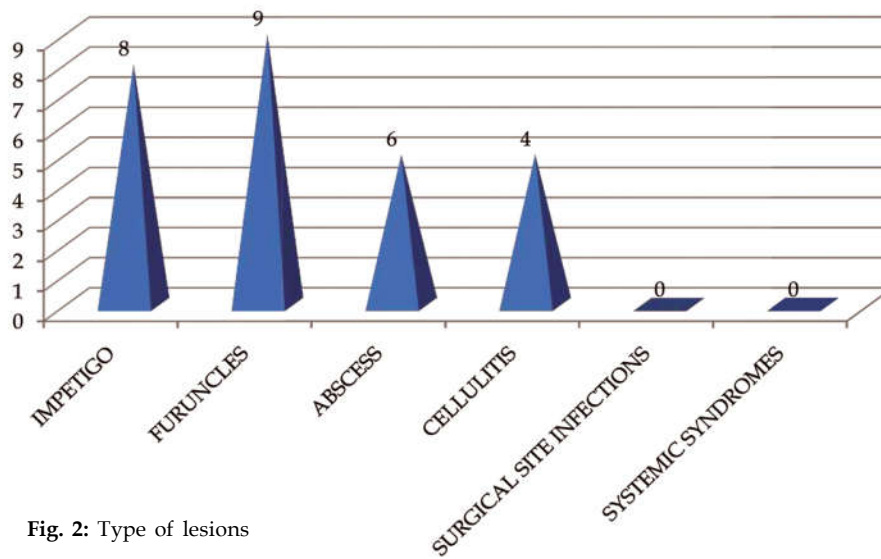


Fig. 2: Type of lesions

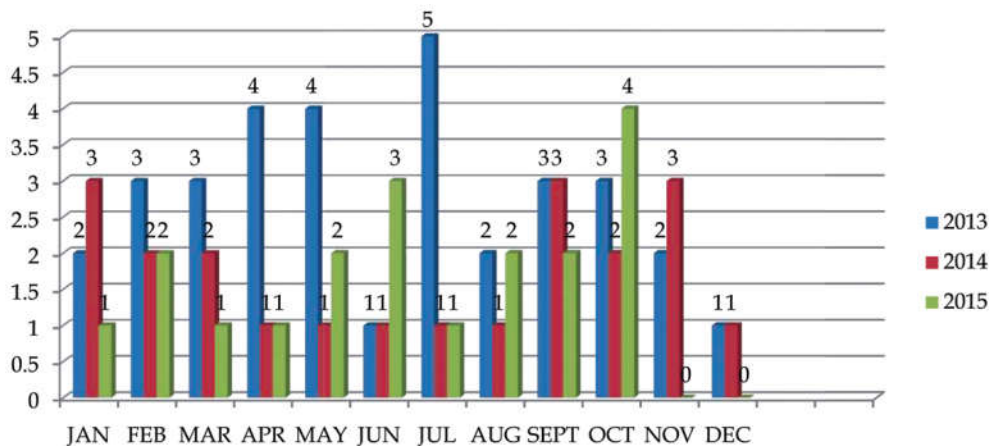


Fig. 3: Hospital records (2012 - 2014)

## Discussion

Community-associated MRSA infections (CA-MRSA) are MRSA infections in healthy people who have not been hospitalized or had a medical procedure (such as dialysis or surgery) within the past year. First recognized in 1960, these were considered to be a medical oddity [8]. Now, MRSA is the most common nosocomial bacterial pathogen isolated in many parts of the World. In the past, community-acquired MRSA (CA-MRSA) infections tended to occur in patients with frequent health care contact or, less commonly, in specific groups of patients, such as intravenous drug users [9]. During the past decade, however, there has been a dramatic change in the epidemiology of community-onset infections caused by MRSA [10]. Young, healthy individuals who lack classic risk factors for MRSA infection are often affected. In present study the prevalence of CA-MRSA was found to be 17.52 % with nose being the more common site (66.66%) than skin (33.34%) (Figure 1). S. K. Fridkin et al (2005) [11] in their study among 1647 cases of CA-MRSA infection observed a prevalence between 8 to 20 percent. Similar findings were also reported by T. J. Ochoa, et al and S. Bratu et al and other researchers in their studies [12-16]. However Joshi S et al (2013) [17] in their study among 26310 isolates found an overall prevalence of 41% while majority of *S. aureus* isolates was obtained from patients with skin and soft tissue infections. Similar results have also been reported in other studies [18,19].

According to a WHO report on antimicrobial resistance high rates of resistance in common infections (e.g. urinary tract infection, surgical site infections, pneumonia and bloodstream infections) have been reported all over the world particularly healthcare associated infections while in MRSA, it is as high as 44% in some parts of the world [20].

In present study all isolates were found to be resistant to all  $\beta$ -lactam antibiotics (beta-lactam antibiotics) and cephalosporins. However, these were found to be sensitive to clindamycin, trimethoprim-sulfa, Vancomycin, Ofloxacin, doxycycline, minocycline, rifampin and linezolid. According to the U.S. Centers for Disease Control (CDC), in 2004, 63% of all reported staph infections in the United States were caused by MRSA [21]. The figure represents a remarkable 300% increase in just 10 years' time. (In 1995, about 22% of all reported staph infections were MRSA, compared with only 2% in 1974). Needless to say, physicians no longer prescribe traditional antibiotics for methicillin-resistant staph infections (Maret, 2007). Instead, they usually

administer "last-resort" intravenous vancomycin, although a growing number of doctors are now prescribing other newer antibiotics. Even with these options, scientists estimate that about 19,000 people in the United States die every year from MRSA. This figure is more than the number of U.S. residents and citizens that die from HIV/AIDS (about 17,000 every year) [21]. In another study by Dr. Pablo et al found less than 20% of *S. aureus* which were isolated mostly from the wounds and abscesses of admitted patients, exhibited resistance to chloramphenicol, tetracycline, and ciprofloxacin but with excellent susceptibility to linezolid [22]. The susceptibility test also confirms a high and increasing prevalence of MRSA and ICR among admitted patients [24].

CA-MRSA strains can produce a variety of lesions i.e. from impetigo to life-threatening necrotizing fasciitis. However, abscesses and cellulitis are the most common presentations i.e. 50%-75% of patients present with abscesses, while 25%-50% with cellulitis generally as single lesions over the extremities [10]. Folliculitis caused by CA-MRSA is a less frequent form of presentation usually with erythematous folliculocentric pustules, which can compromise uncommon localizations (e.g., periumbilical). Impetigo and scalded-skin syndrome due to CA-MRSA (usually in children) are also uncommon forms of the disease. Pyomyositis and myositis due to CA-MRSA are uncommon infections usually involving the lower extremities or pelvis [25]. The main lesions reported by the students in present study were Furuncle (33.00%), Impetigo (29.62%), abscess (22.22%) and cellulitis (14.81%).

Hospital records of preceding three years i.e. 2012 - 2014 were also analysed and it was observed that highest number of cases were recorded in the month of July i.e. 07; while maximum number of cases were reported during 2012 (33), followed by 2014 (21) while the lowest number of cases were admitted during 2013(19) (Figure 3).

All students found positive for MRSA were given appropriate treatment. Their swabs were repeated 48 hours after the completion of treatment and thereafter at weekly intervals for three consecutive weeks. All other hostel inmates were de-colonised. Hand hygiene practices by the staff and students were stepped up. Hand rubs were provided in portable sizes. The Staff was sensitized about the outbreak and its nature

## Conclusion

MRSA is a global health problem causing

infections in hospitals as well as in the community. It also remains one of the most important causes of Health Care Associated infections worldwide. Moreover, many MRSA strains have developed resistance to most of the available antibiotics. MRSA carriers also serve as reservoirs for further transmission as they move through and across healthcare facilities. Needless to say that, with strict adherence to basic infection-control practices i.e. hand hygiene, observance of universal precautions, early identification of cases, isolation and decolonisation of infected patients; it is possible to bring down the MRSA transmission to minimum levels. Besides, the knowledge of the risk factors, transmission mechanism, preventive measures and local epidemiology of MRSA, will further help in improving compliance.

#### Limitation

The study had the limitation of not undertaking the sub typing of MRSA strains needed to identify specific strains of MRSA as many studies have found that CA-MRSA strains in India carry the Panton-Valentine leukocidin (PVL) virulence factor and has staphylococcal cassette chromosome mec (SCCmec) type IV and SCCmec type V.

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