MULTIDRUG-RESISTANT STAPHYLOCOCCUS AUREUS ISOLATED FROM INFECTED BURNS SENSITIVE TO HONEY

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SUMMARY. Twenty-eight strains of coagulase-positive Staphylococcus aureus isolated from infected burn wounds were found to be resistant to routinely used higher antibiotics in our hospital. Using an agar incorporation technique, the sensitivity of these strains to honey was tested by the method of minimum inhibitory concentration. All the tested strains of Staphylococcus aureus showed inhibition with honey at concentrations of 25%. The present study shows that in burn wounds infected by multidrug-resistant Staphylococcus aureus, honey may be useful for controlling infection.

Introduction

For centuries honey had a valued place in traditional medicine, being used in the treatment of wounds and diseases of the gut. The scientific community has now rekindled interest in the therapeutic use of honey in modern medicine, and a number of published reports support its use in certain medical conditions, including burns and wounds. In a systematic review of clinical trials of honey in burns and wounds, Moore et al. concluded that honey was superior to other treatments and suggested that there was a biological plausibility.1 In particular, in burns, honey was found to be effective in preventing the conversion of superficial burns to deep burns, hypertrophic scarring, and contractures.2

Immunosuppression frequently accompanies major burns and is a significant factor in the aetiology of infection. Pseudomonas spp. and Staphylococcus aureus are the organisms most frequently isolated from burns, and infection of the underlying burn surface can facilitate septic complications. The emergence of antibiotic-resistant pathogens has led to interest in honey treatment for burns, owing to its antimicrobial properties.3 In this study a number of strains of coagulase-positive Staphylococcus aureus isolated from burn wounds were tested in the laboratory for their sensitivity to the honey used in our clinical trials.

Material and methods

Twenty-eight strains of Staphylococcus aureus were isolated in swabs collected from burn patients in the Burn Unit, General Hospital, Sangli, India. All the strains were identified. The antibiotic sensitivity of all the isolates was performed by Muller Hinton agar plates using the Kirby Bauser disc diffusion method. The antibiotics tested were ampicillin, chloramphenicol, tetracycline and gentamicin, penicillin, erythromycin, amoxicillin, ciprofloxacin, and norfloxacin.

Honey from Apis cerana of the plant source Syzygium cumini was used in this study.4 Different concentrations of honey (vol/vol) were prepared in Muller-Hinton’s medium (Hi-Media) at 56 °C to give final concentrations of 5, 10, 15, 20, 25, and 30%, as previously described. The antimicrobial effects of honey were studied in vitro by the agar dilution method. Standard bacterial broth cultures were inoculated on the Muller-Hinton agar medium. The plates were incubated for 16-20 h at 37 °C. After overnight incubation, the plates were observed for inhibition of growth. The plate of Muller-Hinton/honey agar medium with the minimum honey concentration that completely inhibited the growth of the strain was taken as the minimum inhibitory concentration (MIC) for that strain. The MIC found to be optimal, as being completely inhibitory to all the strains tested, was taken as the MIC of the honey used for all the strains isolated.

Table 1 - Number of strains of organisms sensitive to antibiotics (total number, 28)

<table>
<thead>
<tr>
<th>Number of strains</th>
<th>A.</th>
<th>C.</th>
<th>E.</th>
<th>K.</th>
<th>P.</th>
<th>S.</th>
<th>T.</th>
<th>G.</th>
<th>Amo</th>
<th>Cf.</th>
<th>Nil</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sensitive</td>
<td>3</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>3</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Resistant</td>
<td>25</td>
<td>28</td>
<td>28</td>
<td>28</td>
<td>28</td>
<td>28</td>
<td>27</td>
<td>27</td>
<td>25</td>
<td>27</td>
<td>27</td>
</tr>
</tbody>
</table>

Results

All the 28 strains showed a similar antibiogram. Not more than three strains were sensitive to any of the antibiotics. These strains were thus multidrug-resistant (Table I).

The MIC for honey used in this study is shown in Table II. Out of 28 strains, 100% inhibition was observed at honey concentrations of 25 and 30%, whereas it was 53.5% at 20%. Thus all strains were inhibited at 25% concentrations of honey.

Discussion

The use of natural products to enhance wound healing is a common practice in many parts of the world. Honey consists of a supersaturated solution of sugars and has a low pH between 3.2 and 4.5. This, together with honey’s high osmolarity and the presence of hydrogen peroxide, reduces bacterial growth at the wound site. When used as a wound dressing, honey has been reported to provide an ideal environment for the rapid tissue repair, regeneration, and re-modelling that are essential for growth of the wound bed.3

Staphylococcus aureus is the most frequently isolated wound pathogen, and it is becoming increasingly resistant to antibiotics. Honey has been reported to be effective in eradicating antibiotic-resistant bacteria, in particular, methicillin-resistant Staphylococcus aureus and vancomycin-resistant enterococci. In this study, Staphylococcus aureus was inhibited at concentrations of 25%, which was much higher than the percentage reported in other studies.5 In clinical studies it was observed that subsequent culture of wounds infected with Staphylococcus aureus after treatment with honey made the wounds sterile.3

Honey is effective even when it is diluted by burn wound exudate. In burns honey’s antibacterial and anti-inflammatory properties allow a moist healing environment to be maintained that protects the wounds.

Table II - Minimum inhibitory concentration (vol/vol)

<table>
<thead>
<tr>
<th>Organism</th>
<th>Number and percentage of strains inhibited on Muller-Hinton medium with honey at different concentrations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Staphylococcus aureus</td>
<td>8%</td>
</tr>
<tr>
<td></td>
<td>0</td>
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</tbody>
</table>

BIBLIOGRAPHY


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