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Original Research Article

Staphylococcus associated acute throat infection among children presented to a tertiary care hospital

Santhosh John Thattil[1,2]*, Sumitha Santhosh[3], Thekkuttuparambil Ananthanarayanan Ajith[4]

[1]Department of Microbiology, Nyle Hospital, Kaiparambu, Thrissur, Kerala, India
[2]Department of Microbiology, Malabar Dental College, Edappal, Malappuram, Kerala, India
[3]Department of Microbiology, Aswini Nursing College, Nadathara, Thrissur, Kerala, India
[4]Department of Biochemistry, Amala Institute of Medical Sciences, Amala Nagar, Thrissur, Kerala, India

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***Correspondence:**
Dr. Santhosh John Thattil,
E-mail: drsanthoshjohnthattil@gmail.com

ABSTRACT

Background: *Staphylococcus* infection remains one of the most common bacterial infections that cause high rate of morbidity and mortality in children and adults. This study was aimed to find the prevalent age group and type of *Staphylococcus* strain among the children presented with sore throat to a tertiary care hospital.
Methods: A retrospective study was done by analyzing the medical records of children (less than 10 years of age) who presented to the outpatient Paediatric department with sore throat and confirmed diagnosis of *Staphylococcus*. Number of coagulase negative *Staphylococcus* (CoNS), *Staphylococcus aureus* (SA), methicilline resistant (MR) and methicilline sensitive (MS) strains was analyzed in various age groups and analyzed statistically.
Results: Total 129 cases of *Staphylococcus* infected cases were found during the period of this study. The male to female ratio was 1.86 with high rate of prevalence found among the children of age 1-3 years (39.5%) (p= 0.0031). The CoNS was found in 65/129 (50.38%) cases and all were MSSA. No MRSA infection was found during the study period. Among the total cases, 122/129 (94.57%) cases were infected with MS strains. The MR strain was found in 7/129 cases (5.4%) which was mainly in neonates. The rate of infection was less in older children (7-10-year age).
Conclusions: The prevalence of *Staphylococcus* associated throat infection was high among the children of 1-3-year age with male dominance. The MR strain was found only 5.4% of cases and no MRSA found in this study.

Keywords: β-lactam antibiotics, Coagulase negative *staphylococcus*, Methicillin resistant *Staphylococcus aureus*, Panton-valentine leukocidin, *Staphylococcus aureus*

INTRODUCTION

The infections such as tonsillitis, pharyngitis and laryngitis are belonging to acute sore throat which remains as the most common complaints to consult general practitioners. The risk factors of sore throat include mainly viral and to a lesser extend bacterial infections. It can also be due to allergic reaction to certain environmental factors such as dust, low humidity and smoke. Patients with upper respiratory tract infection can also present with acute sore throat and fever. *Staphylococcus* and *streptococcus* remains the most common bacterial infections associated with 10-15 % sore throat. *Staphylococcus* infection causes worldwide ~30% mortality. The respiratory infection by *Staphylococcus* can result in sinusitis, Pneumonia, empyema and otitis media. The infection can be acquired from community or hospital associated.[1] The frequency of these community-acquired and hospital-associated infections is alarmingly increasing during the last few decades. The most common sites of infection were skin/soft tissue and respiratory tract whereas the area of

colonization was mainly found is nostrils, axilla and groin.[2] Ten percent of healthy children under the age of 2 years carry *staphylococcus* in their throats.[3] Similar findings reported for MRSA in infants' throats.[4] This indicates that throat has to be considered as an important carriage site for *S. aureus* including MRSA.[5]

Among the *S. aureus* infection, methicillin resistant *S. aureus* (MRSA) is due to the acquisition of *mecA* gene found to the main cause for bacteremia which is endemic in India.[6] The major risk factors associated with MRSA infection includes prolonged hospitalization, HIV-seropositive status, antibiotic exposure and gastrointestinal diseases.[7] Children who are weak in immunity due to poor quality weaning diet or those who are weaning early without exclusive breast feeding are more prone to get infections. The incidence of *staphylococcus* infection is associated with ethnicity. Whilst the prevalence of *staphylococcus* infection in adult has been reported, the rate of *staphylococcus* associated throat infection among the children of various age groups such as infants (<1month), neonates (1-12months), toddlers (1-3years) and older children (Age >3years) are not available in this population. Therefore, this study was aimed to find the prevalent age group and type of *staphylococcus* strain among the children of various age groups presented with sore throat to a tertiary care hospital.

METHODS

Study design and sample

A retrospective study was done by analyzing the medical records of children (less than 10 years of age) who were presented in the outpatient Paediatric department with the major symptom of acute sore throat and confirmed diagnosis of *staphylococcus* infection during the period of October, 2017 to March, 2018. Children above the age of 10 years or treated with antibiotic two weeks before the complaint of sore throat or under antibiotic /steroid therapy for co-morbidities were excluded from the study. Cases with sore throat due to bacteria other than *staphylococcus* were also excluded from the study. The demographic data was analyzed to find the most prevalent age group, gender, number of methicillin resistant (MR), methicillin sensitive (MS), coagulase negative *staphylococcus* (CoNS) and *S. aureus* (SA) cases.

Procedure

Two samples of throat swab were collected from the patients. The specimen collected from each tonsil by rubbing with a sterile cotton swab. The specimens inoculated on sheep blood agar plates, chocolate agar and MacConkey agar plates (HiMedia, Mumbai) in duplicate. The plates were incubated over night at 37ºC and the growth was identified. *Staphylococcus* colonies were gram stained and gram positive cocci in clumps were identified in smears which were subjected to catalase test positivity in order to differentiate the *staphylococcus* strain from streptococcus and other gram positive cocci. Further, the tube coagulase test was performed to differentiate SA from other species of *staphylococcus.* Methicilline sensitivity was done as per the standard procedure in a salt agar.[8]

Statistical analysis

Data were expressed as number and percentage. Fisher's exact test (In stat soft ware, v16, IBM, CA, USA) was used to compare the significance of data between the most prevalent groups. P<0.05 was considered as significant.

RESULTS

Total 129 cases of *staphylococcus* infected sore throat were analyzed during the period of this study. The male to female ratio was found to be 1.86 (Figure 1).

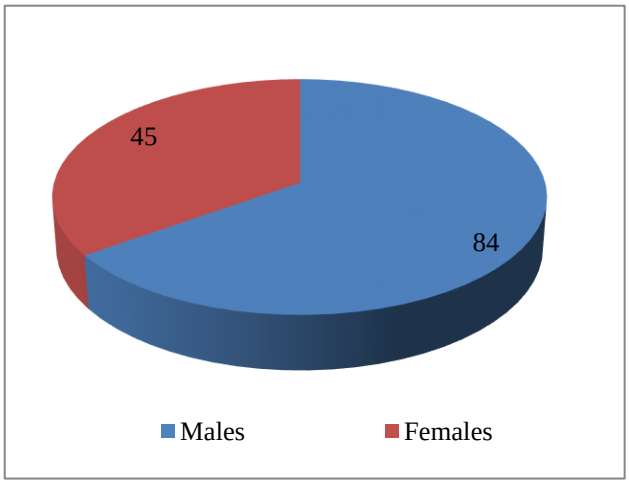
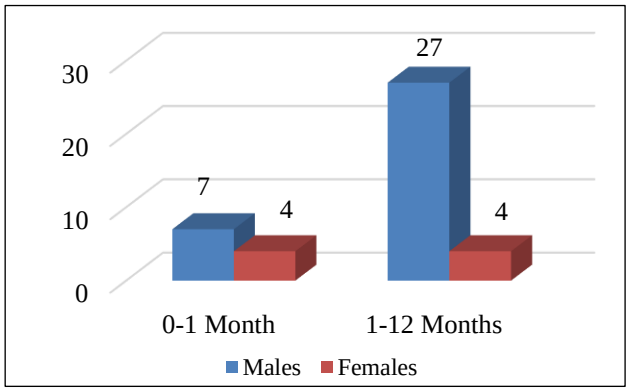


Figure 1: Distribution of gender.

Table 1: Distribution of *staphylococcus* infections as per gender and age.

Age (years)	Males		Females		Total	
	Number	Percentage	Number	Percentage	Number	Percentage
<1	36	27.90	6	4.65	42	32.55
1-3	29	22.48	22	17.05	51	39.53
4-6	13	10.08	13	10.08	26	20.16
7-10	6	4.65	4	3.10	10	7.75
Total	84	65.11	45	34.88	129	100

The prevalence of infection was found to be significantly (p= 0.0031) high among the children of age 1-3 year (39.5%) (Table 1). Male dominance was observed in all the groups and highest (27.9%) among the <1-year age group. The infection was less among the children belonged to 7-10-year group (7.75%). Both males and females were infected equally in the 4-6 years group (10.8%). Among the children less than 1 year, 11 were belonged to 0-1 month-old and 31 were in the 1-12 months old group with male dominance (Figure 2).



Fisher's exact test two sided p = 0.1743, not significant

Figure 2: Distribution of number of *staphylococcus* infection in children of less than 1 year old.

Table 2: Distribution of coagulase negative and positive *staphylococcus* infection as per age.

AGE (years)	Coagulase negative infections	Percentage with respect to N=129
<1	23	17.82
1-3	25	19.38
4-6	11	8.53
7-10	6	4.65
Total	65	50.38

Distribution of CoNS infection as per age is given in Table 2. Among the total number of cases, 50.38% cases was CoNS and 49.62% cases was SA strain. More number of infections was found in the 1-3 years age group and <1 year age group, but they are non-significantly differ from each other (p=0.6778). Distribution of *Staphylococcus* infection according to MR/MS and age is given in Table 3. None of the cases with MR was found in the 7-10-year age group while more number of cases was indentified in 1-3-year age group (3.8%) and <1 year age group (0.78%). But no statistically significant difference could evident between these groups (p=0.0874).

Among the total, 122/129 (94.57%) cases were infected with MS *strain*, whereas the MR strain was found only in 7/129 cases (5.4%) (Figure 3). Regarding the MS and MR distribution among the children belonging to 1-12 months age group, 37/42 cases were MS and 5/42 cases were MR (Figure 4).

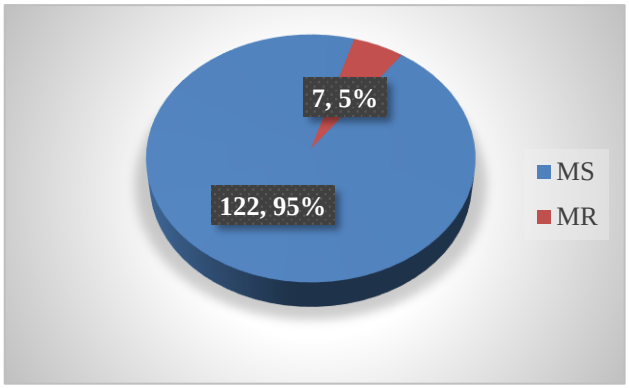
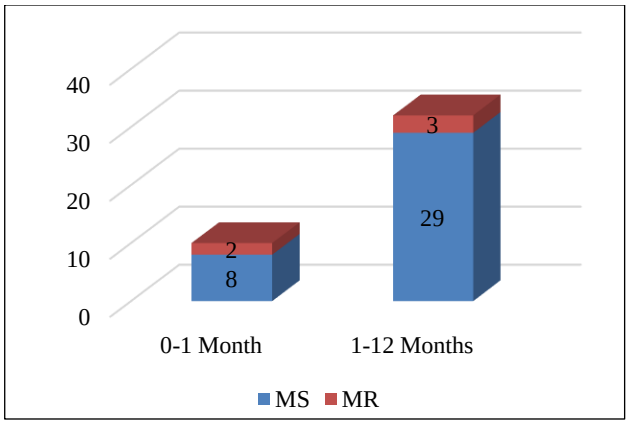


Figure 3: Distribution of number of cases of methicillin sensitive (MS) and methicillin resistant (MR) strain of *Staphylococcus*.



Fisher's exact test two sided p =0.5773, not significant

Figure 4: Distribution of number of cases of methicillin sensitive (MS) and methicillin resistant (MR) strain of *Staphylococcus* infection among the children of less than 1 year old.

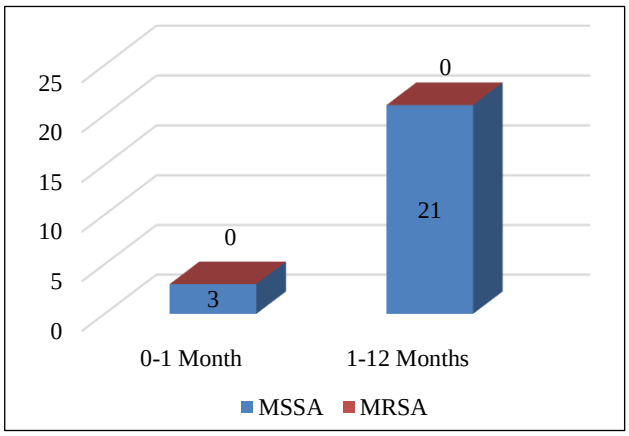


Figure 5: Figure 5. Distribution of number of S. aureus infected cases among the children of less than 1 year old. Methicilline resistant S. aureus (MRSA) and methicilline sensitive S. aureus (MSSA).

The highest rate of infection due to MR strain was found among the children of less than 1-year age (5/7). Analyzing the distribution of MSSA and MRSA among the 64/129 cases of SA, no MRSA was found (Table 4). The prevalence of SA infection was observed in the children of <1 year age (37.5%) with all MSSA strain. Among the children below 1 year of age, more number of infections was found in the 1 to 12 months age group (Figure 5). None of the older children (>7 year of age) got MR *staphylococcus* infection (Table 3).

Table 3: Distribution of *staphylococcus* infections according to methicillin resistance and age.

Age (year)	Methicillin sensitive *Staphylococcus*	Percentage	Methicillin resistant *Staphylococcus*	Percentage	Total	Percentage
< 1	37	28.68	5	3.80	42	22.48
1 - 3	50	38.76	1	0.78	51	39.53
4 - 6	25	19.38	1	0.78	26	20.16
7 - 10	10	7.75	0	0.00	10	7.75
Total	122	94.57	7	5.40	129	100

Table 4: Distribution of *Staphylococcus aureus* infections according to methicillin resistance and age.

Age (year)	Methicillin resistant *S. aureus*	Percentage	Methicillin sensitive *S. aureus*	Percentage
< 1	0	0	24	37.5
1 - 3	0	0	22	34.3
4 - 6	0	0	18	28.1
7 - 10	0	0	0	00.0
Total	0	0	64	100

DISCUSSION

Results of the study reveal that the infection of *staphylococcus* is most commonly observed in the children of 1-3-year age group with male dominance. Only 5.4% of cases were detected as MRCoNS strain and none of the cases were MRSA. Study in healthy children below 2 years of age found incidence of 10% of *staphylococcus* presence in their throats. The very low prevalence observed in this study probably due to short duration of the study and, thereby, low sample size. Previous study from Chennai reported that 40-50 per cent MRSA prevalence among the adult.[9,10] Study conducted in 15 Indian tertiary care centres also found 41 per cent prevalence of MRSA.[11]

The availability of more tonsillar crypts in the tonsils of children favors the growth of bacteria. Most of the children below 2 years of age obtain nutrients from the breast milk and after the age of 6 months (age of weaning), the nutrients are also added from the solid foods. Low immunity among the children in the 1-3 age group can be ascribed to the highest infection rate observed in this study which may be correlated to the quality of the weaning diet or variation in the duration of exclusive breast feeding.[12] Breast milk contains many bioactive constituents including anti-inflammatory mediators, hormones and growth factors that contribute to protection from respiratory and gastrointestinal infection.[13,14]

Many previous studies in adult population reported the male dominance and the male to female ratio of ~1.5 or 2.29. The basis for the increased risk in males has not yet been understood. Present study results are consistent to the previous reports.[15-17] Skin related findings of *staphylococcus* infection were vasculitis, petechiae, ecchymoses and infarcts as the acute systemic manifestations.[18]

Prolonged hospitalizations, prolonged exposure to antibiotics, surgical and invasive procedures were identified as the major risk factor for MRSA infection in children. The presence of *staphylococcal* cassette chromosome *mec* (SCC*mec*) and presence of panton valentine leukocidin (PVL) toxin are described as the two important genotypic markers to differentiate community-acquired MRSA from hospital-acquired MRSA starins.[19] SCC*mec* type V was reported as the emerging MRSA in India.[20] In children, this gram-positive organism causes the skin abscesses which were more commonly manifested in PVL-positive community-acquired SA strains.[21,22] All the cases selected in this study were from out-patients, hence there is a great paucity for community based infection.

The sore throat is usually found as self-limiting and, hence, the subjects will be symptom-free by the end of 1 week. An immediate antibiotic therapy was found to be associated with high possibility for reinfection.[23] However, the *Staphylococcal* mediated infection is

challenging to the clinician due to the high emergence of drug resistant strains. Based on the signs of infections and possibility of respiratory complications, antibiotic therapy using penicillin V (2 or 3 times/day for 10 days) is recommended in nonallergic patients while in children allergic to penicillin, erythromycin is suggested.[24] Cefdinir and cefpodoxime proxetil, the third generation cephalosporins are also approved for use in a more convenient 5-day dosing schedule.[25] Linezolid and glycopeptides are the mainstay for treating the MRSA infections and for the treatment of MSSA, first-generation cephalosporins are the drugs of choice in patients who can't tolerate antistaphylococcal penicillins. Daptomycin and vancomycin are used as alternative drugs for treating severe MRSA infections.

Limitations of this study include a single-centre study and no genotypic characteristics of MRSA isolates were done. Furthermore, no data were collected on the characterization of weaning diet or duration of breast feeding to justify the prevalence of sore throat in children below 3 years of age. The study emphasizes the need of encouraging the local community to improve the infant's nutrition and exclusive breast feeding for the first 6 months and continue up to 2 years of age or beyond which will improve their resistance against the infections. Furthermore, there is high possibility for transmission of infection from the care givers of the child which emphasizes the importance of adequate hygiene awareness among them.

CONCLUSION

The prevalence of *Staphylococcus* associated throat infection was high among the children of 1-3-year age with male dominance. The MR strain was found only 5.4% cases and no MRSA found in this study.

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Conflict of interest: None declared
Ethical approval: The study was approved by the Institutional Ethics Committee

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