

# Comparison of Duration of Hospitalization and Clinical Outcome in Children Infected With Methicillin Resistant Staphylococcus Aureus and Methicillin Sensitive Staphylococcus Aureus

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## ABSTRACT

**Objective:** To compare the duration of hospitalization and clinical outcome in children infected with methicillin-sensitive staphylococcus aureus and methicillin-resistant Staphylococcus aureus.(MRSA and MSSA)

**Study Design:** comparative cross sectional

**Place and Duration of Study:** This Study was carried out at the Paediatrics Department, Nishtar hospital Multan from 14.01.2012 to 13.07.2012

**Materials and Methods:** Children meeting the inclusion criteria were selected. Clinical samples were collected before starting antibiotics and sent to microbiology lab for culture. Colony morphology, gram staining and production of catalase and coagulase . confirmed growth of S. aureus. Methicillin resistance was determined by disk diffusion method according to CLSI guidelines. S.aureus with inhibition zone more than 18 mm were taken as methicillin-sensitive and those inhibition zone of less than 18 mm were taken as methicillin-resistant. Adequate information regarding identification of patient, clinical diagnosis, duration of hospital stay and clinical outcome were entered . After taking consent from parents.Lab results were entered in the proforma.

Children of all age groups up to 12 years of age and both sexes were included to avoid any bias. All patients clinically diagnosed to be suffering from staphylococcal infection (septicemia, pneumonia, skeletal infection, skin & soft tissue infection, meningitis ) who were admitted in pediatric ward were included.

**Results:** Sixty patients with S. aureus infection were included in the study. Thirty patients were of MRSA and 30 were of MSSA. In MRSA group 12 (40%) patients remained in the hospital for less than a week and 18 (60%) patients stayed for more than a week but less than 3 weeks. In MSSA group 23(76.6%) patients were hospitalized for less than one week duration and 7(23.4%) patients were admitted for more than 1 week but less than 3 weeks duration. In MRSA group, 15(50%) patients recovered, 4(13.4%) patients improved, 2(6.6%) patients didn't improve and 9(30%) patients expired. In MSSA group, 22(73.4%) patients recovered completely, 4(13.4%) patients improved, 2(6.6%) patients didn't improve and 2(6.6%) patients expired.

**Conclusion:** Children suffering from MRSA infection have more severe illness as compared to those suffering from MSSA infection. Duration of hospitalization of children suffering from MRSA infection is prolonged as compared to MSSA infection while clinical outcome is better in children suffering from MSSA infection as compared to MRSA infection.

**Key Words:** Methicillin-resistant Staphylococcus aureus, MSSA

## INTRODUCTION

Staphylococcus aureus is a very common cause of infection in all age groups, diseases produced by S. aureus in children include skin & soft tissue infection, abscesses,wound infections, neonatal sepsis, toxic shock syndrome, staphylococcal Scalded skin syndrome and food poisoning.<sup>1</sup>

S.aureus gets colonized on the body surface of newborns within first week of life through transmission by direct contact. S.aureus is also present in anterior nares of 20-30% of normal individuals. Invasive disease follows colonization in susceptible individuals.<sup>2</sup>

Staph.aureus is becoming increasingly difficult to treat

these days. In 1944 when Penicillin was introduced, over 95% of staphylococcus isolates were susceptible to the drug. Slowly penicillin resistance emerged. In 1959 introduction of beta lactamase stable antibiotics, methicillin, cloxacillin and flucloxacillin, briefly overcome this resistance. However by early 1970 Methicillin resistant Staphylococcus aureus (MRSA) emerged.<sup>3</sup>

S.aureus strains that are sensitive to B-lactamase-resistant penicillins are called methicillin-sensitive S.aureus (MSSA). Strains of S.aureus that are resistant to the B-lactamase resistant penicillins such as methicillin and nafcillin, are commonly known as methicillin resistant S.aureus(MRSA). Community associated methicillin resistant S.aureus (MRSA is a

dangerous pathogen that is difficult to treat and has been associated with increasing fatality in children and young adults worldwide.<sup>4</sup>

The aim of this study is to find out the difference between duration of hospitalization and clinical outcome in children infected with methicillin-resistant *S.aureus* (MRSA) and methicillin sensitive *S.aureus* (MSSA).

## MATERIALS AND METHODS

This comparative cross sectional was carried out at Paediatrics Department, Nishtar Hospital Multan from 14-01-2012 to 13-07-2012.

Before starting the study, permission from the ethical review committee of the Hospital was taken. Standard antibiotics and other supportive treatment were provided to the hospitalized children included in the study. This study was without any harm to participating patients.

Children of all age groups up to 12 years of age and both sexes were included in the study to avoid any bias. All patients clinically diagnosed to be suffering from staphylococcal infection (septicemia, pneumonia, skeletal infection, skin & soft tissue infection, meningitis) were admitted in pediatric ward.

Adequate information regarding identification of patient, clinical diagnosis, duration of hospital stay and clinical outcome were entered in a pre-designed proforma after taking consent from the parents. Laboratory results were entered in the proforma.

Blood, pus and any collection of fluid like pleural fluid were drawn before starting the antibiotics and sent to microbiology lab for culture. Colony morphology, gram staining and production of catalase and coagulase confirmed growth of *Staph. aureus*.

Confirmed growth of *S. aureus*. Methicillin resistance was determined by disk diffusion method according to CLSI guidelines. *S.aureus* with inhibition zone more than 18 mm were taken as methicillin-sensitive and those inhibition zone of less than 18 mm were taken as methicillin-resistant.

Data was entered into SPSS version 10. Descriptive statistics were used to describe the variables in both groups. Mean and standard deviation of age, hemoglobin and leukocyte count were assessed. Proportion of patients belonging to different categories in address, source of infection and clinical diagnosis were assessed. The duration of hospital stay and clinical outcome were compared in both groups to draw the results. During comparison of variables student's t-test was used to compare numerical variable e.g. age and duration of hospital stay and chi-square test was used to compare categorical variables e.g. source of infection, clinical diagnosis and clinical outcome. Level of significance (p-value) was taken at 0.05.

## RESULTS

Sixty children with positive *S.aureus* infection were included in this study All the patients were divided in to

two groups; methicillin resistant *S.aureus*. (MRSA) and methicillin sensitive *S.aureus* (MSSA) groups. In each group there were 30 patients. Results of the study according to variables are below.

70% patients were less than one month of age in MRSA group and 56.7% patients were in MSSA group which were less than one month 20% patients were between the age of 1 month- 5 years in MRSA group. While this number was 16.6% in MSSA group. 10 % patients were the age between 6 years- 12 years in the former group while this number was 16.6% in the later group.

In MRSA group 66.6% patients were male while this figure was 60% in MSSA group 33.4% patients were female in the former group while these 40% patients in the later group. 66.6% patients were in MRSA group came from urban areas while 33.4% patients belongs to rural area in this group. In the MSSA group 40% patients belong to rural area in this group. The MSSA group 40% patients were from urban areas while remaining 60% patients came from rural areas.

**Table No.1: Source of infection n=60.**

Source	MRSA	%age	MSSA	%age
Community Acquired	17	56.7%	23	76.7%
Hospital Acquired	13	43.3%	7	23.3%
Total	30	100%	30	100%

P-value = 0.006

**Table No.2: Clinical diagnosis n=60.**

Diagnosis	No. of Patients of MRSA	%age	No. of Patients of MSSA	%age
Septicemia	19	63.4%	14	46.7%
Pneumonia	08	26.6%	11	36.7%
Skin&Soft Tissue Infection	02	6.6%	03	10%
Skeletal Infection	0	0%	01	3.3%
Meningitis	01	3.3%	0	0%
Other sites	0	0%	0	3.3%
Total	30	100%	30	100%

**Table No.3: Duration of hospitalization n=60.**

Duration	MRSA	%age	MSSA	%age	p-value
< 7 Days	12	40%	23	76.6%	0.04
7-21 Days	18	60%	7	23.4%	0.02
Total	30	100%	30	100%	

**Table No.4: Clinical outcome of patients n=60.**

Outcome	MRSA	%age	MSSA	%age
Recovered	15	50%	22	73.4%
Improved	4	13.4%	4	13.4%
Not Improved	2	6.6%	2	6.6%
Expired	9	30%	2	6.6%
Total	30	100%	30	100%

P-value (by comparing alive and expired) = 0.001

## DISCUSSION

Among 60 patients of our study (30 from each group); age, gender and type of infection of the patients in two groups were similar. Among source of infection, majority of the patients (66.6%) were having community acquired infection while the remainders (34.4%) were having nosocomial infection. Among nosocomial infection, majority (65%) was of MRSA type and the remaining revealed MSSA on culture; p-value = 0.006.

Duration of hospitalization was more prolonged for MRSA group as compared to MSSA group (Eighteen patients from MRSA group remained for more than 7 days but less than 21 days duration in hospital as compared to MSSA group in which seven patients remained in the hospital for the above mentioned duration; p-value= 0.02 Twelve patients from MRSA group remained from less than 7 days duration while this number was 23 for MSSA group; p-value =0.04). Regarding outcome, it was better for MSSA group as compared to MRSA group (Nine patients from MRSA group expired and remaining were alive while two patients expired in MSSA group and the remainder were alive in this group; p-value =0.001)

Romero-Vivas et al.,<sup>5</sup> who conducted the largest study, noted a significantly higher fatality rate among patients with MRSA bacteremia (58.3% for MRSA group as compared to 32% for MSSA group = p<0.01). More recently, Conterno et al.,<sup>6</sup> also reported methicillin resistance as a risk factor for a poor outcome in patients with Staph. aureus bacteremia.

In another study conducted by Skiest DJ et al.,<sup>7</sup> at The University of Texas Southwestern Medical Center, Dallas, USA, patients with MRSA most commonly presented with a skin or soft tissue infection. 69% versus 45% p=0.0012 while patients with MSSA were more likely to have infection of the respiratory tract: 11% versus 3%, p=0.02. They also noted that most patients with MRSA infection did have used antibiotics in the last six months.

According to Rozgonyi F et al.,<sup>8</sup> numerous studies have indicated, based on mortality rates, that methicillin-resistant Staphylococcus aureus (MRSA) strains are more virulent than methicillin-sensitive Staphylococcus aureus (MSSA) strains.

A study conducted by Miller R et al.,<sup>9</sup> at Nuffield Department of Medicine, University of Oxford, John Radcliffe Hospital, Oxford, UK, says that clinical presentation of MRSA and MSSA bacteremia was similar. The patients admitted with MRSA bacteremia had significantly higher levels of previous hospital exposure than patients with MSSA infection and also had more co-morbidities as compared to MSSA infection.

In contrast to our study, in a review of Staphylococcus aureus infection, Dr. Lowy,<sup>10</sup> stated that bacteremia

involving methicillin-resistant Staphylococcus aureus (MRSA) is not associated with higher mortality than bacteremia involving methicillin-sensitive Staphylococcus aureus.

## CONCLUSION

This study showed higher mortality rate with MRSA infection than infection with MSSA strains of Staphylococcus aureus. It also showed that duration of hospitalization was prolonged in patients with MRSA infection as compared to MSSA group.

**Recommendations:** Infection with Staphylococcus aureus in patients admitted to our hospitals is of serious concern and many patients admitted with sepsis or pneumonia have Staphylococcus aureus as the cause of their morbidity.

Majority of the patients with MRSA infection, acquire their microbe from hospital environment. So, there is dire need to adopt basic principles of asepsis and sterilization; most importantly hand washing.

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