Antibiotic Susceptibility Patterns of Methicillin Resistant Staphylococcus aureus at National Institute of Health Sciences, Islamabad, Pakistan

Hizbullah, Fahad Ali, Sulaiman Bahadar, Zunaira Shahid, Rahimullah, Khalil ur Rahman, Afzal Ahmad, Muhammad Daud, Ilyas Khan, Javid Khan, Azam Hayat, Mujadad-ur-Rahman and Muhammad Ayub Khan

1Department of Microbiology, Abbottabad University of Science and Technology, Havalian, Abbottabad, Pakistan
2Department of Genetic, Hazara University Mansehra Dhodial, KhyberPakhtoonkhwa Pakistan
3Department of Biotechnology and Genetic Engineering, Kohat University of Science and Technology, Kohat, Pakistan
4Department of Microbiology, Hazara University Mansehra Dhodial, Khyber Pakhtoonkhwa Pakistan
5Department of Microbiology, Kohat University of Science and Technology, Kohat, Pakistan

Abstract: Methicillin resistance Staphylococcus aureus is a major public health problem all over the world especially in progressive countries. As there is an unstoppable change in the prevalence of MRSA, the present study was designed to investigate the recent trend in the prevalence and antibiotic susceptibility of MRSA. In current study, 450 clinical samples were assemble at National Institute of Health, (NIH) from January 2015 to March 2015. Samples were subjected to phenotypic based identification for MRSA and determination of its antibiotic susceptibility pattern. Out of 450 isolates, 320(71.11%) were confirmed phenotypically as MRSA. Among these 320 isolates (samples), 190(59.37%) were males and 130(40.62%) were females (samples). The prevalence of MRSA was found higher in pus 165(51.56%), followed by blood 70(28.17%), urine 59(18.43%) and sputum 26(8.12%). MRSA positive samples were collected mainly from surgical wards followed by medical wards, Paediatrics wards and outpatients. All isolates were found sensitive to vancomycin and teicoplanin while sensitivity to Novobiocin 80.31% clindamycin was (53.12%), chloramphenicol (45%) and ciprofloxacin was 25%. MRSA is endemic in all units of LRH. It is responsible for increased morbidity and mortality, cost, hospital stay and poses a great challenge for hospital infection control program.

Key words: MRSA - Nosocomial infections - Antibiotics

INTRODUCTION

Methicillin Resistant Staphylococcus aureus (MRSA) is the main source of nosocomial infections all over the world [1]. Soon after its discovery, it was considered an important pathogen globally in both clinical practices and communities [2]. Methicillin, which is semisynthetic penicillin and poorly hydrolyzed by pencillinase came in clinical practice in the year of 1960. After a very short usage of this new antibiotic a resistant strain developed i.e. MRSA emerged unfortunately in 1961 [3] MRSA infection first was determined in hospitalized patient and there subsequently described as powerful nosocomial infection [4]. Nosocomial infection have been started soon when people begin to use methicillin as antibiotic in 1961. Physicians start giving methicillin against penicillin resistant staphylococci, but unfortunately it was no longer effective and soon MRSA recognized an important human Hospital acquired infection [5]. MRSA were detected by American physician in 1970s and later on it was considered endemic in 1990 [6].

Corresponding Author: Sulaiman Bahadar, Department of Microbiology, Abbottabad University of Science and Technology, Havalian, Abbottabad, Pakistan.
MRSA came in to being from the methicillin-susceptible S. aureus (MSSA) by exogenously acquisition of methicillin resistance gene carried out by a mobile genetic element known as staphylooccal cassette chromosome i.e. mec (SCCmec) at 30 end (i.e., 15-bp SCCmec insertion site, att) or FX of their chromosome [7, 8]. SCCmec carries a mecA gene that encoding a penicillin binding protein known as PBP20 which show resistant toward beta-lactam agents [9].

In industrialized countries the rate of nosocomial infection is very rare as compare to the developing countries, it is due to the devastating effort of these people to overcome the morbidity and mortality rate for which they follow standard legislative measure. While on the other hand a rare premature study reported from the developing countries. According to the World Health Organization (WHO) in 2001, that nosocomial infection has the highest in the Eastern Mediterranean and South East Asia and describe the reason that the hazard use of antibiotics, overcrowding and unhygienic environment leads to the increased resistance in the pathogen [10].

Hospital acquired MRSA are frequently multidrug resistant and poses a constant problem to clinicians and hospital infection control program. Moreover, the MRSA situation is getting worse with the passage of time at our tertiary care level hospital despite so many precautionary measures. We are a resource challenge society and a prompt infection control policy is the only way to reduce this burden [11, 12].

MATERIAL AND METHODS

Study Design and Sampling: The present study was carried out in NIH a period of three months from January 2015 to march 2015 at the Microbiology Department. Clinical samples were received from different hospitals e.g NIH Patients, outsider patients and other hospital patients were considered in the study. Different types of samples which include pus, HVS swabs, blood, urine, catheter tips, CSF, stool and tissue. Samples were collected aseptically with the help of sterile cotton swab and were immediately brought to the microbiological laboratory, department of microbiology, NIH for bacterial isolation and identification MRSA using standard bacteriological techniques. (Cruickshark et al.)

Isolation and Identification of S. aureus: Samples was inoculated on blood agar, XLD (Xylose lysine dextrose) and mannitol salt agar and the stool samples also were inoculated in peptone water but the urine where inoculated on CLED (Cysteine Lactose Electrolyte Deficient agar) and incubated at 37°C for 24 hours. The suspected isolates were identified based on Gram staining, cultural and biochemical characters.

Determination of Antibiotic Susceptibility and Screening for MRSA: The Kirby-Bauer’s disk diffusion method was used to check the antibiotics susceptibility pattern of isolated MRSA. Sterile swabs were used to pick the inoculums and streaking was done over the entire sterile surface of Mueller Hinton agar plate. The streaking was repeated 2-3 times by rotating the plate each time to ensure the uniform distribution of inoculums. The antimicrobial disks of specific concentration were dispensed onto the medium surface gently using sterile forceps. Each disk was pressed down enough to come in contact with agar surface and was incubated for 24 hours at 37°C. Zones around the antibiotics disk were measured. A clear zone indicates that bacteria are sensitive to that antibiotic while absence of clear zone indicates resistance of bacteria against particular antibiotic and results were reported as per CLSI guidelines. Antibiotic such as vancomycin, teicoplanin, linezolid, clindamycin, cefoxitin, cefazidine, ceftriaxone, vovobiciocin, chloramphenicol and amikacin.

Statistical Analysis: The analysis was done by using the statistics software for windows.

RESULTS

In the present study among total isolates (450), 320 (71.11%) were confirmed as MRSA. When sample-wise distribution was checked it was found that MRSA was more prevalent in pus 165 (51.56%), in blood 70 (28.17%), in urine 59 (18.43%) and MRSA was less prevalent in sputum sample 26 (8.12%) (Table 1).

Antibiotic Susceptibility Profile of MRSA: All MRSA isolates were showed complete resistance to amikacin and penicillin while complete sensitive to vancomycin, linezolid and teicoplanin. These MRSA strains were also showed various degree of resistance to other antimicrobials such as Clindamycin (46.87%), cefoxitin (47.54%), cefazidine (53.12%), ceftriaxone (59.06%) and chloramphenicol (55.55%) (Table 2).
Table 1: Sample-wise distribution of MRSA

<table>
<thead>
<tr>
<th>S.NO</th>
<th>Samples</th>
<th>Frequency Of MRSA, N (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Pus</td>
<td>165 (51.56)</td>
</tr>
<tr>
<td>2</td>
<td>Blood</td>
<td>70 (28.17)</td>
</tr>
<tr>
<td>3</td>
<td>Urine</td>
<td>59 (18.43)</td>
</tr>
<tr>
<td>4</td>
<td>Sputum</td>
<td>26 (8.12)</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>320</td>
</tr>
</tbody>
</table>

Table 2: Antibiotic susceptibility pattern against MRSA

<table>
<thead>
<tr>
<th>S #</th>
<th>Antibiotics</th>
<th>Sensitivity n%</th>
<th>Intermediae sensitivity n%</th>
<th>Resistivity n%</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Vancomycin</td>
<td>320(100%)</td>
<td>0 (00)</td>
<td>0 (00)</td>
</tr>
<tr>
<td>2</td>
<td>Teicoplanin</td>
<td>320(100%)</td>
<td>0 (00)</td>
<td>0 (00)</td>
</tr>
<tr>
<td>3</td>
<td>Linezolid</td>
<td>320(100%)</td>
<td>0 (00)</td>
<td>0 (00)</td>
</tr>
<tr>
<td>4</td>
<td>Clindamycin</td>
<td>170(53.12%)</td>
<td>0 (00)</td>
<td>150(46.87%)</td>
</tr>
<tr>
<td>5</td>
<td>Cefoxitin</td>
<td>153(47.81%)</td>
<td>4.68(15.66%)</td>
<td>152(47.54%)</td>
</tr>
<tr>
<td>6</td>
<td>Ceftazidine</td>
<td>124(38.75%)</td>
<td>26(8.12%)</td>
<td>170(53.12%)</td>
</tr>
<tr>
<td>7</td>
<td>Ceftriaxone</td>
<td>119(45.46%)</td>
<td>12(3.75%)</td>
<td>189(59.06%)</td>
</tr>
<tr>
<td>8</td>
<td>Novobiocin</td>
<td>80.31%</td>
<td>20.66%</td>
<td>0 (00)</td>
</tr>
<tr>
<td>9</td>
<td>Chloramphenicol</td>
<td>145(45%)</td>
<td>0 (00)</td>
<td>275(55.55%)</td>
</tr>
<tr>
<td>10</td>
<td>Ciprofloxacin</td>
<td>50%</td>
<td>25%</td>
<td>25%</td>
</tr>
<tr>
<td>11</td>
<td>Penicillin</td>
<td>0 (00)</td>
<td>0 (00)</td>
<td>320(100%)</td>
</tr>
<tr>
<td>12</td>
<td>Amikacin</td>
<td>0 (00)</td>
<td>0 (00)</td>
<td>320(100%)</td>
</tr>
</tbody>
</table>

**DISCUSSION**

MRSA is recognized as a major threat to the patients globally and their associated infection is a challenge for clinicians due to its rapid spread and limited therapeutic options available [13]. As soon as MRSA introduced, steady rise in the number of S. aureus isolates was found in various clinical settings. Several studies have been carried out to find MRSA prevalence in different infections. Study that reported by National Nosocomial Infections surveillance was showed an increase of MRSA range from 2.5% to 29% in 1975 to 1991 [14]. Ashiq and Tareen in a prospective study reported 5% prevalence of MRSA in Karachi [15]. Bukhari et al. [16] in 2004 found out that 38.5% of bacterial isolates were MRSA, in an antibiotic susceptibility based study conducted at King Edward Medical College, Lahore, Pakistan. Similarly, Khatoon et al. [17] concluded 38.5% prevalence of MRSA in a laboratory based antibiotic susceptibility study, carried out from June 2000 to December 2000.

Similar studies were also carried out in different parts of the world like Germany, France, Spain, Italy and the United Kingdom which revealed about 25% MRSA prevalence while Austria, Poland, Slovakia, Czech Republic had reported MRSA rates of 7% to 14%. [18] Karakatsanis et al. [19] reported 40% MRSA prevalence in Greece. While George reported a high prevalence (73%) of MRSA based on bacteriological, epidemiological and clinical observation, in a Greek hospital [20]. But studies from the Westerns countries show a decline of MRSA which is due to the infection control program and strict ascetic techniques [21].

In our study maximum numbers of MRSA (51.56%) were isolated from pus. A similar study was carried out in India that reported the same prevalence rate of MRSA in pus samples [22]. The main reasons may be the increased number of pus specimen compared to other samples received in our bacteriology section. Residence in a care facility for a long time, catheters, dialysis and other medical devices also contribute as a risk factor of MRSA. Furthermore, busy surgeons and paramedical staff also contribute to this scenario. However, some cases of MRSA infection were also reported from healthy communities without having any risk factor for MRSA [23]. MRSA is also resistant to all other group members of beta-lactam antibiotics including penicillins, cephalosporins and cephemycins. Along with that MRSA is often resistant to other classes of antimicrobials agents, like aminoglycosides, quinolones and macrolides. This feature makes MRSA as multidrug-resistant bacteria [24]. The progressive spread of MRSA poses a huge threat to the patients as well as to the community in term of diseases and high financial losses. The high variation in number of MRSA among various hospital setting limited the therapeutic option [24]. Regarding other therapeutic options of MRSA all isolates were found uniformly sensitive to Vancomycin and Linezolid, thus making treatment options possible. Similar findings was observed by Ahmad et al., in Saudi Arabia while performing a prevalence study to find out nosocomial infections of MRSA in worker of a hospital [25]. In this study resistance to pencillin, amikacin, ceftriaxone clindamycin, chloramphenicol, ceftazidine cefoxitin and ciprofloxacin suggest that the use of these antibiotics should be carefully prescribed to treat MRSA infections.

**CONCLUSION**

MRSA is prevalent in every nook and corner of our hospital. It is the most important nosocomial pathogen and an alarming superbug, posing a serious threat to infection control program. Strict surveillance, timely diagnosis and effective control measures are urgently needed to check its rapid spread. Our hospital direly needs effective and prompt control measures to reduce morbidity, mortality and economy loss due to MRSA.

**REFERENCES**


