A community based Study on Nasal Carriage of *Staphylococcus aureus*

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Abstract

Background. *Staphylococcus aureus is a major bacterial cause of superficial infectionand a health care associated infection. The emergence of multiple resistances to anti staphylococcal penicillins like cloxacillin, methicillin and other agents has compromised therapy. Methicillin Resistant Staphylococcus aureus (MRSA) infection has become a major problem among the hospitals and the communities. Community studiesin MRSA colonization are lacking. The aim of this study was to describe the prevalence of Methicillin Sensitive Staphylococcus aureus (MSSA) and MRSA nasal colonization in the community and antibiotic susceptibility patterns of these isolates.*

Methods. *This study was a community based descriptive cross sectional study. Nasal samples for S.aureus culture and sociodemographic data were obtained from 317 adults and children≥2 years of age from the selectedtwo communities over a period of two months. S. aureus isolates were identified by routine laboratory methods and antimicrobial susceptibility tests were done by following the CLSI guidelines.*

Results. *Of the 317 persons, 88(27.76%) were positive for S. aureus. Of the 88 isolates, 18 were MRSA and 70 were MSSA. Of the MRSA isolates the sensitivity to Erythromycin, Clindamycin, Linezolid, Ciprofloxacin, Trimethoprim-sulfamethoxazole, Tetracycline and Gentamicin were 5.55%, 33.33%, 100%, 94.44%, 94.44%, 77.77%, 94.44% respectively. Of the MSSA isolates the sensitivity to Erythromycin, Clindamycin, Cefoxitin, Linezolid, Ciprofloxacin, Trimethoprim-sulfamethoxazole, Tetracycline and Gentamicin were 44.28%, 78.57%, 100%, 100%, 72.85%, 95.71%, 84.28%, 81.42% respectively. Inducible Clindamycin resistance was reported 44.44%, 7.14% for MRSA and MSSA isolates respectively.*

Conclusion. *More than a quarter of the study population were colonized with S. aureus. MRSA colonization prevalence was 5.67% (18/317). More than 75% MRSA isolates were sensitive to Ciprofloxacin, Gentamicin, Trimethoprim – sulfamethoxazole, Tetracycline, Linezolid. Therefore, MRSA isolates of this study were more likely to be community acquired. However, further molecular studies are needed to confirm these findings.*

Keywords: Methicillin resistant *Staphylococcus aureus*, *Staphylococcusaureus*, community-acquired.

I. INTRODUCTION

Staphylococcus aureus is the major bacterial cause of skin, soft tissue and bone infections and one of the commonest causes of health care associated infections. Antibiotics are the basis for treatment of staphylococcal infections, but the emergence of multiple resistances to anti staphylococcal penicillins and other agents has compromised therapy. Methicillin resistance was detected in *Staphylococcus aureus* shortly after the agent was introduced clinically and now there is a global epidemic of methicillin resistant *Staphylococcus aureus* (David & Daum,2010). Strains sensitive to methicillin are classified as methicillin- sensitive *Staphylococcus aureus*, or MSSA.

MRSA is a serious current healthcare concern. MRSA was first detected in patients in hospitals and other health facilities, especially among elderly, debilitated and those require long term inmates' (Chambers, 2001). It was also found in patients who undergo surgery and other invasive procedures. In these settings, MRSA is referred to as health care-

associated MRSA (HA-MRSA). MRSA also has been found to cause infections in the community outside of hospitals and other health facilities and is known as community-associated MRSA (CA-MRSA) (Huang, et al.,2006). Both CA- MRSA and HA-MRSA are growing threats to the immune compromisedindividuals as well as to the general public.

Many of the MRSA isolates are becoming multi drug resistant and they are susceptible only to the glycopeptide antibiotics such as vancomycin. Even to vancomycin a low level resistance is emerging (Dhand & Sakoulas, 2012). A prolonged hospital stay or the indiscriminate uses of antibiotics are some of the common factors of the MRSA infections globally. The community prevalence of MRSA is increasing largely due to community associated MRSA strains (Salgado, et al.,2003).

S.aureus colonization can be an indication of a higher risk for subsequent infections, including MRSA. However, no community based prevalence study has been conducted to measure *S.aureus carriage* and reliable published data are lacking within Sri Lanka. The aim of this study was to describe the prevalence of Methicillin Sensitive *Staphylococcus aureus* (MSSA) and MRSA nasal colonization in the community and antibiotic susceptibility patterns of these isolates and their risk factors.

II. MATERIALS AND METHODS

Survey design and Collection of data. This study was a community based descriptive cross sectional study. This study was conducted in two selected communities in Ratmalana divisional secretariat area. This area is within the Medical Officer of Health (MOH) –Dehiwela area.

Study population. Study population was 317, adults and children ≥2 years of age living in the two communities.

Sampling for the survey was done by obtaining nasal swabs. *S. aureus* screening was done for all participants. Known risk factors of MRSA carriage (defined as stay either in an acute care facility or a long term health care facility during last 3 months or 6 months before participation) (CDC, 2010) and other factorsincluding residence with patient with chronic disease, age, gender, occupation, number in house hold, education level, antibiotic use within 3months or 6 months, residence with a patient who had been recently admitted to the hospital were examined.

Laboratory Methods. Nasal samples were collected from both anterior nares by using sterile culture swabs. Culture swabs were plated on Mac Conkey agar and incubated overnight at 35°C. Colonies with distinctive morphology of *S.aureus* were identified by routine laboratory methods and antimicrobial susceptibility tests were done by following the CLSI guidelines.

S. aureus isolates were screened for cefoxitin(30µg).Zone diameters were measured and recorded after 24 hours incubation at 35°C.Isolates determined to be resistant to cefoxitin were selected as MRSA and sensitive to cefoxitin were selected as MSSA (CLSI guidelines, 2012).

Inducible Clindamycin resistance were performed according to the CLSI method.

III. RESULTS

Population characteristics. Three hundred seventeen subjects ≥ 2 years of age were selected from the two communities. 62.77% were female and 37.22% were male. Among the age group selected, highest number of participants was included in the age group of 2-10 years (18.61%). When considering the education level, most of the participants had at least secondary education (52.68%). Both the communities were semiurban communities. 116 families were included for the study.

***S. aureus* carriage**. Out of 317subjects, 88(27.76%) were identified as colonized with S. *aureus*(Table 1). *S. aureus* colonization was highest (26.13%) in the age group of 2-10 years and it was more frequent in households with more than 05 members. Hospital admissions and residences with a patient with a chronic disease were reported only 1.57% and 0.63% respectively for the *S. aureus* isolates. The most number of *S. aureus* carriage rate of 85.22%(75/88) was reported in the families with anincome ofRs.20, 000/= and below, per month.

MRSA carriage. MRSA prevalencewas 5.67% (18/317). MRSA prevalence was highest in the age group of 2-20 (55.54%). The most number of MRSA

carriage rate of 83.33% (15/18)was reported in the families with an income of Rs. 20,000/= and below,per month.

Antibiotic Susceptibility testing. Antibiotic susceptibility tests were done for the antibiotics Erythromycin, Clindamycin, Cefoxitin, Linezolid, Ciprofloxacin, Trimethoprim- sulfamethoxozole, Tetracycline and Gentamicin. High sensitivity was noted in Linezolid (100%), Ciprofloxacin (94.44%), Trimethprim-sulfamethoxozole (94.44%), Tetracycline (77.77%) and Gentamicin (94.44%) for MRSA isolates (Table 3).

MSSA isolates weresensitive to Erythromycin, Clindamycin, Cefoxitin, Linezolid, Ciprofloxacin, Trimethoprim- sulfamethoxazole, Tetracycline and Gentamicin were 44.28%, 78.57%, 100%, 100%, 72.85%, 95.71%, 84.28%, 81.42% respectively(Table 2).

Inducible Clindamycin resistance. Inducible Clindamycin resistance was reported 7.14%, 44.44% among MSSA and MRSA respectively.

Table 1: Prevalence of MSSA and MRSA

Sample size (Study population)	Total No.(%) of subjects with SA	No. (%) of subjects with MSSA	No.(%) of subjects with MRSA
317	88(27.76)	70(22.08)	18(5.67)

Note:
SA- *Staphylococcus aureus*
MSSA-*Methicillin Sensitive Staphylococcus aureus*
MRSA- *Methicillin Resistant Staphylococcus aureus*

Table 2: MSSA antibiotic susceptibilities in 70 samples

Antibiotic	No.(%) of samples, by susceptibility		
	Susceptible	Resistant	Intermediate
*Cloxacillin	70(100.00)		
Erythromycin	31(44.28)	19(27.14)	20(28.57)
Clindamycin	55(78.57)	5(7.14)	10(14.28)
Trimethoprim-sulfamethoxazole	67(95.71)		3(4.28)
Ciprofloxacin	51(72.85)	9(12.85)	10(14.28)
Tetracycline	59(84.28)	8(44.44)	3(4.28)
Gentamicin	57(81.42)	6(8.57)	7(10.00)

* sensitivity tested with cefoxitin(30 µg) disc

Table 3: MRSA antibiotic susceptibilities in 18 samples

Antibiotic	No.(%)of samples, by susceptibility		
	Susceptible	Resistant	Intermedia te
*Cloxacillin		18(100.00)	
Erythromycin	1(5.55)	13(72.22)	4(22.22)
Clindamycin	6(33.33)	10(55.55)	2(11.11)
Trimethoprim-sulfamethoxazo le	17(94.44)	1(5.55)	
Ciprofloxacin	17(94.44)	1(5.55)	
Tetracycline	14(77.77)	4(22.22)	
Gentamicin	17(94.44)		1(5.55)
Linezolid	18(100.00)		

* sensitivity tested with cefoxitin(30µg) disc

IV. DISCUSSION

This was a community based study on MRSA and published data on MRSA within the Sri Lankan community is lacking. Overall, this study demonstrates the prevalence of *S. aureus* in the community and also the prevalence of community acquired methicillin resistant *S. aureus*. This study included young and adult participants of varied age groups from two semi urban communities in the western province.

We found that 27.76% (88/317) of the participants were colonized with *S. aureus*. MRSA prevalence of this study was 5.36% (18/317).Similar finding was noted in the studies of Alvarez & Reddy (2012) in the Indian communitieswhich showed a MRSA prevalence of 4.6%-10.6%.

The risk factors for hospital associated MRSA colonization have been well described, the same has not fully described for CA-MRSA. In this study, we found crowding may contribute to *S. aureus* and MRSA colonization and infection.

In this study, nearly one fourth of the two communities had *S. aureus* colonization and Peak prevalence was found in 2-10 years age group.

In this study has shown that known risk factors for HA-MRSA such as hospital admission (0.315%), residence with a patient with chronic disease (0.315%) and residence with a patient who recently admitted to the hospital (0.63%) had no significant

association with MRSA carriage. Most of the antibiotics tested were sensitive (more than 75%), except for Erythromycin and Clindamycin.Antibiotic sensitivity pattern indicates, all the MRSA isolates were likely to be community acquired MRSA. However, further molecular studies are needed to confirm these findings.

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