

Original Article

Prevalence of Methicillin Resistant Staphylococcus Aureus In Khwaja Yunus Ali Medical College Hospital

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Abstract

Background: Methicillin-resistant *Staphylococcus aureus* (MRSA) is a major cause of healthcare-associated infections. To combat the challenge of life threatening MRSA remains a primary focus of most hospital infection control programs⁶. This study is undertaken in Khwaja Yunus Ali Medical College Hospital to identify the MRSA for determination of its prevalence and is considered a component of an infection control program in many countries⁵.

Methods: Three hundred seventy hospitalized patients of surgery and medicine departments were studied during 2015. Clinical information of the patients and their pus, wound swab, sputum, throat swab and CSF were cultured.

Results: Out of 370 patients, pus and wound swab of 217 (59%) had wound infection, sputum and throat swab of 141 had respiratory tract infection (38%) and CSF of 12 (3.2%) had meningitis were aseptically collected and cultured. *Staphylococcus aureus* were isolated in 51% cases and out of them MRSA was identified in 72 (73%) cases. MRSA isolated in 50% cases of meningitis, 49% cases of respiratory tract infection and 29% cases of wound infection.

Conclusion: Methicillin-resistant *Staphylococcus aureus* appeared as a common cause of major illness and death and impose serious economic costs on patients and hospitals of our area like other developing countries. Detection of MRSA was associated with more severe clinical presentation.

Introduction

MRSA is any strain of *Staphylococcus aureus* that has developed, through the process of natural selection, resistance to beta-lactam antibiotics (penicillins, methicillin, dicloxacillin, nafcillin, oxacillin, etc.), cephalosporins, tetracyclines and clindamycin. It is also called oxacillin-resistant *Staphylococcus aureus* (ORSA)¹. MRSA is responsible for several difficult-to-treat infections in humans. It was first reported in 1961

shortly after its introduction in therapy. When MRSA strains first appeared, they occurred predominantly in the healthcare setting and the first hospital outbreak of MRSA was reported in 1963^{2,3}. Since that time, MRSA has spread worldwide. The prevalence of methicillin resistance among *S. aureus* isolates in intensive care units in the United States is 60 percent⁴ and more than 90,000 invasive infections due to MRSA occurred in the United States in 2005⁵.

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It is associated with longer hospital stay and more infections in intensive care units and leads to more antibiotic administration. Asymptomatically colonized patients and health care workers are the major sources of methicillin-resistant *Staphylococcus aureus* (MRSA) in the hospital environment. Now, the disease is no longer confined in inpatients' infections, but spreads rapidly in the community, underlying more deaths in the US than AIDS⁶ and shows increasing prevalence not only among people with weak immune system, but also among those who would otherwise be the healthiest among us, such as athletes, military personnel and school-age children⁷.

In Bangladesh the frequency of MRSA is alarming, in 1991 was 62.6%⁸, in 2002, 47.2%⁹ and in Dhaka city, in 2011, 43.5% was reported¹⁰. Whereas in India it was 54.8%, in Nepal was 69.1% and in Pakistan was 29%^{11,12,13}. No such study report of Sirajgonj area is available to combat MRSA infections.

Therefore, it become necessary to design a study for investigating the prevalence of MRSA among the hospitalized patients of Khwaja Yunus Ali Medical College & Hospital, a tertiary level health care center in the selection of appropriate empirical treatment of these infections. By reporting sensitivity test to a single antibiotic oxacillin physicians may be guided not to prescribe a number of antibiotics which belongs to beta-lactam group of antibiotics and cephalosporins in MRSA positive cases.

We have determined the prevalence of MRSA, the so called superbug from different clinical samples and their in vitro susceptibility pattern to various antimicrobial agents to record the current status of MRSA response to commonly used anti *Staphylococcus* antibiotics.

Materials and method

A total of 370 clinical specimens comprising pus, wound swab, sputum, throat swab, and CSF were collected aseptically from the hospitalized patients suffering from wound infection, respiratory tract infection and meningitis of Khwaja Yunus Ali Medical College Hospital during 2015 for isolation of bacterial pathogens and MRSA. These collected samples were immediately transported to the microbiology laboratory and inoculated onto MacConkey agar and Mannitol Salt agar plates (Hi-Media Laboratories, Mumbai). These plates were incubated at 37°C for 24 - 48 h. Plates were observed for growth and a Gram smear was performed from different types of colonies. Gram reaction, colony

morphology, pigment formation, catalase, coagulase, urease and oxidase tests were performed and allocated to appropriate genera to the isolates. The cultural characteristics including lactose fermentation on MacConkey agar and golden yellow colored colonies of *S. aureus* on mannitol salt agar were noted. Further identification to species level was carried out on the basis of various specialized tests¹⁴.

All the confirmed *S. aureus* strains were subsequently tested for methicillin resistance based on Kirby-Bauer disk diffusion method¹⁵ using oxacillin discs (1µg) obtained from Hi-Media Laboratories Pvt. Ltd, Mumbai (India). The isolates were considered methicillin resistant if the zone of inhibition was 10 mm or less. Further, the antibiotic susceptibility pattern of methicillin resistant *S.aureus* strains was determined on the day of their isolation by the Kirby-Bauer disk diffusion method¹⁵ on Muller Hinton agar using the criteria of standard zone sizes of inhibition to define sensitivity or resistance to different antimicrobials. Finally, the data were recorded and analyzed at the completion of the study as per recommendations of the NCCLS¹⁶. *S. aureus* MTCC 87 was used as reference strain for the standardization of antibiotic susceptibility testing.

Result

MRSA is a major nosocomial pathogen causing significant morbidity and mortality. The important reservoirs of MRSA in hospitals/institutions are infected or colonized patients and transient hand carriage is the predominant mode of patient-to-patient transmission¹⁷. Among the 370 study population 59% patients were suffer wound infections, 38% from respiratory tract infections and remaining 3% were associated with meningitis (Figure 1).

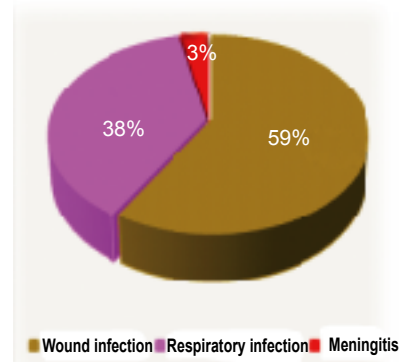


Figure 1: Distribution of infection among the study population

Table 1 - Age and sex distribution of 98 MRSA positive study population

Sex	Age in years						
	0-10	11-20	21-30	31-40	41-50	51-60	>61
Male-51	09	08	07	05	10	07	05
Female-47	04	08	10	10	08	07	00
Total-98	13	16	17	15	18	14	05

MRSA was isolated in 52% male patients and 48% in females (Figure - 2).

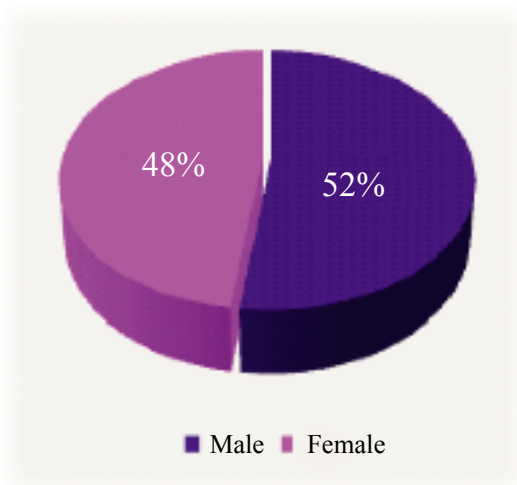


Figure 2: Distribution of 98 MRSA positive study population in sex

Table 2 - Pattern of microbial growth on cultural examination on 370 study population

Infection	Specimen	Growth				No growth	Total
		MRSA +ve	MRSA -ve	Other organism	Total		
Wound infection (54)	Pus	31	17	52	100	87	187
	Wound swab	04	01	13	18	12	30
Resp. infection (44)	Sputum	06	01	07	14	16	30
	Throat swab	30	06	24	60	51	111
Meningitis (2)	CSF	01	01	00	02	10	12
Total- 98		72 (73)	26 (27)	96 (26)	194 (52)	176 (48)	370

" +ve" means positive, "-ve" means negative and figure in parenthesis indicate percentage

Cultural examination of clinical specimens revealed growth in 194 (52%) cases (Table -3) of which

Staphylococcus aureus were found in 98 (51%) cases and among them maximum 72 (73%) was MRSA positive (Figure -3).

Figure-3: Distribution of MRSA (+) ve among total Staphylococcus aureus

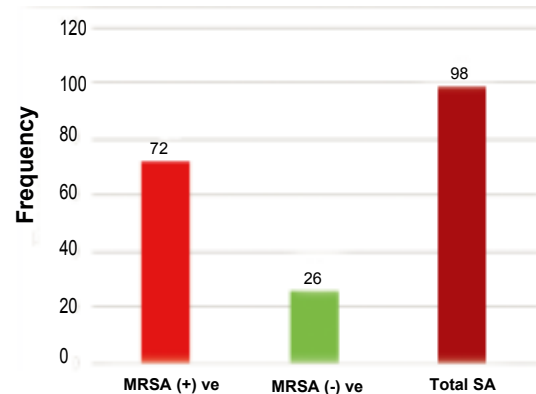


Table 3 - Antibiotic resistant pattern of 98 MRSA study cases.

Name of antibiotics	Resistant (%)
Ampicillin	79
Amoxicillin	63
Amoxiclav	44
Oxacillin (Methicillin)	79
Amikacin	29
Cotrimoxazole	71
Cefuroxime	39
Cephadrine	82
Cefixim	85
Ceftriaxone	62
Ciprofloxacin	50
Gentamicin	17
Meropenem	27
Tobramycin	42
Clindamycin	50
Azithromycin	78

In our study, the isolated Staphylococcus aureus were found resistant to methicillin in significant number 79 (Table-3) but sensitive in maximum cases to Gentamicin 81, Meropenem 71, Amikacin 69, Tobramycin 56 and Amoxiclav 54 (Figure-4).

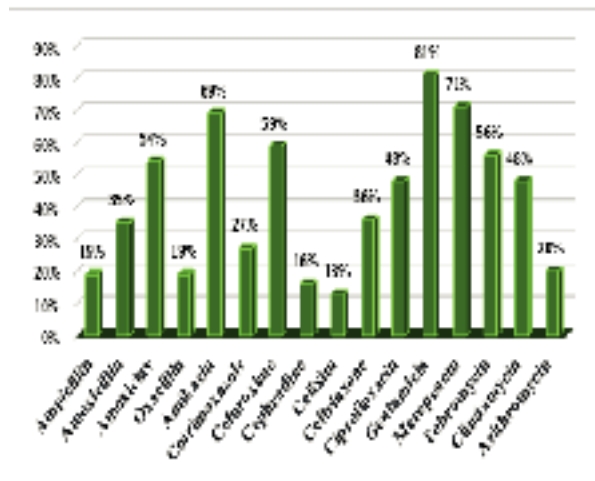


Figure 4: Antibiotic susceptibility pattern of 98 MRSA study cases

Discussion

In Bangladesh, the significance of MRSA had been recognized relatively late than India and epidemic strains of these MRSA are usually resistant to several antibiotics¹⁸. During the past 15 years, the appearance and world-wide spread of many such clones have caused major therapeutic problems in many hospitals, as well as diversion of considerable resources to attempts at controlling their spread¹⁹. In this study, the prevalence and antibiotic susceptibility patterns of various MRSA isolates obtained from the clinical samples were determined. Our study it is evidenced that *Staphylococcus aureus* were found resistant to methicillin in 79% cases and to other commonly prescribed beta lactum antibiotics. Similar three studies of Bangladesh shows that prevalence of MRSA in 1991 was 62.6% in⁸, in 2002, 47.2%⁹ and in Dhaka city, in 2011, 43.5% was reported¹⁰.

Prevalence of MRSA in some developed countries like UK, USA, Canada, Austria, Belgium, Spain and France were found 15.8%, 48.4%, 40%, 21.6%, 25.1%, 30.3% and 33.6% respectively^{20,21,22,23}. It is clear by comparison with above mention prevalence of MRSA reports our study finding is alarming due to indiscriminate and expanded use of antimicrobial drugs outside the hospitals^{8,9}.

Conclusion

Finally, the study showed high prevalence of MRSA (79%) in hospital setting indicating need of good control measures such as proper hand hygiene, surveillance

cultures and monitoring of susceptibility patterns of MRSA may also help in arresting the spread of infections in this tertiary hospital remote area of Bangladesh.

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Reference

1. Salaria M, Singh M. Methicillin resistant *Staphylococcus aureus*. *Indian Pediatr* 2001; 38:29-36
2. BARBER M. Methicillin-resistant staphylococci. *J Clin Pathol* 1961; 14:385.
3. Benner EJ, Kayser FH. Growing clinical significance of methicillin-resistant *Staphylococcus aureus*. *Lancet* 1968; 2:741.
4. National Nosocomial Infections Surveillance System. National Nosocomial Infections Surveillance (NNIS) System Report, data summary from January 1992 through June 2004, issued October 2004. *Am J Infect Control* 2004; 32:470.
5. Klevens RM, Morrison MA, Nadle J, et al. Invasive methicillin-resistant *Staphylococcus aureus* infections in the United States. *JAMA* 2007; 298:1763.
6. Boyles, Salynn. "More U.S. Deaths From MRSA Than AIDS." *WebMD*. 16 Oct. 2007. 7 July 2009 <http://www.webmd.com/news/20071016/more-us-deaths-from-mrsa-than-aids>.
7. Scheckler WE, Brimhall D, Buck AS, Farr BM, Friedman C, Garibaldi RA, et al. Requirements for infrastructure and essential activities of infection control and epidemiology in hospitals: a consensus panel report. *Society for Healthcare Epidemiology of America* [see comments]. *Infect Control Hosp Epidemiol* 1998;19:114-24.
8. Khan MA, Morshed MG, Khan WA and Aziz KMS. The emergence of methicillin resistant *Staphylococcus aureus* isolated from skin lesions. *Bangladesh J Microbiol* 1991; 8(1):21-25

9. Rahman M, Hossain M, Samad TMA, Shahriar M, Zakaria MM. Prevalence of β -lactamase producing methicillin resistant *Staphylococcus aureus* antimicrobial sensitivity pattern. *Bangladesh Pharm J* 2002; 12 (2): 1-4.
10. Haque ME, Shahriar M, Haq A, Gomes BC, Hossain MM, Razzak MA, Mazid MA. Prevalence of β -lactamase producing and non-producing methicillin resistant *Staphylococcus aureus* in clinical samples in Bangladesh. *JMA* 2011; 3(5):112-18
11. Anupurba S., Sen, M.R., Nath, G., Sharma, B.M., Gulati, A.K. and Mohapatra, T.M. Prevalence of methicillin resistant *Staphylococcus aureus* in tertiary referral hospital in eastern Uttar Pradesh. *Indian J. Med. Microbiol* 2003, 21: 49-51.
12. Tiwari HK, Das AK, Sapkota D, Sivarajan K, Pahwa VK. Methicillin resistant *Staphylococcus aureus*: prevalence and antibiogram in a tertiary care hospital in western Nepal. *J Infect Dev Ctries* 2009; 3 (9): 681-84
13. Farzana K, Rashid Z, Akhtar N, Sattar A, Khan JA, Nasir B. Nasal carriage of staphylococci in health care workers: antimicrobial susceptibility profile. *Pak J Pharm Sci* 2008; 21: 290-4.
14. Collee, J. G., A.G. Frasier, B.P. Marmion and A. Simmons (1996). In Mackie and McCartney's *Practical Microbiology*, pp 978, 14th ed., Churchill Livingstone, New York.
15. Bauer, A. W., Kirby, W.M. M. and Sherris, J. C. (1966). Antibiotic susceptibility testing by a single disc method. *AM. J. Pathol.*, 45: 493-496
16. National Committee for Clinical Laboratory Standards (NCCLS) (2000). Methods for dilution antimicrobial susceptibility tests for bacteria that grows aerobically. Approved standard M7-A5 National Committee for Clinical Laboratory Standards, Wayne, PA
17. Vogelaers D (2006). MRSA: total war or tolerance? *Nephrol. Dial Transplant*, 21: 837-838
18. Rajadurai pandi, K., Mani, K. R., Panneerselvam, K., Mani, M., Bhaskar, M. and Manikandan, P. (2006). Prevalence and antimicrobial susceptibility pattern of methicillin resistant *Staphylococcus aureus*: A multicenter study. *Indian J. Med. Microbiol*, 24 (1): 34-8.
19. D.H. Tambekar, D.V. Dhanorkar, S. R. Gulhane and M. N. Dudhane (2006). Prevalence and antimicrobial susceptibility pattern of methicillin resistant *Staphylococcus aureus* from healthcare and community associated sources. *Afr. J. Infect. Dis.* 1 (1): 52 - 56
20. David MZ, Daum RS. Community associated methicillin resistant *Staphylococcus aureus*: Epidemiology and clinical consequences of an emerging epidemic. *Clin Microbiol Rev* 2010; 23 (3): 616-87
21. Center for Disease Dynamics, Economics and Policy (CDDEP), 2004. Available at: http://www.cdddep.org/tools/methicillin_resistant_staphylococcus_aureus_infection_rates_united_states_and_other_countries.
22. Wylie JL, Nowicki DL. Molecular epidemiology of community and health care associated methicillin resistant *Staphylococcus aureus* in Manitoba, Canada. *J Clin Microbiol* 2005; 43: 2830-6.
23. Herwaldt LA, Wenzel RP. Dynamics of hospital acquired infection. In: *Manual of clinical microbiology*. 6th ed. Washington DC. Am. S. Microbiol 1996; 169-81.