

Methicillin-resistant *Staphylococcus aureus* in a Secondary Care Hospital in Muzaffarabad, Azad Jammu & Kashmir

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ABSTRACT

Background: *Methicillin-resistant Staphylococcus aureus* (MRSA) is an important nosocomial and community pathogen. It has a high impact not only on patient morbidity and mortality but also on hospitalization costs.

Objective: The objective of this study was to determine the frequency of *Methicillin-resistant Staphylococcus aureus* (MRSA) in a tertiary care hospital.

Methods: This prospective, descriptive study was carried out in the Department of Microbiology, Abbas Institute of Medical Sciences, Muzaffarabad from December 2015 to November 2017. Various clinical specimens for culture & sensitivity testing of both indoor and outdoor patients were received at Pathology Department of Abbas Institute of Medical Sciences. All specimens were inoculated on appropriate media. *Staph aureus* was identified on the basis of colony morphology, Gram staining, catalase test, coagulase test and DNase test. All confirmed *S. aureus* isolates were screened for methicillin resistance using cefoxitin (Fox) disk. To check methicillin resistance, bacterial lawn was prepared on Mueller–Hinton agar and Fox disk was placed on it, followed by incubation at 35 °C for 24 hours. Antibiotic sensitivity was interpreted as per the CLSI guidelines.

Results: Out of total 261 *S. aureus* isolates, the frequency of MRSA was 32.18 % (n = 84), While MRSA exhibited 100 % susceptibility to vancomycin and linezolid. Among MRSA, the frequencies of community acquired MRSA and hospital acquired MRSA were 26% (n = 22) and 74 % (n = 62) respectively. The data was analyzed using WHONET software 5.6 versions.

Conclusion: We observed considerably high rates of MRSA in a regional hospital. The MRSA is a potential threat to the public health as this can disseminate both in community and indoor patients leading to fatal clinical outcomes. There is an urgent need to improve infection control practices and surveillance program in healthcare settings to limit the spread of such resistant pathogens.

Key words: MRSA, *Staphylococcus aureus*, Methicillin resistance

Background

Staphylococcus aureus causes wide spectrum of pyogenic lesions involving several organs, hospital outbreaks and community acquired infections.¹ It was estimated that about 2 billion populations globally carry *S.aureus* as colonizer on different body sites.²

If *S. aureus* strains acquire the *mecA* gene, they become methicillin-resistant *S. aureus* (MRSA) strains that confers resistance to all beta-lactam antibiotics like penicillin, cephalosporin, cabapenem and monobactams.^{3,4}

The MRSA strains associated with hospitals are referred to as *hospital-acquired MRSA* (HA-MRSA) and those associated with the community are referred to as *community-acquired MRSA* (CA-MRSA).⁵ MRSA was first reported in 1968 and started to disseminate from 1980 and became one of the major problems in hospital infections⁶. Healthcare-associated methicillin-resistant *S. aureus* (HA-MRSA) has been associated with significant mortality and morbidity. Increasing resistance in *staphylococci* has also become an important public health problem globally. Infections with MRSA impose a serious economic burden on healthcare resources worldwide. Community-acquired MRSA mostly colonizes in different body sites and these individuals and their close contacts are more likely to develop skin and soft tissue infections.⁷ The

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most common infections caused by MRSA include surgical site infections, skin infections, bacteremia, upper and lower respiratory tract infections and urinary tract infections. MRSA (Methicillin Resistant *Staphylococcus aureus*) has been associated with outbreaks in healthcare settings. The irrational usage of antibiotics in humans and overuse of antibiotics in animal feed has resulted in emergence of bacterial resistance.⁸ MRSA strains are highly variable in different geographical areas.⁹ The spread of Staphylococcal infections can be effectively controlled by rational usage of antibiotics and implementing infection prevention and control practices in hospitals.¹⁰

Surveillance data has shown that MRSA represents a global problem and associated with an increase in mortality. MRSA is characteristically multidrug resistant and often there is a need to use last-resource expensive antibiotics.¹¹The irrational use of antibiotics in hospitals leads to the development of hospital acquired MRSA strains. Furthermore, increased use of antibiotics in animal feed and agriculture also resulted in antibiotic-resistant bacteria.¹²

Methods

This prospective, descriptive study was carried out in the Department of Microbiology, Abbas Institute of Medical Sciences, Muzaffarabad from December 2015 to November 2017. Various clinical specimens for culture & sensitivity testing of both indoor and outdoor patients were received at Pathology Department of Abbas Institute of Medical Sciences. The common specimens were pus, pus swabs, ear discharge, eye swabs, blood, sputum and urine. All specimens were inoculated on appropriate media prepared from commercially available dehydrated media (Oxoid, UK). Inoculated plates were incubated aerobically for 18-24 hours at 35°C and then examined for growth. *Staph aureus* was identified on the basis of colony morphology, Gram staining, catalase test, coagulase test and DNase test. All confirmed *S. aureus* isolates were screened for methicillin resistance using cefoxitin (Fox) disc. To check methicillin resistance, bacterial lawn was prepared on Mueller-Hinton agar and Cefoxitin disk (Oxoid, UK) was placed on it, followed by incubation at 35 °C for 24 hours. The isolates were considered as Methicillin-resistant if the zone of inhibition was ≤ 22 mm. Other antibiotics were selected and tested as prescribed by Clinical Laboratory Standards (CLSI).¹³The sensitivity to Vancomycin was checked for using E-strip test (AB

Biodisk USA). *Staphylococcus aureus* ATCC 29213 of known susceptibility was included as control strain for comparison. Results were compiled and analyzed using WHO NET 5.6.

Results

261 *S. aureus* isolates from 261 patients, one isolate from each patient were identified and tested for MRSA. The most common specimens were pus, pus swabs, nasal swabs, ear swabs and urine. The frequency of MRSA was 32.18 % (n = 84). Among the 84 patients having MRSA infection, 57.50 % (46) were males. The age of the patients having MRSA ranged from 1 to 80 years, with clustering around 50 years of age. Among MRSA, the frequencies of community acquired (CA) MRSA and hospital acquired (HA) MRSA were 26 % (n = 22) and 74 % (n = 62) respectively.

Discussion

All MRSA showed 100 % susceptibility to vancomycin and linezolid. High resistance was found to Erythromycin (64.2%), Ciprofloxacin (55.9%), Levofloxacin (58.3%), and Trimethoprim-sulfamethoxazole (53.5%); while resistance rates of Clindamycin, Gentamicin, Rifampicin and Tetracycline were 29%, 23.8%, 22% respectively. (Table 1).

Table 1. Antibiotic resistant pattern of MRSA

Antibiotics	Resistance Number (%)
Clindamycin	25 (29)
Tetracycline	19 (22)
Erythromycin	54 (64.2)
Gentamicin	20 (23.8)
Ciprofloxacin	47 (55.9)
Levofloxacin	49 (58.3)
Trimethoprim-sulfamethoxazole	45 (53.5)
Rifampicin	20 (23.8)
Linezolid	0 (0)
Vancomycin	0 (0)

Discussion

MRSA strains were first described in England in 1960.¹⁴Within a short span of time, the organism has become a major nosocomial pathogen particularly in critical care units of tertiary care hospitals. The prevalence of MRSA varies considerably from one country to another and even among the hospitals within a country.¹⁵

In this study, the prevalence of MRSA strains from various samples was 32%. Hafiz et al reported variable rates of MRSA in different parts of the country; Lahore (61%), Karachi (57%), Rawalpindi Islamabad (46%), Peshawar (36%), Quetta (26%) while minimum resistance was reported in Sukkur (2%).¹⁶ To our knowledge, this is the first report of routine surveillance for this issue in Muzaffarabad. In our study, prevalence of MRSA among indoor and outdoor patients was 26.2 % (n = 22) and 73.8 % (n = 62) respectively. This is because MRSA is indeed more problem in the hospitals than in communities. In healthcare settings immunocompromised patients like infants, the elderly, the chronically ill, burn survivors, organ transplants recipients, cancer patients receiving chemotherapy agents, steroid users, diabetic patients, intravenous drug users are more at the risk for MRSA infections. Overuse of antibiotics and poor infection control practices may be the contributory factors for such infections. Additionally, the patients in critical areas of hospitals are more prone to such infections. Additional risk factors for HA-MRSA infection include over stay in hospital, overuse of antibiotics and exposure to people infected with MRSA in hospital with poor infection control practices.¹⁷ According to CLSI guidelines, Oxacillin resistant *Staphylococcus* must be reported as resistant to all β -lactams like penicillin, cephalosporin, carbapenem and monobactams; despite of the fact that they appear sensitive in vitro but are not effective in vivo. So far, no vancomycin resistant *Staphylococcus aureus* has been isolated from Pakistan.¹³

In our study all MRSA have shown 100% susceptibility to vancomycin and linezolid, which is comparable to Yildiz et al.¹⁸ Another study carried out at the PIMS Islamabad reported similar sensitivity pattern against vancomycin and linezolid as in this study.¹⁹ This indicates that resistance to linezolid and vancomycin resistance has yet not emerged among MRSA isolates in our hospitals. In our study MRSA have shown the reduced susceptibility to Erythromycin (64.2%), Ciprofloxacin (55.9%), Levofloxacin (58.3%) and Trimethoprim-sulfamethoxazole (53.5%). However, multicenter studies are recommended to evaluate its resistance patterns. Clinically vancomycin is routinely used as the drug of choice in serious life-threatening infections caused by MRSA. However, reports of resistance and intermediate resistance to this drug from Karachi necessitates careful monitoring of prevalence of MRSA and its antibiotic susceptibility pattern.²⁰ Irrational usage of antibiotics in humans, poultry and agriculture has emerged the global antimicrobial resistance. The prevalence of the MRSA varies from place to place that mainly depends on the local antibiotic policy and infection control practices.²¹ As MRSA is a serious threat in critical care patient

areas, therefore, screening for MRSA colonization both for patients and staff should be done regularly in hospitals. Isolation and contact-based precautions for MRSA cases play a major role in attempts to reduce the spread of MRSA in health care settings.²²

Based on this and other related studies it is strongly recommended that there is an urgent need to develop and implement a National Action Plan for Combating Antibiotic-resistant Bacteria which should focus on the following goals;

1. Develop and implement the effective hospital infection control programs in accordance with international recommendations to prevent the Spread of Resistant Infections in healthcare settings
2. Strengthen National One-Health Surveillance Efforts to Combat Resistance as required by international health regulations (IHR)
3. Strengthen lab capacities for Identification and Characterization of resistant bacteria like MRSA.
4. Accelerate Basic and Applied Research and Development for New Antibiotics, and Other Therapeutics.

Conclusion

In conclusion, we observed considerably high rates of MRSA in a regional hospital. The MRSA is a potential threat to the public health as this bug can disseminate both in community and indoor patients leading to fatal clinical outcomes. There is an urgent need to improve infection control practices and establish an ongoing surveillance program in healthcare settings to limit the spread of such resistant pathogens.

Conflict of Interest: All the authors declare no conflict of interest

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CONTRIBUTION OF AUHTORS:

- Dr. Mumtaz Ahmad Khan: Study design, conduction of study, results compiling and writing
- Dr. Uzma Hafeez: Article writing and review
- Dr. Syed Nadeem ur Rehman: Article writing and review

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