Staphylococcus aureus Nasal Colonization of HIV-infected Adults in Botswana

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**Background and Motivation**

- *Staphylococcus aureus*, an opportunistic pathogen, is a major cause of morbidity and mortality in Africa and elsewhere and a leading cause of bacteremia in Botswana.
- Nasal colonization, especially if persistent over time, is a primary risk factor for disease, so understanding who is at highest risk of colonization is critical for identifying who is at greatest risk of disease.
- Individuals with HIV are at higher risk of staphylococcal infection than those without HIV, especially severe and invasive forms of *S. aureus* disease, such as pneumonia and bacteremia.
- HIV-infected individuals are at increased risk for treatment failure and death due to *S. aureus* infections.
- Though the burden of HIV in southern Africa is overwhelming, data describing the prevalence of *S. aureus* nasal colonization in Africa, especially among HIV-infected individuals, are sparse, and there is no data from Botswana.

**Study Aims**

To describe the following among adult, HIV-infected, but otherwise healthy, outpatients in southern Botswana:

- Prevalence of asymptomatic *S. aureus* nasal colonization
- Antibiotic resistance of isolated *S. aureus*
- Risk factors for *S. aureus* and MRSA colonization

**Methods**

- We collected 2 nasal swabs, 4 weeks apart, from HIV-infected adult outpatients of Princess Marina Hospital (a public urban tertiary referral hospital in Gaborone & the largest in Botswana) and Bamalete Lutheran Hospital (a rural district general hospital 35km from Gaborone).
- Antibiotic resistance assessed by standard disk diffusion methods* and Oxacillin E-test (Methicillin resistance (MRSA))

**Results**

- During March-June, 2013, 404 HIV-positive adults, ages 21-68 participated and were assigned carriage status (see Figure 1).
- We detected *S. aureus* in 36.9% (n=149) of the study population, and 2.5% (10) were colonized with MRSA (Figure 2).
- Carriage were equally persistent (49.7%) and intermittent (50.3%).
- Risk factors for carriage differed by sex, but prevalence did not.
- MRSA carriage not associated with HIV clinical parameters; living longer with HIV increased risk of MSSA but not MRSA carriage.

**Figure 1. Carriers: positive for *S. aureus* on ≥2 swabs; Persistent Carriers: 2 positive swabs

**Figure 2. S. aureus nasal carriage 36.9% prevalence; MRSA rare**

**Figure 3. Resistance to common antibiotics among *S. aureus* carriers**

**Table 1. Risk factors for *S. aureus* nasal carriage (n=404)**

<table>
<thead>
<tr>
<th>Risk Factor</th>
<th>Adjusted Prevalence Ratio (PR) (95% CI)</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Female</td>
<td>1.97 (1.03, 3.59)</td>
<td>0.037</td>
</tr>
<tr>
<td>Has Asthma/Eczema</td>
<td>2.50 (1.07, 5.84)</td>
<td>0.035*</td>
</tr>
<tr>
<td>Admitted to a Hospital in the Past 7 Years</td>
<td>1.39 (1.02, 1.91)</td>
<td>0.039</td>
</tr>
<tr>
<td>Household Size ≥4</td>
<td>1.54 (1.09, 2.18)</td>
<td>0.015</td>
</tr>
<tr>
<td>Years Since HIV Diagnosis*</td>
<td>1.06 (1.01, 1.11)</td>
<td>0.014</td>
</tr>
</tbody>
</table>

**Table 2. Risk factors for MRSA among *S. aureus* carriers (n=149)**

<table>
<thead>
<tr>
<th>Risk Factor</th>
<th>Adjusted Prevalence Ratio (PR) (95% CI)</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Years since HIV Diagnosis*</td>
<td>0.86 (0.75, 0.98)</td>
<td>0.028</td>
</tr>
<tr>
<td>Has Eczema</td>
<td>3.49 (0.85, 14.35)</td>
<td>0.083</td>
</tr>
<tr>
<td>Has Asthma</td>
<td>4.37 (1.24, 15.36)</td>
<td>0.022</td>
</tr>
<tr>
<td>Has Asthma and Eczema</td>
<td>13.10 (2.00, 82.02)</td>
<td>0.005</td>
</tr>
<tr>
<td>Has ever had Tuberculosis</td>
<td>3.58 (0.099, 12.69)</td>
<td>0.052</td>
</tr>
<tr>
<td>Has ever had Pneumonia</td>
<td>11.58 (1.96, 68.40)</td>
<td>0.007</td>
</tr>
<tr>
<td>Smokes Cigarettes</td>
<td>11.73 (2.14, 64.26)</td>
<td>0.006</td>
</tr>
<tr>
<td>Has served in military or police force</td>
<td>28.42 (4.5, 179.66)</td>
<td>&lt;0.001</td>
</tr>
</tbody>
</table>

*Each PR adjusted for CD4 cell count, viral load, ARV line, and years since HIV diagnosis, but not for other variables in the table. All contain a frequency ≥5 individuals (n=149). Continuous variable; PR should be interpreted as the increases in prevalence per unit.

**Conclusions**

- A high proportion of HIV-infected adults with comorbid asthma and eczema carry *S. aureus*, especially MRSA.
- Persistent viremia and low CD4 cell count may be useful indicators of staphylococcal carriage risk in a clinic setting.
- High resistance to cloxacillin is noteworthy, as it is the most commonly prescribed anti-staphylococcal drug, used empirically in both inpatient and outpatient settings, in Botswana; otherwise, resistance, including MRSA, is limited in this population.
- Persistent carriers are a potential reservoir for antibiotic resistance, including MRSA and cloxacillin-resistant *S. aureus*.
- The high prevalence of MRSA in former pneumonia patients is interesting, since carriage often results in disease.
- HIV patients at high risk of *S. aureus* or MRSA carriage may benefit from individualized decolonization or treatment strategies.

**Future Directions**

- Molecular epidemiology of *S. aureus* carriage isolates
- Prevalence of *S. aureus* carriage, risk factors, and antibiotic resistance in pediatric patients
- Prospective study in this cohort to link carriage status to infection incidence, recurrence, and health outcomes
- Etiology of bacterial pneumonia in Botswana and link to carriage...