

# *Staphylococcus aureus* Nasal Carriage is a Risk Factor for Skin and Soft Tissue Infection in Children of Rural Area

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## ABSTRACT

### BACKGROUND

We wanted to screen children with wound infection for nasal colonization of methicillin resistant *Staphylococcus aureus* (MRSA) and evaluate its association with skin and soft tissue infection.

### METHODS

This is a cross-sectional observational study conducted among 112 children with wound infection. *Staphylococcus aureus* isolated from pus swab and nasal specimen was subjected to Cefoxitin disk and Oxacillin agar method to screen for MRSA.

### RESULTS

Out of 112 pus samples, 97 (86.6 %) were confirmed for *S. aureus* and 15 (13.4 %) showed no isolation of *S. aureus*. Out of 97 *S. aureus* isolates, 80 cases (82.5 %) were positive for Methicillin Resistant *Staphylococcus aureus* (MRSA) and 17 (17.5 %) were Methicillin Susceptible *Staphylococcus aureus* (MSSA). Nasal carriage positivity for *S. aureus* was seen in 73 (75.3 %) out of 97 children with wound infection caused by *S. aureus*. Statistical analysis of the risk factor association of MRSA, MSSA nasal colonization and cutaneous infections was calculated using the Chi-square test (Epi info software).

### CONCLUSIONS

Nasal colonization of *S. aureus* is one of the risk factors associated with skin and soft tissue infection. Screening should be made an essential component of assessment of carrier transmitted drug resistant strains of Staphylococci in the community in a hospital setting.

### KEYWORDS

Nasal Carriers, *Staphylococcus aureus*, MRSA, Skin & SSI, Screening of Nares

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## BACKGROUND

During the school health survey, most of the students were observed with pyogenic cutaneous and soft tissue infection. *Staphylococcus aureus* is one of the common pathogens responsible for community as well as hospital associated infection. Long established as a hospital pathogen, methicillin resistant *Staphylococcus aureus* (MRSA) is a major cause of skin and soft tissue infections and now it presents in the community.<sup>1,2</sup> *S. aureus* is a common type of bacteria that normally colonize in the nasal passages of people and present on the skin of healthy individual.

Staphylococcal disease may follow endogenous or exogenous as modes of transmission may be by contact or through fomites.<sup>3</sup> Nasal colonization by *S. aureus* may be a risk factor for these infections not only in hospital settings and long-term care facilities but also now in the community. About 10 – 30 % of healthy persons carry staphylococci in the nose and about 10 % in the perineum and also on the hair.<sup>4,5</sup>

We wanted to screen children with wound infection for nasal colonization of methicillin resistant *Staphylococcus aureus* (MRSA) and evaluate its association with skin and soft tissue infection.

## METHODS

This study was conducted at DVVPF'S Medical college & Hospital, Ahmednagar after obtaining approval by the institute ethics committee.

School going children of age group 5 years to 12 years (1<sup>st</sup> to 7<sup>th</sup> standard) with skin and soft tissue infection were observed during school health survey and home visit. Informed consent was taken from the students, teachers and parents.

From each subject, specimen was collected from anterior nares and pyogenic wound by using sterile cotton swab kit moistened with mannitol salt broth. A total 112 pus samples were collected from skin lesions as furuncles, small abscesses, cellulitis, folliculitis and any pyogenic wound infections and at the same time 112 nasal (anterior nares) swabs from the same children were collected for the study. Baseline demographic data were recorded in constructed proforma.

Collected wound swab and nasal swab were processed in central research laboratory. All the specimens were inoculated on Sheep Blood agar and incubated overnight at 37°C temperature in the incubator. Next day growth was observed and identified by using standard methods.<sup>6</sup> Confirmed growth of *Staphylococcus aureus* were included in the study and further processed for antibiotic susceptibility testing.

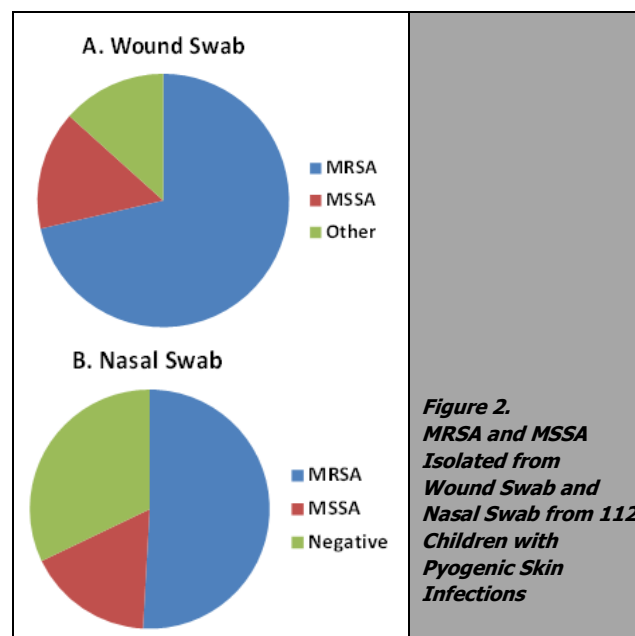
Methicillin resistance was detected by using Cefoxitin disk diffusion method that incubated at 37°C for overnight. Inoculum was prepared and compared with 0.5 MacFarland turbidity standard. Oxacillin screen agar method was used to detect methicillin resistance in Mueller Hinton agar supplemented with 6 µg / mL of Oxacillin and 4 % NaCl as

per Clinical and Laboratory Standards Institute recommendations.<sup>7</sup> MRSA confirmed by both methods were considered in the study. Control strain ATCC 25923 for *Staphylococcus aureus* was used in this study. Data were analysed for association with skin infection.

Statistical analysis of the risk factor association of MRSA, MSSA nasal colonization and cutaneous infections was calculated using the Chi-square test (Epi info software).



**Figure 1. Pyogenic Skin Infection**



**Figure 2. MRSA and MSSA Isolated from Wound Swab and Nasal Swab from 112 Children with Pyogenic Skin Infections**

## RESULTS

In the study we found skin and soft tissue pyogenic infection in 112 children and more cases were found in the age group 7 to 9 years and fewer cases in the age group 10 to 12 years [Table. 1].

Among 112 pus samples, ninety-seven (97) isolates were confirmed as *Staphylococcus aureus* (66 boys and 31 girls). Out of 97 isolates, 82 % (80 cases) infections were caused by Methicillin Resistant *Staphylococcus aureus* (MRSA) and 18 % (17 cases) by MSSA. In the study, we found that in 57 (71 %) cases out of 80 MRSA were associated with nasal carriage and 16 (94 %) cases out of 17 MSSA associated with nasal carriage [Table. 2].

Skin infections were more likely to develop in MRSA carriers (90 %) than in methicillin-susceptible *S. aureus* carriers (69 %) or non-carriers of *S. aureus* (p value = 0.006) [Table: 3]

	No. of Cases	Wound Swab		Nasal Swab	
		MRSA	MSSA	MRSA	MSSA
5 – 6	18 (16 %)	13 (16 %)	3 (18 %)	10 (18 %)	3 (18 %)
6 – 7	16 (14 %)	12 (15 %)	2 (12 %)	8 (14 %)	2 (12 %)
7 – 8	24 (21 %)	18 (23 %)	3 (18 %)	10 (18 %)	3 (18 %)
8 – 9	22 (20 %)	17 (21 %)	3 (18 %)	13 (23 %)	4 (23 %)
9 – 10	17 (15 %)	12 (15 %)	3 (18 %)	7 (13 %)	3 (18 %)
10 – 11	9 (8 %)	5 (6 %)	2 (12 %)	4 (7 %)	1 (6 %)
11 – 12	6 (5 %)	3 (4 %)	1 (6 %)	4 (7 %)	1 (6 %)
<b>Total</b>	<b>112</b>	<b>80</b>	<b>17</b>	<b>57</b>	<b>19</b>
	<b>(100 %)</b>	<b>(100 %)</b>	<b>(100 %)</b>	<b>(100 %)</b>	<b>(100 %)</b>

**Table 1. Age Wise Distribution of Cases, and Isolated Organisms from Wound Swab and Nasal Swab**

Nasal Carriage of <i>S. aureus</i>	MRSA	MSSA	Total
Present	57 (59 %)	16 (17 %)	73 (76 %)
Absent	23 (23 %)	1 (1 %)	24 (24 %)
<b>Total</b>	<b>80 (82 %)</b>	<b>17 (18 %)</b>	<b>97 (100 %)</b>

**Table 2. Nasal Carriage of *S. aureus***

Chi-square test value + 3.937 p value = 0.04

Pus Specimen Nasal Carrier	MRSA	MSSA	Total
MRSA	51 (70 %)	5 (7 %)	56 (77 %)
MSSA	6 (8 %)	11 (15 %)	17 (23 %)
<b>Total</b>	<b>57 (78 %)</b>	<b>16 (22 %)</b>	<b>73 (100 %)</b>

**Table 3. Association between Nasal Carriage of MRSA and MSSA Isolated from Pus**

## DISCUSSION

Anterior nasal colonization appears to be the main reservoir and source of infection of *S. aureus* in both adults and children.<sup>8</sup>

In the present study, according to the results, there is a strong association between nasal carriers and cutaneous, and soft tissue infections (p value is 0.04). Nasal carriage for *Staphylococcus aureus* is one of the major sources of infection to other patients and is known to be a significant risk factor.<sup>9</sup> Many healthy people are carriers of MRSA without any symptoms for periods ranging from a few weeks to many years and a common reservoir during skin and soft tissue infection outbreaks.<sup>10</sup> Present study shows 73 (75.3 %) cases of wound infection caused by *S. aureus* out of 97 were observed also positive for nasal colonization with *Staphylococcus aureus*. On the other hand, out of 15 cases of pyogenic skin infection caused by other microorganism were observed nasal colonization with *S. aureus* in 3 cases. It indicate endogenous transmission, person's own colonized flora can cause autoinfection.<sup>11</sup> But for confirmation isolated strains from nasal swab and wound swab should be screened by molecular or phage typing method.

*Staphylococcus aureus* is a one of the common pathogens responsible for community as well as hospital associated infection. Methicillin-resistant *Staphylococcus aureus* infection is increase during the last some decades and raised as one of the most important cause of hospital infections worldwide.<sup>12</sup> Other published reports says that repeated skin infections were more common among MRSA carriers and PVL-positive CA-MRSA increased the risk for subsequent soft tissue infection.<sup>13,14</sup>

Infection caused by MRSA are difficult to treat, as bacteria are resistant to all common beta lactam antibiotics and most types of other antibiotic also.<sup>15</sup> The treatment options for MRSA strain are limited significantly then the

prevention is one of the key factor to control the spread of infection. Most of the children play together closely in the dust outside and has less knowledge of personal hygiene. Most of the hybrid strains also acquired a factor that increases their virulence, resulting in the development of deep-tissue infections from minor wound infection at the site of abrasions or cuts, as well as many cases of fatal pneumonia. The most common manifestations of CA-MRSA are skin infections such as life-threatening necrotizing fasciitis or pyomyositis, necrotizing pneumonia, infective endocarditis and acute osteomyelitis.<sup>16,17</sup>

As knowledge regarding transmission of infection we can take preventive measures as "search and destroy strategy for carriers.

## CONCLUSIONS

Nasal carriage is one of the major sources of infection and is associated with endogenous transmission in cutaneous and soft tissue infection. They may spread the infection not only in the community but also in the health care system. Screening communities has been found to be effective in minimizing the spread of MRSA in the community. Screening should be made an essential component of assessment of carrier transmitted drug resistant strains of *Staphylococci* in the community in a hospital setting.<sup>18</sup>

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