Prevalence of Methicillin-Resistant *Staphylococcus aureus* in Hospitals of Kathmandu Valley

Reena K. Mukhiya, Anima Shrestha, Shiba K. Rai, Kritu Panta, R.N. Singh, Ganesh Rai, Amita Prajapati

1St. Xavier’s College
Maitighar Kathmandu
2Shi-Gan Health Foundation,
3Nat’l Institute of Tropical Medicine and Public Health Research,
Taku, Kathmandu
4Nepal Police Hospital
MaharajJung, Kathmandu
e-mail: aastha_rina@yahoo.com

Abstract

Present study was conducted to determine the prevalence of nosocomial pathogen methicillin resistant *Staphylococcus aureus* in hospital environment samples (surface swabs and air, n=188) and health care workers (nose and hand, n=162) of hospitals located in Kathmandu valley. The samples were studied following the standard protocols. Of the 61 *S. aureus*, 20.9% and 14.3% were isolated from health personnel and hospital environment respectively. Of 20.9% *S. aureus* in hospital environment, 6.6% were isolated from OPD and 17.9% from wards. Similarly, in HCWs 28.3% and 13.5% were hand and nasal carrier respectively. In total, 45.9% were MRSA. Among MRSA isolates, 50% were from HCWs whereas, 40.7% from hospital environment. The most effective antibiotic for all isolates was vancomycin with 100% efficacy. The isolates had relatively high rate of resistance to cefixime (44.0%), followed by co-trimoxazole (28.0%), erythromycin (23.0%), gentamicin (18.0%), tetracycline (16.0%) and ofloxacin (8.0%). Since MRSA prevalence was not reduced, so indicates regular surveillance of nosocomial infection, hand hygiene improvement strategies and monitoring of antimicrobial susceptibility pattern.

Key words: healthcare workers, hospital environment, methicillin resistant *S. aureus*, nosocomial infection

Introduction

*Staphylococcus aureus*, a gram positive cocci, is the major cause of both hospital and community acquired infections worldwide (Kluytmans 1998). *S. aureus* is a common pathogenic commensal bacterium, where approximately 60% of the human populations are by it and as high as 20% humans are persistent carriers (Friendship & Weese 2009).

*S. aureus* causes a range of infections from superficial abscesses and boils to the more serious infections of osteomyelitis, septicaemia and pneumonia. Approximately, 25% of all nosocomial infections are caused by *S. aureus* and leading to increase hospital stay, antibiotic use, costs and mortality (Minties-de Groot et al. 2000, Pittet et al. 1995).

The incidence of community-acquired and hospital acquired *S. aureus* infections has been rising with increasing emergence of drug-resistant strains called methicillin resistant *S. aureus* (MRSA) (Shakya et al. 2010). MRSA is a major cause of morbidity and mortality around the world (Hiramatsu et al. 2001) and has become a challenge to the physicians for its treatment which are often multi drug resistant (Crawcroft & Catchpole 2002). Hospital environment (surfaces, air) and carrier (nasal and hand) of healthcare workers may serve as reservoir and transmission occurs from HCWs to patients or among the patients (Boyce et al. 1997).
The percentage of hospitals isolation MRSA in the developed countries has increased from 2% in the 1970s to 30% in the 90’s (Gordon 1993). In UK, 44.0% of S. aureus isolated from healthcare system are MRSA (Gould 2005) and in Japan 60.0-70.0% of S. aureus are MRSA in inpatients (Kikuchi 2003). In Nepal, prevalence of MRSA shows an increasing trend; 29.1% - 68.0% (Rai et al. 1990, Shrestha et al. 2009, Rijal et al. 2008, Khanal & Jha 2010). Therefore, objective of this study was to determine prevalence of MRSA.

Methodology

Sample collection: Hospital environments comprised surface swabs of bed bar, bed sheet, nursing station, cuffs, etc and air samples (taken by plate exposure technique for 20- 25 minutes). Similarly, HCWs comprised swab of palm and web space between fingers of hand (cotton swab dipped in BHI broth) and nasal swab (sterile cotton swab rotated 4-5 minutes clockwise and anticlockwise within nasal cavity). Study design was cross sectional. After proper sampling, the specimens were transported to laboratory of Nat’l Institute of Tropical Medicine and Public Health Research (NITMPHR) and processed immediately.

Sample processing and bacterial identification: Specimens were inoculated into MacConkey Agar (MA), Blood Agar (BA) and Mannitol Salt Agar (MSA) (only for nasal) and incubated at 37°C for 24 hours. Gram positive cocci in clusters, catalase +ve, fermentative, manitol fermentor and coagulase +ve were identified as S. aureus.

Antibiotic susceptibility test: All the identified isolates of S. aureus were undertaken in-vitro antibiotic susceptibility test by using Kirby Bauer’s disc diffusion method. The antibiotics used were Cefixime (5mcg/disc), Methicillin (30mcg/disc), Co-trimoxazole (25mcg/disc), Ofloxacin (5mcg/disc), Tetracycline (30mcg/disc), Gentamycin (10mcg/disc), Erythromycin (15mcg/disc), and Vancomycin (30mcg/disc).

Results and Discussion

Of the 350 samples studied, S. aureus was isolated from 61 samples (17.4%). The prevalence rate of S. aureus in HCWs were 20.9% and hospital environment (14.3%) were found. Out of 61 S. aureus isolates, 28 (45.9%) were methicillin resistant. Among them, 17 (50.0%) and 11 (40.7%) were from HCWs and hospital environment respectively (Table 1). Similarly, in hospital environment the prevalence rate of S. aureus in OPDs was found to be 6.6% and 17.9% in wards (Table 2). In HCWs, 13.5% and 28.3% were nasal and hand carrier respectively (Table 3).

Among 61 S. aureus isolates, 45.9% showed resistant towards methicillin followed by cefixime (44.0%), co-trimoxazole (28.0%), erythromycin (23.0%), gentamicin (18.0%), tetracycline (16.0%) and ofloxacin (8.0%), while none (0.0%) were resistant to vancomycin (Fig. 1).

### Table 1. Frequency of S. aureus and MRSA from different sample sources

<table>
<thead>
<tr>
<th>Sample sources</th>
<th>Total samples</th>
<th>S. aureus (%)</th>
<th>MRSA (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Health-personnel</td>
<td>162</td>
<td>34 (20.9%)</td>
<td>17 (50%)</td>
</tr>
<tr>
<td>Hospital environment</td>
<td>188</td>
<td>27 (14.3%)</td>
<td>11 (40.7%)</td>
</tr>
<tr>
<td>Total</td>
<td>350</td>
<td>61 (17.4%)</td>
<td>28 (45.9%)</td>
</tr>
</tbody>
</table>

### Table 2. Frequency of S. aureus from environment samples

<table>
<thead>
<tr>
<th>Sampling site</th>
<th>Total sample</th>
<th>+ve</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>OPDs</td>
<td>60</td>
<td>4</td>
<td>6.6</td>
</tr>
<tr>
<td>Wards</td>
<td>128</td>
<td>23</td>
<td>17.9</td>
</tr>
<tr>
<td>Total</td>
<td>188</td>
<td>27</td>
<td>14.3</td>
</tr>
</tbody>
</table>

### Table 3. Frequency of S. aureus from nose and hand of HCWs

<table>
<thead>
<tr>
<th>Sample site</th>
<th>Total sample</th>
<th>+ve</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hand</td>
<td>81</td>
<td>23</td>
<td>28.3</td>
</tr>
<tr>
<td>Nose</td>
<td>81</td>
<td>11</td>
<td>13.5</td>
</tr>
<tr>
<td>Total</td>
<td>162</td>
<td>34</td>
<td>20.9</td>
</tr>
</tbody>
</table>
MRSA is a global phenomenon with a prevalence rate ranging from 2% in Netherlands and Switzerland, to 70% in Japan and Hong Kong (Fluit et al. 2001, Diekema et al. 2001). In this study, the prevalence of MRSA was found to be 45.9% which was in accordance with the reports by Rijal et al. 2008, Shrestha et al. 2009 and Shakya et al. 2010. On the contrary, some of the reports show an alarmingly high incidence of MRSA (Khanal & Jha 2010, Ajmal et al. 2009). Higher isolation rates reported in these studies can be attributed to several factors. These include indiscriminate use of antibiotics, lack of awareness and failure to observe simple yet effective infection control precautions like strict patient isolation and frequent hand washing by health care personnel, population and area studied, etc.

Present study revealed that the prevalence of MRSA in hospital environment was 40.7% which was higher than reports from Panta et al. 2006 and Boyce et al. 1997. This was, however, significantly less as compared to the results on clinical samples (Khanal & Jha 2010, Shrestha et al. 2009, Verma et al. 2000, Ahmad et al. 2007). The difference might be due to the reason that clinical isolates showed higher degree of resistance to antibiotics than environmental isolates (Shaffer & Goldin 1969). Similarly present study showed the prevalence of S. aureus was high in wards than in OPD. It might be due to large sample size from wards. This report was contrary from Chitwan (Sanjana et al. 2010).

The 28.3% hand samples showing S. aureus was lower than that has been reported by Zahoor et al, and Pant et al. among hospital staffs. The lower hand carrier rate among the study subjects observed in this study was indicative of adequate hygienic practice.

There was low resistance towards ß-lactam antibiotics like methicillin and cefixime among the others which were in accordance with the findings of Shakya et al. Resistance to quinolones was not high as compared with the reports from Khanal & Jha (2010) and Kumari et al. (2008). The low resistance rate in our study was probably due to the samples of hospital environment as well as indiscriminate and empirical use of the drugs in other study.

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References


