SHORT REPORT

Antimicrobial susceptibility pattern of Methicillin-resistant Staphylococcus Aureus isolates in Fauji Foundation Hospital Rawalpindi

Asim Ali Shah[1], Yasir Ali[2], Ayesha Maqbool[3], Shahid Ahmad Abbasi[4]

Abstract

The current study was conducted in the Department of Microbiology, Fauji Foundation Hospital, Rawalpindi, from July 2018 to January 2019. The main purpose of the study was to evaluate Methicillin-resistant Staphylococcus aureus antimicrobial susceptibility pattern. Clinical samples were collected and cultured according to Clinical and Laboratory Standards Institute (CLSI) guidelines. A total of 90(30%) samples were found to be methicillin-resistant out of 300 samples of Staphylococcus aureus. Major isolates were 42 (46.67%) from pus and 22 (24.44%) from tracheal tubes. The incidence ratio of Methicillin-resistant Staphylococcus aureus was high in the samples isolated from 69 (76.67%) females compared to those of 21 (23.33%) males. Patients were more in the age group of 41 to 60 years. Vancomycin 90 (100%) was sensitive to all strains followed by Chloramphenicol 66 (73.33%) and Doxycycline 52 (57.78%). Imipenem, Meropenem andAugmentin showed resistance to all strains.

Keywords: Methicillin-resistant Staphylococcus aureus, MRSA, Vancomycin, Antimicrobial susceptibility

DOI: https://doi.org/10.5455/JPMA.41422

Introduction

Methicillin-resistant Staphylococcus aureus (MRSA) causes a wide range of infections in humans and animals and is genetically different from other strains.[1] Infections caused by MRSA are broadly divided into two categories: hospital-acquired and community-acquired infections. Hospital-acquired infections are also called nosocomial infections that are contracted in hospitals, nursing homes and in other clinical settings.[2] Community-acquired infections are contracted in the community outside clinical settings.[3] Both infections are of serious concern and cause different diseases and death.[4] MRSA infections are treated with assorted antibiotics but due to resistance of some strains against penicillins, methicillin emerged as a multi-drug resistant (MDR) strain that causes serious infections and is difficult to treat normally.[5]

[1,4]Department of Microbiology, Fauji Foundation Hospital, Rawalpindi, Pakistan; [2]Department of Biology, Virtual University of Pakistan Rawalpindi, Pakistan; [3]Department of Molecular Biology, Virtual University of Pakistan Rawalpindi, Pakistan.
Correspondence: Yasir Ali. e-mail: yasirswati85@gmail.com

Vancomycin is mostly sensitive to MRSA strains but there are some strains recorded to be resistant to vancomycin as well.[6] A high rate of mortality due to MRSA was reported in the United States of America.[7] MRSA is also associated with eye infections and were isolated from blepharo-conjunctivitis, cellulitis, dacryocystitis, keratitis and endophthalmitis.[8]

The prevention of such organisms spreading among the general population requires different approaches such as general hygiene, screening, cleaning measures and vaccination.[9] Centres for Disease Control and Prevention (CDC) organised a meeting in July 2004 on the management of MRSA. They stated that infections can be reduced by preventive measures such as wearing gloves, gowns and proper hand washing after touching contaminated items, wounds and body fluids.[10] The main objective of this study was to evaluate Methicillin-resistant Staphylococcus aureus antimicrobial susceptibility pattern in clinical samples isolated from male and female patients.

Methods and Results

This cross-sectional study was conducted in the Department of Microbiology, Fauji Foundation Hospital, Rawalpindi from July 2018 to January 2019, after receiving approval from the institutional ethics committee. Consecutive non-probability sampling technique was used consisting of male and female patients from different wards between the ages of 10-90 years. Their pancultures exhibited a growth of MRSA having cefoxitin disk size <22mm and growth other than MRSA. Outpatient Department (OPD) samples, patients taking antibiotics and those whose ages were <10 and >90 years were excluded from the study. Over a seven-month period, clinical samples (including vaginal swabs, pus, sputum, urine, body fluids, tracheal tube, canula double lumen and blood) were collected aseptically as per standard microbiological methods from different departments / wards of the hospital.

All clinical samples were inoculated on blood agar and MacConkey agar and incubated for 24 hours at 37^{O}C while the significant colonies were subjected to Gram staining, catalase and Coagulase / DNase test. All strains of methicillin-resistance were screened by Cefoxitin (30µg) disk diffusion test and Oxacillin (1µg) as per Clinical and

Laboratory Standards Institute (CLSI) guidelines. The antimicrobial susceptibility testing of the samples was done on Mueller Hinton agar plates by Kirby Bauer disc diffusion method using Vancomycin (30µg), Chloramphenicol (30µg), Doxycycline (30µg), Co-Trimoxazole (25µg), Gentamicin (10µg), Erythromycin (15µg), Ciprofloxacin (5µg), Cloxacillin (5µg), Cephradine (30µg), Imipenem (10µg), and Meropenem (10µg) according to CLSI guidelines. A total of 300 Staphylococcus aureus strains were isolated, of which 90 (30%) were identified as Methicillin-resistant Staphylococcus aureus (MRSA). The maximum isolates were 42 (46.67%) from pus samples followed by 22 (24.44%) from tracheal tube samples, 8 (8.89%) from vaginal swabs , 5 (5.56%)from urine, 4 (4.44%) from canula double lumen , 4 (4.44%) from body fluids, 3 (3.33%) from sputum and 2 (2.22%) from blood samples. The prevalence ratio of MRSA was high in samples isolated from 69 (76.67%) females compared to the 21 (23. 33%) males (Table 1). Vancomycin was sensitive to all Methicillin-resistant 90 (100%) strains followed by Chloramphenicol in 66 (73.33%), Doxycycline in 52 (57.78%), Co-trimoxazole in 41 (45.56%), Gentamycinin 34 (37.78%), Erythromycinin 18 (20%, and Ciprofloxacin16 (17.78%). Imipenem, Meropenem and Augmentin showed resistance to all strains (Table 2). MRSA was found most common between the age group of 41 to 60 years in 38(42.22%) patients.

Table-1: Distribution of S.Aureus and MRSA.

Source	No. of S.aureusisolated	MRSA Isolated n=90 n (%)	MRSA Isolated from Male samples n (%)	MRSA isolated From Female samples n (%)
Pus	130	42(46.67)	8 (38.10)	34 (49.28)
T.T	83	22(24.44)	8 (38.10)	14 (20.29)
V.S	21	8(8.89)	0	8 (11.60)
Urine	17	5(5.56)	1 (4.76)	4 (5.80)
CDL	16	4(4.44)	0	4 (5.80)
B.F	14	4 (4.44)	1 (4.76)	3 (4.35)
Sputum	10	3 (3.33)	2 (9.52)	1 (1.45)
Blood	9	2(2.22)	1 (4.76)	1 (1.45)
Total	300	90	21(23.33)	69 (76.67)

T.T=Tracheal Tube, V.S=Vaginal Swab, CDL=Canula Double Lumen, B.F= Body Fluid, MRSA=Methicillin Resistant Staphylococcus aureus

Table-2: Sensitivity and resistance pattern of 90 MRSA Samples.

Antibiotic	Sensitive isolates	Resistant isolates
Vancomycin	90 (100)	0
Chloramphenicol	66 (73.33)	24 (26.67)
Doxycycline	52 (57.78)	38 (42.22)
Co-Trimoxazole	41 (45.56)	49 (54.44)
Gentamicin	34 (37.78)	56 (62.22)
Erythromycin	18 (20)	72 (80)
Ciprofloxacin	16 (17.78)	74 (82.22)
Cloxacillin	2 (2.22)	88 (97.78)
Cephradine	1 (1.11)	89 (98.89)
Imipenem	0	90 (100)
Meropenem	0	90 (100)
Augmentin	0	90 (100)

Discussion

Methicillin-resistant Staphylococcus aureus (MRSA) causes infections in humans and animals worldwide. Its distribution varies due to different factors such as areas studied, population and culture techniques. Antimicrobial resistance is a common issue in MRSA infections. In this study we collected 300 samples of Staphylococcus aureus, of which 90 (30%) were identified as Methicillin-resistant. The maximum isolates were from vaginal swabs, pus, tracheal tube and sputum samples. The incidence ratio of MRSA was high in samples isolated from 69 (76.67%) females compared to 21 (23.33%) males. Vancomycin was sensitive to all strains while Imipenem, Meropenem and Augmentin showed resistant to all strains. MRSA was common in patients in ages between 41 to 60 years. In the study of Saikia et al, 96 (34.78%) samples were methicillin-resistant out of 276 coagulase positive staphylococci strains.[11] In another study, Ullah et al isolated 101 (36.1 %) Methicillin-resistant staphylococcus aureus from 280 Staphylococcus aureus strains conducted on various clinical samples in Peshawar region, Pakistan.[12]

The MRSA isolated from pus samples in our study was 46.67% and comparable to the results of another study by Kumar and Bhadauria conducted in District Jaipur, India that showed MRSA in 37.70%pus samples.[13] In another study similar to ours by Gajbhiye et. al. the MRSA isolated from pus samples was 34.02 %.[14]

Most strains of MRSA showed resistance to different antibiotics as in our current study in which among 90 MRSA strains, 80% were resistant to erythromycin and 82.22 % were resistant to ciprofloxacin. It is similar to the study by Pandya et al in which out of 117 MRSA strains, 86.59% showed resistance to ciprofloxacin while 79.27% to erythromycin.[15] The sensitivity pattern of vancomycin (100%) in our current study is also in accordance with the study by Ray et al.[16] The MRSA was high in samples isolated from 69/90 (76.66%) female patients compared to 21/90 (23.33%) male patients and corroborates with the findings of Mansoor et al in which 56% were female and 44% were male patients.[17] MRSA infection was also found common in patients of ages between 41-60 as reported in the study by Alebachew et al.[18]

On the basis of our study we can conclude that in our institution, female patients are more prone to MRSA infection. This study was conducted only in one hospital with specific number of samples from different wards. A

wider sample study that includes patients from OPD and other wards from different hospitals from different geographic regions is recommended. The use of vancomycin in the patients should be limited only to where it is clearly needed.

Conclusion

The present study showed that Methicillin-resistant Staphylococcus aureus was resistant to commonly used antibiotics and Vancomycin is the better choice for staphylococcal infections. The incidence rate was high in female patients and most common in the 41 to 60 years age group.

Disclaimer: None.

Conflict of interest: None.

Funding disclosure: None.

References

1. Harkins CP, Pichon B, Doumith M, Parkhill J, Westh H, Tomasz A, et al. Methicillin-resistant Staphylococcus aureus emerged long before the introduction of methicillin into clinical practice. Genome Biol. 2017; 18:130.
2. Hassoun A, Linden PK, Friedman B. Incidence, prevalence, and management of MRSA bacteremia across patient populations—a review of recent developments in MRSA management and treatment. Crit Care. 2017; 21:211.
3. Glaser P, Martins-Simões P, Villain A, Barbier M, Tristan A, Bouchier C, et al. Demography and intercontinental spread of the USA300 community-acquired methicillin-resistant Staphylococcus aureuslineage. MBio. 2016; 7:e02183-15.
4. Nelson RE, Slayton RB, Stevens VW, Jones MM, Khader K, Rubin MA, et al. Attributable mortality of healthcare-associated infections due to multidrug-resistant gram-negative bacteria and methicillin-resistant Staphylococcus aureus. Infect Control Hosp Epidemiol. 2017; 38:848-56.
5. Ventola CL. The antibiotic resistance crisis: part 1: causes and threats. P T. 2015; 40:277-83.
6. Hasan R, Acharjee M, Noor R. Prevalence of vancomycin resistant Staphylococcus aureus (VRSA) in methicillin resistant S. aureus (MRSA) strains isolated from burn wound infections. Ci Ji Yi Xue Za Zhi. 2016; 28:49-53.
7. Klein EY, Mojica N, Jiang W, Cosgrove SE, Septimus E, Morgan DJ, et al. Trends in methicillin-resistant Staphylococcus aureus hospitalizations in the United States, 2010-2014. Clin Infect Dis. 2017; 65:1921-3.
8. Freidlin J, Acharya N, Lietman TM, Cevallos V, Whitcher JP, Margolis TP. Spectrum of eye disease caused by methicillin-resistant Staphylococcus aureus. Am J Ophthalmol. 2007; 144:313-5.
9. Skov R, Christiansen K, Dancer SJ, Daum RS, Dryden M, Huang YC, et al. Update on the prevention and control of community-acquired meticillin-resistant Staphylococcus aureus (CA-MRSA). Int J Antimicrob Agents 2012; 39:193-200.
10. Johnson PD, Martin R, Burrell LJ, Grabsch EA, Kirsa SW, O'Keeffe J, et al. Efficacy of an alcohol/chlorhexidine hand hygiene program in a hospital with high rates of nosocomial methicillin resistant Staphylococcus aureus (MRSA) infection. Med J Aust. 2005; 183:509-14.
11. Saikia L, Nath R, Choudhury B, Sarkar M. Prevalence and antimicrobial susceptibility pattern of methicillin-resistant Staphylococcus aureus in Assam. Indian J Crit Care Med. 2009; 13:156.
12. Ullah A, Qasim M, Rahman H, Khan J, Haroon M, Muhammad N, et al. High frequency of methicillin-resistant Staphylococcus aureus in Peshawar Region of Pakistan. Springerplus. 2016; 5:600.
13. Kumar S, Bhadauria S. Increasing trend of methicillin-resistant Staphylococcus aureus in Jaipur, Rajasthan, India. Afr J Microbiol Res. 2016; 10:1417-21.
14. Gajbhiye PS, Damle AS. Study of MRSA Isolates from Patients of Tertiary Care Hospital. J Dent Med Sci. 2015; 14:59-62.
15. Pandya N, Chaudhary A, Mehta S, Parmar R. Characterization of methicillin resistant Staphylococcus aureus from various clinical samples at tertiary care hospital of rural Gujarat. J Res Med Dent Sci. 2014; 2:49-53.
16. Ray P, Manchanda V, Bajaj J, Chitnis DS, Gautam V, Goswami P, et al. Methicillin resistant Staphylococcus aureus (MRSA) in India: prevalence & susceptibility pattern. Indian J Med Res. 2013; 137:363.
17. Mansoor K, Tanvir SB, Shariq A, Yousufi M, Ahmed S, Farooq BJ. Prevalence and antimicrobial susceptibility pattern of Clindamycin in MRSA isolates of patients in a tertiary care hospital. European J Biotechnol Biosci. 2015; 3:17-9.
18. Alebachew T, Yismaw G, Derabe A, Sisay Z. Staphylococcus aureus burn wound infection among patients attending Yekatit 12 hospital burn unit, Addis Ababa, Ethiopia. Ethiop J Health Sci. 2012; 22:209-13.