

Prevalence of Methicillin Resistant Staphylococcus Aureus In Surgical Units of a Tertiary Care Hospital

Dr. N. S. Dixit¹, Dr. Deepak Kothari², Dr. Karan Singh Chandrakar^{*3}

¹Assistant Professor Department of Medicine CCM Medical College, Kachandur, Durg (CG)

²Assistant Professor Department of Surgery CCM Medical College, Kachandur, Durg (CG)

^{*3}Assistant Professor Department of Pathology CCM Medical College, Kachandur, Durg (CG)



Abstract:

Background - *Staphylococcus aureus* is a dangerous pathogen for both community-acquired as well as hospital-associated infections. Methicillin-resistant *Staphylococcus aureus* (MRSA) is widely recognized as one of the pathogens causing hospital- and community- acquired infections. Due to increased incidence of MRSA vancomycin has been used as an empirical treatment for *Staphylococcus aureus* infections which in turn results in the emergence of VRSA (vancomycin resistant *Staphylococcus aureus*). It is necessary to know the prevalence of MRSA and its antibiotic sensitivity pattern for proper treatment of the patients and thereby reducing the morbidity and mortality of the patients in our tertiary care hospital.

Methods - A total of 796 sample from the OPD and IPD patients attending the surgery department from various clinical specimens from January 2015 to Feb 2017. All samples were sent to microbiology laboratory for identification and antibiotic susceptibility pattern testing. Results were obtained from the microbiology department as resistant and susceptible according to zone of inhibition shown by the strain.

Results - Of the total 796 samples collected from the surgery department 254 *Staphylococcus aureus* were isolated of which 96 (37.79%) were MRSA and 158 (62.20%) were MSSA (Methicillin sensitive *Staphylococcus aureus*). Of the total 96 MRSA strains 74 strains (77.08%) were multidrug resistant. MRSA strains were more resistant to other antibiotics than MSSA strains. No strain was resistant to vancomycin.

Conclusion - MRSA strains are more prevalent in tertiary care hospital and multidrug resistant MRSA prevalence is higher in surgical units. The most effective way to prevent MRSA is surveillance of antibiotic resistance profiles of *Staphylococcus aureus* and there should be formulation of antibiotic policy in the hospital.

Keyword- MRSA, VRSA, penicillin, oxacillin, cefoxitin, erythromycin, ciprofloxacin, gentamicin, amikacin, linezolid, vancomycin

Introduction

Staphylococcus aureus is a dangerous pathogen for both community-acquired as well as hospital-associated infections. *Staphylococcus aureus* is responsible for causing a variety of human infections, which range from minor skin diseases to life-threatening infections.^[1] Methicillin-resistant *Staphylococcus aureus* (MRSA) is widely recognized as one of the pathogens causing hospital- and community- acquired infections. MRSA is highly prevalent in hospitals worldwide in which high rates more than 50% were reported in Asia, Malta, North and South America.^[2] Methicillin resistant *Staphylococcus aureus* (MRSA) were reported in October 1960.^[3] The incidence of MRSA varies from 25 per cent in western part of India to 50 per cent in South India.^[4, 5] Over the last two or three decades, methicillin resistant *S. aureus* (MRSA) strains have become endemic in hospitals

worldwide and it is now incipient community pathogen in many geographical regions . Due to increased incidence of MRSA vancomycin has been used as an empirical treatment for *Staphylococcus aureus* infections which in turn results in the emergence of VRSA (vancomycin resistant *Staphylococcus aureus*).^[6]

Patients in hospitals those who are infected and colonized mediate the dissemination of MRSA strains, and hospital staff is the main source of transmission which leads to dangerous endemic and epidemic MRSA infections.^[7] these factors increases the chance of emergence and spread of MRSA which lead to repeated hospitalization, indiscriminate use of antibiotics, intravenous drug abuse and indwelling medical devices.^[8]

Thus, control of MRSA is essential to curtail the introduction and spread of infection in the hospitals. This

can be achieved by using universal precautions and conducting regular epidemiological studies.^[9]

It is necessary to know the prevalence of MRSA and its antibiotic sensitivity pattern for proper treatment of the patients and thereby reducing the morbidity and mortality of the patients in our tertiary care hospital.

Material and methods

In our study we collected sample 796 from the OPD and IPD patients attending the surgery department from various clinical specimens like pus, blood, urine, sputum wound swab, aspirates etc. all samples were collected from January 2015 to Feb 2017. All samples were sent to microbiology laboratory of our hospital for identification and antibiotic susceptibility pattern testing. Tube coagulase was taken as a major criterion for identification of staphylococcus aureus.

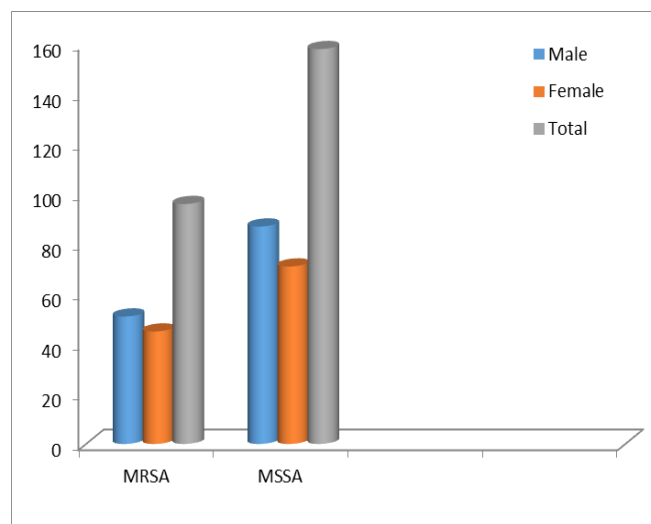
All identified strains were then subjected to antimicrobial susceptibility testing by Kirby–Bauer disc diffusion method. Antibiotics tested were penicillin (10 units), oxacillin (1 µg), cefoxitin (30 µg), erythromycin (15 µg), ciprofloxacin (5 µg), gentamicin (10 µg), amikacin (30 µg), linezolid (30 µg), vancomycin (30 µg). Results were obtained from the microbiology department as resistant and susceptible according to zone of inhibition shown by the strain.

Observation and Results

Of the total 796 samples collected from the surgery department 254 Staphylococcus aureus were isolated of which 96 (37.79%) were MRSA and 158 (62.20%) were MSSA (Methicillin sensitive Staphylococcus aureus). Prevalence of MRSA and MSSA both were higher in males as compared to females. Of the total 96 MRSA isolates 53.13% (n=51) were isolated from the males and 46.88% (n=45) were isolated from the females similarly of the total 158 MSSA isolates 5.06% (n=87) were isolated from the males and 44.94% (n=71) were isolated from the females

Table 1: Gender wise Prevalence of MRSA and MSSA

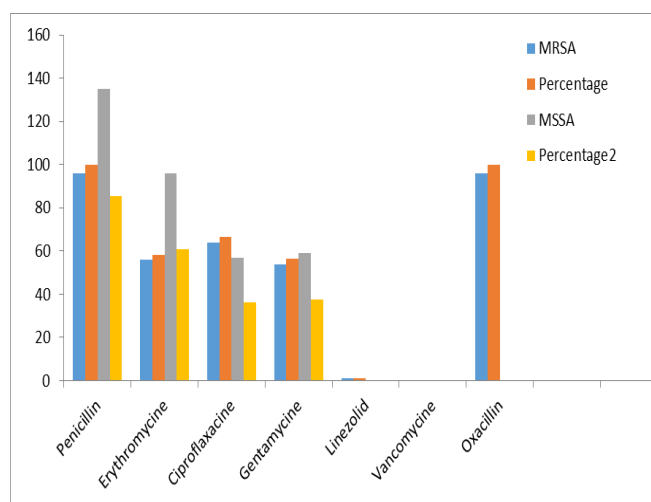
	Male	Female	Total
MRSA	51	45	96
MSSA	87	71	158
Total	138	116	254



Out of 254 isolates, 96 strains were found to be resistant to Oxacillin by oxacillin disc diffusion method. Of the total 96 MRSA strains 74 strains (77.08%) were multidrug resistant i.e. resistant to 3 or more than three drugs tested. One MRSA strain was resistant to linezolid (1.04%). Hundred percent MRSA were resistant to penicillin while resistant to erythromycin was 58.33%, ciprofloxacin 66.67% Gentamycin 56.25%. No strain was resistant to vancomycin. In MSSA resistance pattern observed was Penicillin 85.44%, erythromycin 60.76%, ciprofloxacin 36.08%, gentamycin 37.34 %, vancomycin and linezolid 0%.

Table 2: Antibiogram of Staphylococcus aureus isolates

	MSSA(n= 158)		MRSA (n = 96)	
	Resistant	%	Resistant	%
Penicillin	135	85.44	96	100.00
erythromycin	96	60.76	56	58.33
ciprofloxacin	57	36.08	64	66.67
gentamycin	59	37.34	54	56.25
linezolid	0	0.00	1	1.04
vancomycin	0	0.00	0	0.00
oxacillin	0	0.00	96	100.00



Discussion

Staphylococcus aureus is one of the major pathogen causing skin and soft tissue infections in the community as well as invasive infections in patients. Proportion of MRSA varies from country to country, in Sweden it is 0.4% while in Belgium it is as high as 48.4%.^[10] Our study reports alarmingly high prevalence of 37.79 % MRSA infection amongst patients from surgery department this was in accordance with other studies.^[8,11] however low prevalence of MRSA has also been reported from 23 to 31 %.^[7,12] This variation may be due to different environmental conditions, antibiotic prescribing practices, healthcare facilities, infection control measures and nasal carriage of MRSA. Also it is observed that MRSA strains were more resistant to other antibiotics as compared to MSSA strains which were less resistant to other antibiotics. Vidhani S. et al. also found the difference between MSSA and MRSA sensitivity pattern.^[9] There is increased incidence of community acquired MRSA from India in a study by D' Souza et al. where they found 54 % community acquired MRSA by genotypic methods.^[13] Chatterjee et al. also found that there is overall nasal colonization of Staphylococcus aureus was 52.35 and MRSA was 3.895 in the community.^[14] In a study by Dar et al higher percentage of MRSA (35.5%) was found in pus specimens and zero resistance was found in both methicillin-resistant as well as methicillin-sensitive Staphylococcal isolates, zero resistance was found to vancomycin.^[15] In our study also there was zero resistance to vancomycin. Association of multidrug resistant MRSA adds to the problem and hospital dust is more dangerous than other or roadside dust as former may contain MRSA which may multidrug resistant and may create problem in the hospital specially in surgical units. Researchers from other countries also observed that these MRSA isolates are becoming multidrug resistant and were susceptible only to glycopeptide antibiotics such as vancomycin. Low level resistance even to vancomycin is also emerging.^[16] In our study all MRSA and MSSA strains were sensitive to vancomycin but reports of resistance to vancomycin have been reported from various part of the country.^[1]

Conclusion

To conclude MRSA strains are more prevalent in tertiary care hospital and multidrug resistant MRSA prevalence is higher in surgical units of our hospital. Glycopeptides seems to be the drug of choice for MDR MRSA, but it should be used wisely and only in MDR MRSA confirmed cases empirical use of glycopeptides may lead to the resistant to vancomycin. The most effective way to prevent MRSA is surveillance of antibiotic resistance profiles of Staphylococcus aureus and there should be formulation of antibiotic policy in the hospital

References

- [1] Tiwari HK, Das AK, Sapkota D, Sivrajan K, Pahwa VK .Methicillin resistant Staphylococcus aureus: prevalence and antibiogram in a tertiary care hospital in western Nepal.J Infect Dev Ctries. 2009 Oct 22; 3(9):681-4.
- [2] Stefani S, Chung DR, Lindsay JA, Friedrich AW, Kearns AM, Westh H, Mackenzie FM. Methicillin-resistant Staphylococcus aureus (MRSA): global epidemiology and harmonisation of typing methods. Int J Antimicrob Agents. 2012; 39(4):273–282. doi: 10.1016/j.ijantimicag.2011.09.030.
- [3] Jevons MP. ‘Celbenin’-resistant Staphylococci. BMJ. 1961; 1:124.
- [4] Patel AK, Patel KK, Patel KR, Shah S, Dileep P. Time trends in the epidemiology of microbial infections at a tertiary care center in west India over last 5 years. J Assoc Physicians India. 2010; 58(Suppl):37–40.
- [5] Gopalakrishnan R, Sureshkumar D. Changing trends in antimicrobial susceptibility and hospital acquired infections over an 8 year period in a tertiary care hospital in relation to introduction of an infection control programme. J Assoc Physicians India. 2010; 58(Suppl):25–31.
- [6] Lowy FD Staphylococcus aureus infections.N Engl J Med. 1998 Aug 20; 339(8):520-32.
- [7] Rajadurai pandi K, Mani KR, Panneerselvam K, Mani M, Bhaskar M, Manikandan P.Prevalence and antimicrobial susceptibility pattern of methicillin resistant Staphylococcus aureus: a multicentre study.Indian J Med Microbiol. 2006 Jan; 24(1):34-8.
- [8] Anupurba S, Sen MR, Nath G, Sharma BM, Gulati AK, Mohapatra TM.Prevalence of methicillin resistant Staphylococcus aureus in a tertiary referral hospital in eastern Uttar Pradesh. Indian J Med Microbiol. 2003 Jan-Mar; 21(1):49-51.
- [9] Vidhani S, Mehndiratta PL, Mathur MD.Study of methicillin resistant S. aureus (MRSA) isolates from high risk patients.Indian J Med Microbiol. 2001 Apr-Jun; 19(2):13-6.
- [10] Sader HS, Farrell DJ, Jones RN,Antimicrobial susceptibility of Gram-positive cocci isolated from skin and skin-structure infections in European medical centres.Int J Antimicrob Agents. 2010 Jul; 36(1):28-32.
- [11] Tiwari HK, Sen MR .Emergence of vancomycin resistant Staphylococcus aureus (VRSA) from a tertiary care hospital from northern part of India.BMC Infect Dis. 2006 Oct 26; 6():156

- [12] Majumder D, Bordoloi JS, Phukan AC, Mahanta. Antimicrobial susceptibility pattern among methicillin resistant Staphylococcus isolates in Assam. Majumder D, Bordoloi JS, Phukan AC, Mahanta J Indian J Med Microbiol. 2001 Jul-Sep; 19(3):138-40.
- [13] D'Souza N, Rodrigues C, Mehta A. Molecular characterization of methicillin-resistant Staphylococcus aureus with emergence of epidemic clones of sequence type (ST) 22 and ST 772 in Mumbai, India. J Clin Microbiol. 2010 May; 48(5):1806-11.
- [14] 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 Dec; 130(6):742-8.
- [15] Dar JA, Thoker MA, Khan JA, Ali A, Khan MA, Rizwan M, Bhat KH, Dar MJ, Ahmed N, Ahmad S. Molecular epidemiology of clinical and carrier strains of methicillin resistant Staphylococcus aureus (MRSA) in the hospital settings of north India. Ann Clin Microbiol Antimicrob. 2006 Sep 14; 5():22.
- [16] Assadullah S, Kakru DK, Thoker MA, Bhat FA, Hussain N, Shah A. Emergence of low level vancomycin resistance in MRSA. Indian J Med Microbiol. 2003 Jul-Sep; 21(3):196-8.

Corresponding Author -

Dr. Karan Singh Chandrakar

Assistant Professor Dept. of Pathology
CCM Medical College Kachandur, Durg Chhattisgarh
490024