Asymptomatic Carriage of Nasal Methicillin Resistant *Staphylococcus aureus* (MRSA) among Medical Students of a Public University in Malaysia.

Isabel Lim Fong¹, Efa Ezan binti Abdul Razak², Janice Tham Jia Mei², Nurul Akmal binti Safian², Ong Sheng Tian², Ng Poh Pheng³, Helmy Hazmi⁴

¹ Department of Paraclinical Sciences, Faculty of Medicine and Health Sciences (FMHS), Universiti Malaysia Sarawak (UNIMAS).
² Medical Programme Year 5, FMHS, UNIMAS.
³ Department of Pathology, FMHS, UNIMAS
⁴ Department of Community Medicine and Public Health, FMHS, UNIMAS
Death attributable to antimicrobial resistance every year by 2050
Worldwide prevalence of hospital-acquired *MRSA*
Why the Urgency?

• Community-associated (CA)-MRSA often have a fitness and virulence advantage compared with their nosocomial counterparts (Klein, S., et al., 2019).

• Risk factors of virulent CA-MRSA spread:
  • Increased mobility: Travel activities
  • Migration
  • Waste water (hospitals and municipalities, open defaecation, animal farms, manure runoff from crop fields, aquaculture farms, pharmaceutical manufacturer)
Introduction

• Local studies on MRSA trend is lacking.
• Mild soft skin tissue infection (SSTIs) to invasive diseases (pic).
• Understanding it may help in reducing the morbidity and mortality of MRSA.
• Previous studies have shown that developing countries had lesser *S. aureus* carriers than in the developed countries (Dulon et al., 2014).

• In Malaysia, 21% cases of bacteraemia were reported to be caused by MRSA (Al-Talib et al., 2013)

• This is the first study performed in Sarawak to assess the prevalence of *S. aureus* and MRSA isolates from asymptomatic medical students
Design of Study

• Cross sectional study: 60 medical students (24 preclinical, 36 clinical)
• Preclinical students had little or no patient encounter while the clinical students were more involved in bedside teaching.
• Questionnaires incl. demographic info., academic yr., antibiotic compliance, other potential risk factors (personal hygiene ec.)
• Antibiotic sensitivity profile (Oxoid, CLSI):
  • Erythromycin (15ug)
  • Fusidic acid (10ug)
  • Gentamicin (10ug)
  • Methicillin (5ug)
  • Penicillin (10ug)
  • Vancomycin (30ug)
Methodology (1)

Nasal sample Collection → Inoculation → Identification

S. aureus in BA

S. aureus in MSA
Methodology (2)

Identification: Biochemical

Identification and Validation: Selective agars

Coagulase test, Oxidase test
Antibiotic Sensitivity Profiling on Mueller-Hinton agar (MHA)

Inhibition zone was seen clearly on MHA.

Inhibition zone not observed on MHA (Resistance)
Prevalence of *S. aureus* nasal carriers (N=60)

93%

*S. aureus* status among samples (N=60)

- **Preclinical**: 20 (4), 36 (SA negative)
- **Clinical**: 0 (SA positive)
Antibiotic sensitivity on S. aureus 
(N=56)

- **Gentamicin**: 98.21%
- **Vancomycin**: 91.07%
- **Methicillin**: 75%
- **Fusidic Acid**: 69.64%
- **Erythromycin**: 53.57%
- **Penicillin**: 12.5%

Prevalence of MRSA: 17.8%
# Effects of antibiotics on *S. aureus* based on gender

<table>
<thead>
<tr>
<th>Antibiotics</th>
<th>Gender</th>
<th>Sensitive n (%)</th>
<th>Intermediate n (%)</th>
<th>Resistant n (%)</th>
<th>Chi square value</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Erythromycin</td>
<td>Male</td>
<td>15 (56)</td>
<td>3 (11)</td>
<td>9 (33)</td>
<td>0.1</td>
<td>0.94</td>
</tr>
<tr>
<td></td>
<td>Female</td>
<td>15 (52)</td>
<td>4 (14)</td>
<td>10 (34)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fusidic acid</td>
<td>Male</td>
<td>19 (70)</td>
<td>3 (11)</td>
<td>5 (19)</td>
<td>4.1</td>
<td>0.13</td>
</tr>
<tr>
<td></td>
<td>Female</td>
<td>20 (69)</td>
<td>0 (0)</td>
<td>9 (31)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gentamicin</td>
<td>Male</td>
<td>27 (100)</td>
<td>0 (0)</td>
<td>0 (0)</td>
<td>0.9</td>
<td>1.00a</td>
</tr>
<tr>
<td></td>
<td>Female</td>
<td>28 (97)</td>
<td>0 (0)</td>
<td>1 (3)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Penicillin</td>
<td>Male</td>
<td>4 (15)</td>
<td>0 (0)</td>
<td>23 (85)</td>
<td>0.3</td>
<td>0.70a</td>
</tr>
<tr>
<td></td>
<td>Female</td>
<td>3 (10)</td>
<td>0 (0)</td>
<td>26 (90)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vancomycin</td>
<td>Male</td>
<td>23 (85)</td>
<td>1 (4)</td>
<td>3 (11)</td>
<td>2.4</td>
<td>0.30a</td>
</tr>
<tr>
<td></td>
<td>Female</td>
<td>28 (97)</td>
<td>0 (0)</td>
<td>1 (3)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Methicillin</td>
<td>Male</td>
<td>18 (67)</td>
<td>3 (11)</td>
<td>6 (22)</td>
<td>2.2</td>
<td>0.34</td>
</tr>
<tr>
<td></td>
<td>Female</td>
<td>24 (83)</td>
<td>1 (3)</td>
<td>4 (14)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*a Fisher exact test, Male (n = 27), Female (n = 29)
Antibiotic Sensitivity Based on Duration of Clinical Exposure

![Bar chart showing percentage of antibiotic sensitivity based on duration of clinical exposure. The chart includes antibiotics such as Erythromycin, Fusidic acid, Gentamicin, Penicillin, Vancomycin, and Methicillin. The sensitivity is categorized as Sensitive, Intermediate, and Resistant for both preclinical and clinical exposure.]
Discussion (1)

• 93% of the samples collected were positive for *S. aureus* in contrast with previous studies conducted in West Malaysia at 26% and 28.7% and China at 46% respectively (Neela et al., 2010; Ma et al., 2011; Al-Talib et al., 2013).

• The rate is higher compared to studies that included hospital admitted patients (Al-Talib et al., 2010; Al-Talib et al., 2013)

• An **important finding**: high prevalence of nasal carriage *S. aureus* is a potential source of infection as colonization often precedes infection.
Discussion (2)

• 17.8% of *S. aureus* sampled were MRSA, lower than some studies reported among medical students in HUSM (21.5%).

• This study demonstrated that duration of clinical exposure (preclinical vs clinical) did not increase the risk of being an MRSA carrier status. The prevalence of MRSA in both cohorts are almost similar.

• Our observation noted that the inhibition zone for samples from clinical students were smaller compared to those of preclinical students.
Discussion (3)

• Penicillin is almost non effective towards *S. aureus* (resistance rate >85%), despite a low MRSA nasal colonization.

• Penicillin is a widely used as a first line antibiotic. Even higher in the private setting where cold cases such as URTI are treated.

• *S. aureus* was most sensitive to both gentamicin and vancomycin.

• Limitation: small sample size, thus the risk factors for acquisition of MRSA among medical students cannot be identified.
Conclusions

• high prevalence of *S. aureus* nasal carriage among medical students.

• MRSA prevalence is comparatively low, penicillin resistant *S. aureus* was prevalent.

• Another larger sample size study in different settings is recommended to provide essential epidemiological information on MRSA.
Acknowledgements

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• Janice Tham Jia Mei
• Nurul Akmal binti Safian
• Ong Sheng Tian
References

• Clinical and Laboratory Standards Institute: https://clsi.org/standards/products/microbiology/documents/m100-3/


• Klevens et al., 2007; Alvarez-Uria and Reddy 2012, Al-Talib et al., 2013; Dulong et al., 2014, Song et al., 2011; Chen and Huang, 2014; You et al., 2017, Boucher and Corey, 2008;


References


### CLSI table

<table>
<thead>
<tr>
<th></th>
<th>Resistance (R)</th>
<th>Intermediate (I)</th>
<th>Sensitive (S)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Erythromycin (E 15)</td>
<td>≤ 13</td>
<td>14 – 22</td>
<td>≥ 23</td>
</tr>
<tr>
<td>Fusidic Acid (FD 10)</td>
<td>≤ 18</td>
<td>17 – 20</td>
<td>≥ 21</td>
</tr>
<tr>
<td>Gentamicin (CN 10)</td>
<td>12</td>
<td>13 – 14</td>
<td>15</td>
</tr>
<tr>
<td>Penicillin (P 10)</td>
<td>≤ 28</td>
<td>-</td>
<td>≥ 29</td>
</tr>
<tr>
<td>Vancomycin (VA 30)</td>
<td>≤ 9</td>
<td>10 – 11</td>
<td>≥ 12</td>
</tr>
<tr>
<td>Methicillin (MET 5)</td>
<td>≤ 9</td>
<td>10 – 13</td>
<td>≥ 14</td>
</tr>
</tbody>
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