

Original Article

Antibiotic resistance rate of the Methicillin Resistant *Staphylococcus aureus* isolated from a university affiliated hospital in North Cyprus

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Abstract

Background: Over the past 20 years, studies have indicated that the increasing spread of methicillin-resistant *Staphylococcus aureus* (MRSA) demonstrates the need for adequate information about their epidemiology. This study was conducted in order to investigate the resistance rate of MRSA which were isolated from the Near East University (NEU) Hospital, North Cyprus.

Methods: MRSA was isolated and identified by using selective media and the Phoenix BD 100 system (software version 6.01A) was used for antimicrobial susceptibility testing and identification. The antimicrobial susceptibility results were determined according to the Clinical and Laboratory Standards Institute (CLSI) and the resistance rates of MRSA isolates to antibiotics were examined retrospectively.

Results: The highest number of samples were from the departments of chest disease (24%) followed by dermatology (21.3%) and cardiology (18.7%). Out of 75 MRSA strains,; 29.7% from blood, 25.3% from wound, 14.7% from nasal swabs, 10.7% from aspiration fluids, 9.3% from sputum, 6.7% were from urine, 4.0% from IV catheters culture samples. All strains of MRSA were 94.7% sensitive to vancomycin and teicoplanin.

Conclusions: The obtained results revealed that preventative measures should be implemented in order to minimize the bacterial resistance to antibiotics.

Keywords: Methicillin Resistant *Staphylococcus aureus*; North Cyprus; Resistance

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Introduction

Methicillin-resistant *Staphylococcus aureus* (MRSA) first reported in 1960s and outbreaks of the MRSA were described in the early 1960s¹⁻². The worldwide spread of methicillin-resistant *Staphylococcus aureus* (MRSA) has become a primary public health concern over the past 20 years³. In some areas of the world for example Latin America, the MRSA prevalence is predicted to be >80%. Although in Europe the prevalence of the MRSA is decreasing, in

Unites States and Canada the prevalence of MRSA is closed high between 15% to 45%⁴. *Staphylococcus aureus* is caused for a wide range of infections such as superficial skin infections, food poisoning, osteomyelitis and septicemia. Additionally, If this infections were caused by MRSA, this organisms are resistant to available antibiotics⁵. This study was conducted in order to investigate the resistance rates of MRSA which were isolated from the Near East University (NEU) Hospital, North Cyprus

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Methods

The study was conducted in North Cyprus from January 2015 to December 2015 at university hospital. A total 200 samples were collected from the university hospital in North Cyprus. These included samples collected from different wards (cardiology, cardiovascular surgery, urology, chest diseases, dermatology and emergency services) and consisted of urine, blood, nasal swab, sputum, aspiration fluids, intravenous (IV) catheter and wound culture samples. Blood agar and Mannitol Salt Agar (MSA) were used to isolate and identify *Staphylococcus aureus*. Biochemical tests including gram staining, catalase and coagulase tests were performed using the standard protocols to confirm the presence of *S. aureus*. The Phoenix™ Automated Microbiology System (BD Diagnostic Systems, Sparks, MD) was used for rapid identification (ID) and antimicrobial susceptibility testing (AST) of the *S. aureus* culture. The data analysis was performed using SPSS software version 22.

Ethical clearance: Ethics committee approval was received from the Clinical Research Ethics Committee of the University of Near East (YDU/2019/75-947).

Results

A total of 75 MRSA (37.5 %) strains were determined out of the 200 clinical samples. The 75 MRSA strains were found in 50 male and 25 females. This study indicated that more MRSA positive strains were found among the females than the males (68.0% and 32.0% respectively). The highest number of samples were from the chest disease department (24%) followed by dermatology (21.3%), cardiology (18.7%), emergency (14.7%) and urology (4%), while other samples came from the cardiovascular surgical ward (17.3%). Out of the 75 MRSA strains, (6.7%) were from urine, (29.7%) from blood, (14.7%) from nasal swabs, (9.3%) from sputum, (10.7%) from aspiration fluids, (4.0%) from IV catheters, and (25.3%) from wound culture samples were used for screening of MRSA strains.

Among the MRSA strains, resistance to Cefoxitin was 98.7%, Clindamycine 74.7%, Daptomycine 4.0%, Erythromycin 90.7%, Gentamicine 5.3%, Levofloxacin 5.3%, Norfloxacin 14.7%, Quinupristin-Dalfopristin 5.3%, Ripamfin 5.3%, Teicoplanin 5.3%, Tetracycline 89.3%, Trimethoprim/Sulfamethoxazole 20.0% and Vancomycin was 4.0% (Table 1).

Discussion

MRSA is a serious threat to hospitalized patients globally and it now represents a challenge for public health, as community associated infections appear to be on the increase in both adults and children in different regions and countries. This study revealed that the highest percentage of MRSA was detected in blood samples (29.7%) while the lowest MRSA ratio was in IV catheters (4.0%) and in urine (6.7%). According to Michael A Borg *et al.*, the MRSA strain rate was 63% in Cyprus and the MRSA blood culture isolates percentage were 50%. However, in the present study, the percentage rates of blood culture were lower than in similar studies ⁶. Consequently, such a low sample number may not yield a clear depiction about MRSA, while an increased number of samples may give statistically more valid results. In the present study, the number of samples were from chest diseases (24%) followed by dermatology (21.3%), cardiology (18.7%), emergency (14.7%) and urology (4%) while other samples came from the CV surgical ward (17.3%). It can be concluded that chest disease patients have a higher risk of MRSA along with patients with skin infection, as it is known that the bacteria lives in the nose and on the skin of humans

The most commonly identified risk groups include elderly patients, long-term care facility residents, patients with chronic skin lesions, patients with a history of recent hospitalization, dialysis patients, patients transferred or released from correctional facilities, or patients with a recent history of antibiotic use ⁷. According to the present study, as the age of the patient increases, the resistance of MRSA to the antimicrobial agent also increases.

A study from Tehran, reported that from the 99 MRSA isolates and the Susceptibility of MRSA isolates to linezolid and tigecycline suggests that these drugs may be have an important role in the treatment of infections caused by these multiresistant pathogens ⁸. According to the Indian literature, it seems the impact of multidrug resistant MRSA is increasing over time; for example, 23.2% was reported by Manjula *et al.*, (2007)⁹, 32% by Anuparba *et al.*, (2003)¹⁰ and 63.6% by Rajadurai *et al.*, (2006) ¹¹.

Globally AMR is identified as the one of top public health for treating infectious diseases.⁹ One US study revealed that methicillin-resistant *Staphylococcus aureus* (MRSA) alone is more powerful to increase mortality level among peoples of the USA than

emphysema, HIV/AIDS, Parkinson's disease and homicide combined¹². Currently, the situation AMR is horrifying as almost all available antibiotics or antimicrobials for clinical use are resistant. Now-a-days, it has been advised that infection evasion is much significant than to treat pathogenic infectious diseases. Thus, it recalls the famous English quote, "prevention is better than cure."¹³.

The present study recommends the implementation of preventive measures aimed at minimizing the bacterial resistance to antibiotics. An electronic record of antibiotic usage should be made to prevent unnecessary usage of a broad spectrum of antibiotics and to increase the recommended usage of antibiotics. All healthcare personal should strictly follow the preventive guidelines for the benefit of patients as well as for their own safety. Appropriate antibiotic susceptibility tests should be conducted for all infections that are suspected to have been caused by MRSA and ESBL producing bacteria.

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Table 1: Percentage rate of the MRSA strains according to the antibiotic susceptibility.

| Antibiotic names | Resistant Percentage |
|-----------------------------------|----------------------|
| Cefoxitine | 98,7 % |
| Clindamycin | 74,7 % |
| Daptomycin | 4,0 % |
| Erythromycin | 90,7 % |
| Gentamicin | 5,3 % |
| Levofloksasin | 5,3 % |
| Norfloxacin | 14,7 % |
| Quinopristin-dalfopristin | 5,3 % |
| Rifampin | 5,3 % |
| Teicoplanin | 5,3 % |
| Tetracycline | 89,3 % |
| Trimethoprim/ Sulfamethoxazole | 20 % |
| Vancomycin | 4 % |

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