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Original Article

Methicillin-Resistant *Staphylococcus aureus* Prevalence Among Healthy School Children of Rajshahi (Bangladesh)

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Abstract

Introduction: *Staphylococcus aureus is an important cause of superficial and deep life threatening infections and its antibiotic resistance is a menace. Now it is a global challenge, specially Methicillin resistant S. aureus (MRSA).*

Methods: *This cross-sectional study was carried out to observe nasal carriage of S. aureus and MRSA among healthy school children of different areas of Rajshahi from January 2012 to December 2012. Three hundred students were enrolled for this study and data were collected with a pre-design data sheet.*

Results: *Out of 300 samples, 86 (28.67%) showed the growth of S. aureus and 11(12.79%) isolates were MRSA. There was no significant differences among sexes, age sub-groups and different localities in colonization of S. aureus ($p>0.05$). S. aureus isolates indicated a high rate of resistance to cotrimoxazole 76 (88.37%) and vancomycin 86 (100%) was the only antibiotic against which all the isolates were sensitive.*

Conclusion: *This study revealed that children under 12 years of age are potential carriers of S. aureus, particularly MRSA. It is recommended to conduct regular screening for MRSA surveillance and maintain rational use of antibiotics to minimize carriage and drug resistance.*

Key words: *S. aureus, MRSA, Nasal carriage*

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Introduction

Staphylococcus aureus is an established cause of superficial and deep life threatening infections[1] and its antibiotic resistance is a menace. It colonizes in the skin and mucosal surfaces of healthy individuals, but it is an important human pathogen causing both nosocomial and community acquired infections[2] and infections caused by it is a global challenge. It has the ability to develop resistance to many effective antibiotics due to production of penicillinase, an enzyme that destroy the β-lactum antibiotics. Methicillin is a Penicillinase -resistant penicillin was introduced in Europe in 1959 and in the United States in 1961 and the first cases of Methicillin resistant *S. aureus* (MRSA) were reported in the United Kingdom in 1961 followed by in other European countries, Japan and Australia.[3] The first report of MRSA in the United States appeared in 1968.[4]

Widespread occurrence of MRSA eventually leads to the emergence of multi-drug resistant *S. aureus* which in turn limits treatment options. Methicillin resistance *S. aureus* is a major health problem which can cause both asymptomatic colonization and infection, ranging from minor skin infection to life-threatening condition such as bacteremia and sepsis.[5] This bacteria is transmitted mainly through person to person contact[6] and colonize on multiple body sites. The anterior nares are the most frequent carriage site as this area is well ventilated and usually remains moist.[7] MRSA have become a serious health problem all over the world. The incidence and prevalence of MRSA varies widely between countries, geographical regions, hospitals and even wards in the same hospitals. In Turkey, the prevalence of MRSA in the community is 0.3%,[8] in India 3.89 %,[9] in Chicago, USA 2.5%[10] and in Taiwan 13.23%.[11]

Materials and Methods

This study enrolled 300 healthy school children aged 6 to 12 years. Specimens were obtained from anterior nares with sterile swabs and plated on Blood agar and Nutrient agar plates. Agar plates were incubated at 37°C for 24 hours. The yellow or golden coloured colonies were subcultured on mannitol salt agar and selected for the catalase and tube coagulase test. Mannitol fermenting, catalase and tube coagulase positive isolates were identified as *S. aureus.*[12]

Identified bacteria were tested for antimicrobial susceptibility testing using modified Kirby-Bauer technique on Mueller-Hinton agar and using commercially available antimicrobial discs.[12] The susceptibility test of *S. aureus* were tested against cloxacillin, ampicillin, ciprofloxacin, gentamicin, cotrimoxazole and vancomycin. All *S. aureus* isolates were tested to detect MRSA using oxacillin (1µg) disc. The inoculum size was adjusted with 0.5 McFarland's standard and incubating at 35°C for 24 hours. A zone of inhibition less than 10 mm or any discernable growth within zone of inhibition was indicative of

methicillin resistance. On the other hand a zone of inhibition equal to or more than 13 mm were taken as sensitive.[13]

Results

Among 300 school children, 142 (47.33%) were male and 158 (52.67%) were female. Out of 300 samples studied 86 (28.67%) showed the growth of *S. aureus* and 11 (12.79%) isolates were found to be MRSA. There was no significant sex and age sub-groups difference in colonization of *S. aureus* ($p>0.05$), although the rate was slightly higher among girls and age sub-group 6-8 years 36 (36.67%) (Table I). No significant difference in carriage rate was observed among different areas of schools, but slightly higher in schools of rural area and MRSA in slum area. (Table II). *S. aureus* isolates indicated a high rate of resistance towards cotrimoxazole 76 (88.37%) followed by ampicillin 66 (76.74%), cloxacillin 57 (66.28%), ciprofloxacin 41 (47.67%) and gentamicin 39 (45.35%). No resistance was found against vancomycin (Figure 1).

Table I: Nasal colonization in different age group and sex

Age group(yrs)	Male		Female		Total	
	S. aureus	**%**	***S. aureus***	**%**	***S. aureus***	**%**
06-08	15 (42)	35.71	18 (48)	37.5	33 (90)	36.67
09-10	13 (44)	29.55	16 (48)	33.33	29 (92)	31.52
10-112	12 (56)	21.43	12 (62)	19.35	24 (118)	20.34
Total	**40 (142)**	**28.17**	**46 (158)**	**29.11**	**86 (300)**	**28.67**

Table II: Nasal colonization in different community

Area	Nasal swab	*S. aureus*	%	MRSA	%
Rural	100	30	30	4	13.33
Slum	100	29	29	4	13.79
Urban	100	27	27	3	11.11
Total	**300**	**86**	**28.67**	**11**	**12.79**

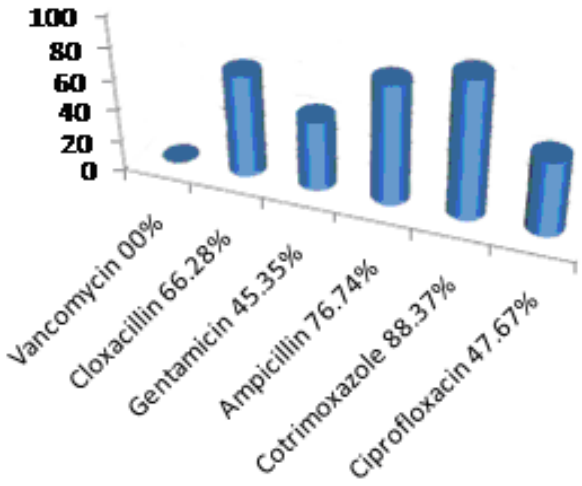

Figure 1: Drug resistance pattern of *Staphylococcus aureus*

Discussion

In our study, *S. aureus* was isolated in 28.67% from healthy school children that is nearly similar with the study of Saxena S et al.[14] in east Delhi, India. Hussein FM et al.[10] in Chicago, USA and Wen-Tsung L et al.[11] in Taiwan and their observations were 29.4%, 24.4% and 25% respectively. Our finding is dissimilar with the Barrett FF et al.[4] and Ramana KV et al.[15] in India and O'Brien FG et al.[16] in two communities in Australia. All *S. aureus* isolates are (100%) sensitive to vancomycin which is consistent with the finding of Shams-uzzaman AK et al.[17] in Bangladesh. Resistance of other drugs to *S. aureus* are variable such as gentamicin (45.35%), ciprofloxacin (47.67%) cloxacillin (66.28%), ampicillin (76.74%) and co-trimoxazole (88.37%).

Out of 86 (28.67%) *S. aureus*, MRSA were 11 (12.79%). Now a days MRSA is increasing in hospitals of all sizes, health care centers, different population groups and various communities all over the world.[18] Our study is nearly similar with the study of Wen-Tsung L et al.[11] in Taiwan and Harputluoglu U et al.[19] in Turkey and their findings were 13.2% and 15% respectively. Our study were dissimilar with the study of Ramana KV et al.[15] in India, Palavecino E[3] in Turkey, Hussein FM et al.[10] and Alfaro C et al.[20] in USA. Their observations were 19%, 0.3%, 2.55% and 22% respectively. This dissimilarity may be due to different geographical location, antibiotics consumption, immunological status, nutritional status and personal hygiene.

Conclusion

Our results suggests that healthy school going children under 12 years of age are potential carriers of *S. aureus* and in particular MRSA. The relatively high

proportion of MRSA and the associated antibiotic resistance in this study emphasizes the need for local or country based surveillance to characterize and monitor MRSA and to develop strategies that improve MRSA treatment and control.

Contribution of the Authors

First author designed and conducted the study and wrote the manuscript. Second and third authors critically reviewed the manuscript. Others helped in data collection and statistical analysis.

References

1. Moreillon P, Que YA, Glauser MP. *Staphylococcus aureus* (including *Staphylococcal* Toxic Shock). Mandell, Douglas and Bennett's principles and practice of infectious diseases. 6th ed. Philadelphia: Elsevier Churchill Livingstone Publishers, 2005;p.2321-2348.
2. Citak S, Bayazitand FN, Aksoy F. Nasal carriage and methicillin resistance of *Staphylococcus aureus* in patients and hospital staff in a tertiary referral center setting. Afr J Microbiol Res. 2011;5(13): 1615-1618.
3. Palavecino E. Community-acquired methicillin-resistant *Staphylococcus aureus* infections. Clin Lab Med. 2004: 24: 403– 418.
4. Barrett FF, McGehee RF Jr, Finland M. Methicillin-resistant *Staphy-lococcus aureus* at Boston City Hospital: bacteriologic and epidemi-ologic observations. N Engl J Med. 1968;279: 441– 448.
5. Voss A, Doebbeling BN. The worldwide prevalence of methicillin-resistant *Staphylococcus aureus*. Int J Antimicrob Agents. 1995;5: 101-106.
6. Kluytmans J, Belkum AV, Verbrugh H. Nasal carriage of *Staphylococus aureus*: Epideomi-logy, Underlying Mechanisms, and Associated Risks. Clin Mic Rev. 1997;10(3): 505-520.
7. Thompson RL, Cabezudo I, Wenzel RP. Epidemiology of nosocomial infection caused by methicillin-resistant *Staphylococcus aureus*. Ann Intern Med. 1982;97: 309-317.
8. Ciftci IH, Kiken R, Bukulmez A. Nasal carriage of *Staphylococcus aureus* in 4-6 age groups in healthy children in Afyonkarahisar, Turkey. Acta Paediatr. 2007;96: 1043-1046.
9. Chatterjee SS, Ray P, Aggarwal A, Das A, Sharma M. A community based study on nasal carriage of *Staphylococcus aureus*. Indian J Med Res. 2009; 130(6): 742-748.
10. Hussain FM, Boyle-Vavra S, Daum RS. Community strain of methicillin resistant *Staphylococcus aureus* colonization in healthy children attending an out patient paediatric clinic. Pediatr Infect Dis J. 2001;20: 763-767.
11. Wen-Tsung L, Wei-Jen L, Min-HuaT, Jang-Jih L, Shih-Yi L, Mong-Ling C et al. Nasal carriage of single clone of

community acquired methicillin-resistant *Staphylococcus aureus* among kindergarten atten-dees in northern Taiwan. BMC Infect Dis. 2007;7: 51-56.

12. Collee JG, Duguid JP, Fraser AG, Marmion BP, Simmons A. Mackie and Mc Cartneys Practical Medical Microbiology. 14th ed. New York: Churchill Livingstone, U.S.A; 1996.
13. Centers for Disease Control and Prevention. Laboratory detection of: Oxacillin/Methicillin-resistant *Staphylococus aureus*. Fact sheet. 2005; 1-4.
14. Saxena S, Singh K, Talwar V. Methicillin-resistant *Staphylococcus aureus* prevalence in community in the east Delhi area. Jpn J Infect Dis. 2003;56: 54-56.
15. Ramana KV, Mohanty SK, Wilson CG. *Staphylococcus aureus* colonization of anterior nares of school going children. Indian J Pediafr. 2009;76(8): *8*13-816.
16. O'Brien FG, Pearman JW, Gracey M, Riley TV, Grubb WB. Community strain of methicillin-resistant *Staphylococcus aureus* involved in hospital outbreak. J Clin Microbiol. 1999;37(9): 2858-2862.
17. Shamsuzzaman AK, Sirajee A, Rahman M, Miah AG, Hossain MA. Pattern of aerobic bacteria with their drug susceptibility of surgery inpatients. Mymensingh Med J. 2003;12(2): 98-103.
18. Azeez-Akande O. Global Trend of Methicillin resistant *S. aureus* and emerging challenges for control. Afr J Cln Exper Microbiol. 2010;11(3): 150-158.
19. Harputlouoglu U, Egeli E, Sahin I , Oghan F, Ozturk O. Nasopharyn-geal aerobic bacterial flora and *Staphylococcus aureus* nasal carriage in deaf children. Int J Pediatr Otorhinolaryngol. 2005;69 (1): 69-74.
20. Alfaro C, Mascher-Denen M, Fergie J, Purcell K. Prevalence of methicillin resistant *Staphylococcus aureus* nasal carriage in patients admitted to Driscoll Children's Hospital. Pediatr lnfect Dis J. 2006;25: 459-461.