

Prevalence of Methicillin Resistant *Staphylococcus aureus* in pyogenic community and hospital acquired skin and soft tissues infections

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Abstract

Objective: To determine the percentage and frequency of Methicillin Resistant *Staphylococcus aureus* in community and hospital-acquired pyogenic skin and soft tissue infections.

Methods: The descriptive cross-sectional study was conducted at the Dermatology Department of Combined Military Hospital, Abbottabad, from June 2009 to March 2010, and comprised 144 community-acquired and 54 hospital-acquired skin and soft tissue infections. Pus swabs from the infected lesions one from each individual were sent to laboratory for culture and sensitivity tests. Methicillin resistance was detected by 1 µg oxacillin disk. Organisms were labelled methicillin-resistant once the inhibition zone for oxocillin was less than 10mm. Data analysis was done by using SPSS 20.

Results: Of the 198 patients in the study, 98(49.5%) were males and 100(50.5%) were females, with an overall mean age of 33.7±14.8144 years. There were 144(72.72%) community-acquired infections and 54(27.27%) had hospital-acquired infections. Community-acquired Methicillin Resistant *Staphylococcus aureus* numbered 40(27.8%) and hospital-acquired ones numbered 26(48.1%).

Conclusion: Prevalence of Methicillin Resistant *Staphylococcus aureus* in community and hospital-acquired pyogenic skin and soft tissue infections was high.

Keywords: MRSA, Community-acquired MRSA, Skin and soft tissue infections. (JPMA 64: 892; 2014)

Introduction

Staphylococcus aureus is one of the most common gram-positive pathogens that cause skin and soft tissue infections (SSTIs).¹ Data from the National Nosocomial Infections Surveillance system suggests that in intensive care units (ICUs) the proportion of Methicillin Resistant *Staphylococcus aureus* (MRSA) isolates has increased from 35.9% to 64.4%.¹ MRSA-associated morbidity and mortality in developing and developed world is increasing. MRSA infection is associated with an almost 50% higher likelihood of hospital deaths compared with Methicillin-Sensitive *Staphylococcus aureus* (MSSA) infections.² Though the majorities of *Staphylococcus aureus* SSTIs are uncomplicated and can be treated with a short course of sensitive antibiotics, some percentage of these cases progress into life-threatening invasive infections.³ MRSA is a multi-drug-resistant isolate and it was first recognised in 1960s, but now it is the most common pathogen emerging rapidly not only in hospitals, but also in community-acquired SSTIs.⁴ Research is required to determine the risks factors of MRSA acquisition because MRSA can cause treatment

failures in empirical treatment by general practitioners, and results in more morbidity and mortality at the basic health setup level and more so at the community level. By knowing the prevalence of MRSA in community and hospital-acquired SSTIs, health planners can plan further strategies for MRSA control. Colonisation with MRSA in health workers is more likely to cause infections to admitted patients.⁵ Open wounds and intravenous devices are potential sites for infection in hospitalised patients. Currently, it is unknown which reservoirs are involved in the rapid spread of community-acquired MRSA, but one view is that nasal carriage of *Staphylococcus aureus* plays an important role in such cases.^{5,6} If MRSA becomes a common form of *Staphylococcus aureus* in a community, it makes the treatment of common staphylococcus infections much more difficult. The most common manifestations of community-acquired MRSA are resistant simple skin infections, but rarely more serious manifestations can occur, such as necrotising fasciitis, necrotising pneumonia,⁷ infective endocarditis, and bone and joint infections.⁸ The risk factors for acquiring MRSA are weak immune system, diabetes,⁹ intravenous drug use, use of antibiotics, hospital admissions and nursing home patients.¹⁰ MRSA infection can be prevented by screening programmes, hand-washing, proper disposal of hospital gowns and wastes, judicious use of antibiotics, infective surfaces sanitising¹¹ and public health awareness

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programmes. The current study was conducted to determine the prevalence of MRSA in community and hospital-acquired pyogenic SSTIs to have a better idea about the increasing percentage of MRSA in Staphylococcus SSTIs.

Patients and Methods

The descriptive cross-sectional study was conducted at the Department of Dermatology, Combined Military Hospital, Abbottabad, from June 2009 to March 2010. All cases of purulent SSTIs coming to the Dermatology Outpatient Department (OPD) were included for community-acquired infections, and those patients who developed pyogenic infections of surgical wounds, burns and cellulitis after 48 hours or later of hospital admissions were included for hospital-acquired SSTIs. Patients with non-purulent SSTIs were excluded. The sub-groupings were done on the basis of most commonly encountered

aureus was identified by coagulase and deoxyribonuclease (DNase) tests. Methicillin resistance was detected by 1µg oxacillin disk. Organisms were labelled methicillin-resistant once the inhibition zone for oxacillin was less than 10mm. Data analysis was done using SPSS 20. Descriptive statistics were used to determine frequencies and percentages of Staphylococcus aureus and MRSA in community and hospital-acquired SSTIs. Independent T test for continuous variables was used to assess the degree of correlation between different variables.

Results

Of the 198 patients in the study, 98(49.5%) were males and 100(50.5%) were females, with an overall mean age of 33.7 ± 14.8144 years. There were 144(72.72%) community-acquired infections and 54(27.27%) had hospital-acquired infections. Among patients with community-acquired

Table-1: Community-Acquired SSTIs.

Diseases	Frequency(n)	Staphylococcus aureus in culture(n1)	Percentage (%)	MRSA in culture(n2)	Percentage (%)
Inf eczema	28	20	71.4	8	28.6
Inf wounds	25	19	76	7	28
Abscesses	26	17	65.4	6	23.0
Furuncles	25	18	72	6	24
Folliculitis	20	16	80	7	35
Inf Tinea pedis	10	6	60	3	30
Inf Scabies	10	7	70	3	30
Total cases	144	103	71.5	40	27.8

SSTIs: Skin and soft tissues infections, Inf: Infected, MRSA: Methicillin Resistant Staphylococcus aureus.

Table-2: Hospital-Acquired SSTIs.

Diseases	Frequency(n)	Staph in culture(n1)	Percentage (%) of staph	MRSA in culture	Percentage(%) of MRSA
Inf surgical wounds	32	26	81.2	14	43.7
Infected burns	14	12	85.7	08	57.1
Cellulitis	08	06	75.0	04	50.0
Total cases	54	44	81.5	26	48.1

SSTIs: Skin and soft tissues infections, Inf: Infected, Staph: Staphylococcus aureus, MRSA: Methicillin Resistant Staphylococcus aureus.

pyogenic SSTI patients in the OPD and wards. After obtaining informed consent from all the patients, thorough clinical examination was done and pus swabs were sent to laboratory for culture and sensitivity tests. Sterile medical cotton swabs with cotton tip in polypropylene test tube were used to collect the pus specimens. Swabs of wound exudates and pus were taken prior to wound cleansing, and transportation to the laboratory without delay was ensured. The specimens were inoculated on blood and MacConkey agar. The same were incubated at 37°C for 24-48 hours. Staphylococcus

SSTIs, the mean age was 30.0 ± 13.8 years, while among the hospital-acquired SSTIs, it was 43.8 ± 12.6 . The difference was statistically significant ($p < 0.05$). Out of 144 community-acquired SSTIs, Staphylococcus aureus was cultured in 103(71.5%) cases and MRSA was found in 40(27.8%)(Table 1). Of the 54 hospital-acquired infections, Staphylococcus aureus was cultured in 44(81.5%) cases and MRSA was found in 26(48.1%) (Table 2).

Discussion

The study was conducted to assess the prevalence of

MRSA which was once thought to be a hospital-acquired pathogen, but is on the rise even in community-acquired SSTIs and it is responsible for higher morbidity and mortality. A review of the history of this emerging pathogen indicates that it will likely develop new virulent characteristics in future because of its adaptability.¹² The cause of resistance to methicillin and all other beta lactam antibiotics is the *mecA* gene, which is situated on a mobile genetic element, the *Staphylococcus* Cassette Chromosome *mec* (SCCmec) and there are seven major variants of SCCmec typing for MRSA. SCCmec genomic complex of types IV and V are usually associated with community-acquired infections.¹³ Our study showed that the percentage of MRSA in hospital-acquired SSTIs was 48.1%. This prevalence rate is similar to a study conducted in India in which the isolation rate of MRSA from admitted patients was 42% while that of ICUs was 43% in 2008, and in 2009 it increased to 49% and 47% respectively.¹⁴ In our study the pus specimens were collected purely from SSTIs, but in the Indian study isolates of MRSA were also collected from blood stream infections and respiratory infections, so our study is one of the few studies which show the prevalence of MRSA exclusively in skin infections and surgical wounds.¹⁵ A study from Libya showed that during the last decade the prevalence of MRSA among *Staphylococcus aureus* infections from patients with burns and surgical wounds was 54-68%.¹⁵ A comparable prevalence rate of MRSA in hospital-acquired infections was also observed by Caini S. et al.¹⁶ Rahman S. et al, from Peshawar, Pakistan, reported that 60% of MRSA cases were contracted in hospitals and more so in burns care centre and after plastic surgery procedures.¹⁷ According to the study, the prevalence of MRSA in all hospital-acquired cases was 32%.

Community associated (CA) MRSA strains have emerged as a substantial cause of infection in individuals without exposure to healthcare system. In all community-acquired SSTIs, we found MRSA in 27.8% cases. One study from Canada showed 32% prevalence of MRSA in all staphylococcus SSTIs presented to hospital emergency departments.¹⁸ Wang et al. from New York showed 65.5% incidence of CA-MRSA from the culture of nasal abscesses caused by *Staphylococcus aureus*.¹⁹ Forcade et al. showed 82% MRSA prevalence in community-acquired abscesses.²⁰ In 1990s the prevalence of MRSA in community-acquired SSTIs was negligible, but now due to the adaptability of this pathogen, the prevalence has risen to an alarming level. The annual incidence of SSTIs in USA has nearly tripled.²¹ An important observation in all studies is that the prevalence of CA-MRSA infections is increasing with each passing year. With this high prevalence, the chances of outbreaks of CA-MRSA

infections are definitely going to increase. One such outbreak was reported by Sanchini et al. from Italy in newborn nursery. The outbreak strain belonged to the USA300 CA-MRSA clone. Asymptomatic carriage of the outbreak strain was found among neonates, parents and hospital staff.²² The risk factors for CA-MRSA are overcrowded living places, high nasal colonisation,²³ irrational antibiotic use and diabetic patients.²⁴ The confounding variables and effect modifiers in our study, as such, can be age, gender, socioeconomic class, family size and co-morbidities like diabetes. Patients with CA-MRSA SSTIs have a high incidence of treatment failure and recurrence. Parchman et al. reported a treatment failure of 21% in primary care clinics.²⁵

The potential sources of bias in our study are selection bias, sampling bias, procedure bias and analysis bias. In our study, random sampling was done of all the pyogenic SSTI cases coming to the dermatology OPD and there were no treatment interferences, so we can say that the study results have external validity. There are several limitations of the study, like the sample size was small and we did not take samples from blood, sputum, intravenous cannulas and urethral catheters which means the study only gives high percentage of MRSA in SSTIs and does not determine the true prevalence and incidence of MRSA. Risk factors like nasal carriage of MRSA, diabetes and overcrowded living places were also not studied.

For the control of SSTIs by CA-MRSA the implementation of appropriate infection control measures in hospitals and changes in prescriptive practices are required. There is a need for judicious use of antimicrobials as per local and international data available for medical microbial disorders. Our study depicts the high percentage of MRSA in hospital and community acquired infections, but there is need for further large-scale studies to analyse the molecular characteristics of different MRSA strains, the risk factors for their increasing incidence and the treatment options which can control this virulent pathogen.

Conclusion

The percentage and frequency of MRSA in hospital and community-acquired pyogenic skin and soft tissues infections was high and it is very essential to restrict the spread of MRSA both in hospital and community settings.

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