Short Communication

Antibiotic Susceptibility Pattern and Beta-lactamase Production in Isolates of Staphylococcus aureus from Recurrent Furunculosis in Southwestern, Nigeria

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ABSTRACT

Furunculosis is a skin infection caused by Staphylococcus aureus. It is characterised by honey crusted ‘cropped’ latent boil with potential to recur in a susceptible host. Isolates of S.aureus obtained from both hospitalised and non-hospitalised patients with furuncles in Southwest, Nigeria were characterised in relation to their resistance to commonly used antimicrobial agents. Exudates of ‘cropped-boils’ from one hundred and forty (140) individuals consisting of forty (40) hospitalised and one hundred (100) non-hospitalised cases of recurrent furunculosis were screened for S. aureus. One hundred and two (102) were positive for the organism by conventional biochemical tests. Detection of β-lactamase was determined by cell-suspension iodometric method. Of the 102 isolates, 30(29.4%) strains possessed β-lactamase and the minimum inhibitory concentration (MIC) of selected antibiotics was in the range of 3.95 – 250µg/ml. The multiple drug resistance as evident in high MICs of the antibiotics tested could probably be due to abuse/ misuse of antibiotics resulting in recurrence of furuncles in the patients.

Keywords: Antibiotic susceptibility, β-lactamase, Recurrent furunculosis, Staphylococcus aureus

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INTRODUCTION

Staphylococcus aureus is a recognised human pathogen responsible for a great variety of pyogenic infection in man and animals, infecting about one-third of the world population (Todor, 2008). The pathogen is also capable of living a benign lifestyle in the nasal passage and skin (Highet et al., 1992). It is the causative agent of many suppuration processes ranging from localised abscess which can occur in any part of the body, to fatal septicaemia and pneumonia. Furunculosis is a primary skin infection characterised by latent honey crusted ‘cropped’ boil and suppuration in susceptible host. People with diabetes and suppressed immune system or acne are at great risk (Zimakoff et al., 1988).

Staphylococcus aureus isolated from furunculosis are drug resistant (El-Gilany and Hanan, 2009). The emergence of drug resistant strains isolated from pathogenic processes has been attributed to the increasing introduction of various antibiotics into general use (Hanan et al., 2005). Penicillin was the first antibiotic used for Staphylococcus infections and penicillin resistance appeared shortly after its introduction. This was followed by resistance to methicillin, amoxillin, tetracycline and to a lesser extent, erythromycin, gentamycin and other antibiotics (Mostafizur et al., 2005). Staphylococcus aureus developed intrinsic resistance to penicillins because of its remarkable ability to hydrolyse beta-lactam antibiotics. The organism also has great ability to degrade skin lipid barrier and spread within skin loci (Laube and Farrell, 2002; Hoegr, 2004). In this study, isolates of S.aureus from cases of furunculosis were screened for β-lactamase production and the antimicrobial susceptibility of the isolates was investigated.
MATERIALS AND METHODS

Sample Collection and Bacterial Isolation
A total of one hundred and forty (140) exudates of ‘cropped’ boil from hospitalised and non-hospitalised patients with recurrent cases of furunculosis were screened for the isolation of S. aureus on mannitol salt agar (Biotech). Suspected staphylococcal isolates were confirmed by catalase test, coagulase test, DNase test and haemolytic test (Harold, 2007). Staphylococcus aureus strain ATCC 29213 was used as reference strain.

Antimicrobial Susceptibility Test
The antimicrobial susceptibility pattern of the isolates was determined using method of Kirby-Bauer (Cheesebrough, 2000). All the strains were tested to the following antibiotics: Cloxacillin (5µg/ml), Gentamicin (10µg/ml), Cotrimoxazole (25µg/ml), Chloramphenicol (30µg/ml), Augmentin (30µg/ml), Amoxicillin (25µg/ml), Erythromycin (5µg/ml), and Tetracycline (10µg/ml). The zones of inhibitions were measured with a meter rule and interpreted as recommended by NCCL (1998) (now Clinical and Laboratory Standards Institute, CLSI). Staphylococcus aureus ATCC 29213 was used as reference strain.

Determination of Minimum Inhibitory Concentration (MIC)
Graded decreasing double-fold concentrations of each antibiotic was prepared in nutrient broth and to each dilution was added 0.1ml of a 10^2 diluted culture of each strain, including the standard strain. The tubes were incubated at 37°C for 24hrs to determine the MIC of each antibiotic (Cheesebrough, 2002).

β-lactamase Detection
Overnight pure culture of each isolate of S. aureus was harvested and homogenised in phosphate buffered penicillin G. The bacterial suspension measuring x10^7 cells/ml using MacFarland turbidity standard was tested for β-lactamase production by the cell suspension iodometric method (Catling, 1975).

RESULTS
One hundred and two (102) haemolytic isolates positive for catalase test, coagulase test, mannitol sugar fermentation and DNase test were selected for further analyses. In the antibiotic susceptibility testing, the percentage resistance of the isolates to the antibiotics used was found to be highest for tetracycline (55.88%) and erythromycin (43.13%), while resistance to Augmentin (12%) was found to be the lowest. Cloxacillin elicited (18.62%) resistance and amoxicillin, an amino acid penicillin was (35.29%). Cotrimoxazole, a double blocker antibiotics elicited 30.39% resistance while the organisms showed 21.56% resistance to chloramphenicol (Table 1).

In the determination of minimum inhibitory concentration of selected antibiotics, the values obtained showed resistance of the S. aureus isolates to Augmentin (3.95 -250 µg/ml), Cefotaxime (15.63-250µg/ml), Ceftriaxone (31.25-250µg/ml), Penicillin (62.5-250µg/ml) and Cloxacillin (15.63-250 µg/ml) when p-value of < 0.05 was considered statistically significant (Table 2).

Table 1: Antimicrobial Susceptibility Pattern of the S.aureus Isolates

<table>
<thead>
<tr>
<th>ANTIBIOTICS</th>
<th>RESISTANCE</th>
<th>SUSCEPTIBLE</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>R 0≤5</td>
<td>S1 5 &lt; 15</td>
</tr>
<tr>
<td>Amoxicillin</td>
<td>36</td>
<td>35.29%</td>
</tr>
<tr>
<td>Augmentin</td>
<td>12</td>
<td>11.75%</td>
</tr>
<tr>
<td>Cloxacillin</td>
<td>19</td>
<td>18.62%</td>
</tr>
<tr>
<td>Cotrimoxazole</td>
<td>31</td>
<td>30.39%</td>
</tr>
<tr>
<td>Chloramphenicol</td>
<td>22</td>
<td>21.56%</td>
</tr>
<tr>
<td>Gentamicin</td>
<td>14</td>
<td>13.72%</td>
</tr>
<tr>
<td>Erythromycin</td>
<td>44</td>
<td>43.13%</td>
</tr>
<tr>
<td>Tetracycline</td>
<td>57</td>
<td>55.88%</td>
</tr>
</tbody>
</table>

DISCUSSION
Staphylococcus aureus is a common cause of skin infection and it has been isolated from 89.2-100% of recurrent and non-recurrent furunculosis patients ((Wiese-Posselt et al., 2007; El-Gilany and Hanan, 2009). The frequency of the pathological distribution of S. aureus obtained in this study reflects a typical prevalence pattern of the organism in furunculosis and corroborated the findings of Dahl (1987) in the strategies for management of recurrent furunculosis. The susceptibility of the organism to augmentin (amoxicillin and clavulanic acid) suggests the efficacy this antibiotic in the management of the infection.
null
implementing measures that can reduce the burden of infections in our setting.

In conclusion, this study offers primary evidence of the involvement of S.aureus in the epidemiology of furunculosis in Nigeria. Noticeably, Staphylococcus aureus remains an agent of recurrent furunculosis and the treatment of the infection requires careful evaluation of the commonly available antibiotics especially the beta-lactams. Lack of information on the biodata of the patients, previous antibiotic usage, underlying cause of the infection and genetic profiling studies present limitations to this study and form the basis for further work.

REFERENCES


Successful Termination of a Furunculosis Outbreak Due to LukS-LukF-Positive, Methicillin-Susceptible Staphylococcus aureus in a German Village by Stringent Decolonization, 2002-2005. Clin Infect Dis. 44:e88-e95