Comparative study of antiseptic substances on antimicrobial action on skin application

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ABSTRACT

Antiseptics are antimicrobial substances that are applied to living tissue/skin to destroy or inhibit the growth of microorganisms and in consequence reduce the possibility of infection and sepsis. The purpose of topical antiseptics is to decrease quickly a broad spectrum of resident and transient microbes to subpathogenic levels and to prevent the rebound of growth for up to 6 hrs after use. The study was conducted on 50 human volunteers as controls and 100 human volunteers as test in Bhaskar Medical College, Moinabad, India. The test group composed of 50 human volunteers to test with 90% ethyl alcohol and 50 human volunteers to test with 5% hypochlorite. Bacterial cultures were done on the prepared skin’s areas. Bacterial cultures were sterile at 0 sec, 30 minutes for both antiseptics. Antiseptic action lasted up to 2 hrs for 90% alcohol and up to 4 hrs for 5% hypochlorite. Antiseptic action lost by 6 hrs for both antiseptics. Thus 5% hypochlorite is longer acting and better antiseptic than 90% alcohol.

Key words: antiseptics, ethyl alcohol, hypochlorite.

INTRODUCTION

Antiseptics are antimicrobial substances that are applied to living tissue/skin to destroy or inhibit the growth of microorganisms and in consequence reduce the possibility of infection and sepsis[1]. Therefore antiseptics are an important component in avoiding healthcare-associated infections (HAI) which are connected invasive procedures, such as surgery or intravascular
devices insertion. Commonly the infective agents are the microorganisms found on the patient’s own skin flora[2-4].

An estimated 18 million surgical procedures are performed in United States each year. Of these more than 500,000 are complicated by nosocomial infections[5]. Surgical site infections (SSI) are responsible for 77% of the deaths in nosocomially infected surgical patients[6]. Bacterial colonization originating from microflora of patients skin is also a common cause of bloodstream infection (BSI). Patients who acquire an SSI have a 2-fold increase in the length of hospital stay and risk of death[5] and annual cost to US healthcare system is in excess of 1.8 billion[7-9].

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**MATERIALS AND METHODS**

The study was conducted on 50 human volunteers as controls and 100 human volunteers as test in Bhaskar Medical College, Moinabad, India. The test group composed of 50 human volunteers to test with Surgical Spirit BP containing 90% ethyl alcohol and 50 human volunteers to test with 5% hyochlorite. Inclusion criteria includes human volunteers of both sexes from 18-70 years. Exclusion criteria includes human volunteers with history of skin allergies or atopy, as well as reactions to soaps, chlorine or latex.

**Interventions:**

Biological: Bacterial culture of the prepared skin’s areas[10-13]

Other: Preparing skin’s area to be tested

Biological: Bacterial culture of the prepared skin’s areas

Cultures were taken with sterile swab over an area of 5cm² swabbed for 2min over the skin previously prepared, then it was added to 3ml of culture broth (Nutrient broth HiMedia Laboratories Private Limited, Mumbai,India)and incubated for 30min at 37°C and a sample 50mL was spread in a plate containing a blood agar (HiMedia Laboratories Private Limited, Mumbai,India ) and incubated at 37°C for 24 hrs. After incubation, the colonies were counted.

Other: Preparing skin’s areas to be tested.

Two antiseptics (90% ethyl alcohol and 5% sodium hypochlorite) and two controls were tested as skin antiseptics[14-16]. The intervention consisted of preparing four skin’s areas with the antiseptic or the control, two in each arm of the volunteer. These ones were approximately 25cm² on the forearm for each antiseptic or control. The antiseptic or control were applied in an outward circular motion using a swab that was soaked with the solution. The solution was kept on the skin for 60 seconds before the culture was conducted[17]. Every volunteer were studied in three separate occasions, alternating the four areas in every subsequent test, so every area was studied with each control or antiseptic. The swabs were taken at 0min, 30min, 2hrs, 4hrs and 6hrs for control and test areas and the swabs were placed in nutrient broth for 30 minutes and

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incubated. Later 50mL of the broth was transferred on to the Blood agar plate and streaking done. The plates were incubated for 24hrs at 37\degree C. After incubation the colonies were counted.

**RESULTS**

The demographic data for the 150 participants, 75 were females and 75 were males. The study group included 50 controls, 50 were cleaned forearm with 90% ethyl alcohol and 50 were cleaned forearm with 5% hypochlorite Table.1.

<table>
<thead>
<tr>
<th>Baseline Measures</th>
<th>Controls</th>
<th>Patients with 90% ethyl alcohol</th>
<th>Patients with 5% hypochlorite</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of Participants</td>
<td>50</td>
<td>50</td>
<td>50</td>
</tr>
<tr>
<td>Age &lt;=18 years</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>18-65 years</td>
<td>50</td>
<td>50</td>
<td>50</td>
</tr>
<tr>
<td>&gt;=65 years</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Mean±standard deviation</td>
<td>29.7±1.75</td>
<td>31.4±0.76</td>
<td>35.2±1.02</td>
</tr>
<tr>
<td>Gender Female</td>
<td>75</td>
<td>75</td>
<td>75</td>
</tr>
<tr>
<td>Male</td>
<td>75</td>
<td>75</td>
<td>75</td>
</tr>
<tr>
<td>Region of Enrollment Hyderabad</td>
<td>50</td>
<td>50</td>
<td>50</td>
</tr>
</tbody>
</table>

Table 1: Baseline parameters of controls, patients with 90% ethyl alcohol and 5% hypochlorite

Bacterial colony count are measured at 0seconds, 30minutes, 2hours, 4hours and 6hours

<table>
<thead>
<tr>
<th>Measurable Values</th>
<th>0 sec Time</th>
<th>30min Time</th>
<th>2hrs Time</th>
<th>4hrs Time</th>
<th>6hrs Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bacterial colony count of skin culture for the 90% ethyl alcohol</td>
<td>0</td>
<td>2±0.5</td>
<td>4±0.75</td>
<td>6±1.25</td>
<td>12±1.5</td>
</tr>
<tr>
<td>Bacterial colony count of skin culture for the 5% hypochlorite</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>2.5±0.75</td>
<td>7.45±1.25</td>
</tr>
</tbody>
</table>

*p<0.05 is significant

At 4hrs and 6hrs colonies showed significance between 90% ethyl alcohol and 5% hypochlorite. After 6hrs the colonies were reached control level i.e., 14.5±021.

**DISCUSSION**

This study of the effectiveness of antiseptics did not support manufacturer’s claim of 99.9% reductions in forearm bacteria. In fact, the greatest percentage of bacteria are eliminated at 0 time with both antiseptics. This indicates that the onset of antiseptic action with both antiseptics was identical. There were no allergic reactions at 0 time period with both antiseptics. Thus this proves both antiseptics can be used for immediate action.

At 30min there were some bacterial colonization with 90% ethyl alcohol but not with 5% hypochlorite[18]. With 5% hypochlorite, the swabs were sterile. The observation showed that
although the antiseptic solutions killed the bacteria present on skin of forearm, the complete sterilisation was not there with 90% ethyl alcohol.

At 2hrs also there were no colonization with 5% hypochlorite. There were few colonisations with 90% ethyl alcohol[19], 5% hypochlorite showed complete sterilization until 2hrs as it lifts dust and bacteria; so 5% hypochlorite is better antiseptic than 90% ethyl alcohol until 2hrs.

At 4hrs, both antiseptics showed bacterial colonization on skin but more in number with 90% ethyl alcohol. 50% less colonization with 5% hypochlorite then 90% ethyl alcohol.

At 6hrs the colonization were abundant with both antiseptics. It was almost comparable with control. This showed that the duration of action of both antiseptics was 0-6hrs. Alcohol denatures the bacterial membranes thus it showed antiseptic action.

Colonizations are significant at 4hrs and 6hrs. Hence 5% hypochlorite is faster and better antiseptic than 90% ethyl alcohol. After 6hrs colonies control level i.e., antiseptic action observed for 6hrs. There were no hypersensitivity reactions to antiseptics[20].

If more data was acquired in future testing, a more accurate assessment of effectiveness could have been obtained. As many natural in gradients can provide nutrients for bacteria, the natural based products could have resulted in a larger bacterial reduction. Another factor that could be further investigated would be the effects of temperature on bacterial growth. The incubation temperature was 37\(^\circ\)C, however a normal room temperature(20\(^\circ\)C) may not have allowed as much bacteria to form. The humidity in the incubator may also have assisted in bacterial growth. Finally, the time spent cleansing the forearm may have also been a factor in the reduction of forearm bacteria. The health department, as well as other sources, suggest a 30second scrubbing period, while others suggest a full 2minutes. Finally, it was recommended for further testing on what type of bacteria is eliminated by these products. The FDA requires that transient bacteria be eliminated, yet some pathogenic bacteria may still be present[21]. Bacteria can be found everywhere in our environment and are capable of multiplying every 20minutes. Proper learning with 5% hypochlorite is recommended as a key method to stay healthy by the Centers for Disease Control. The importance of clearing arm with 5% hypochlorite is practiced properly before surgery.

***CONCLUSION***

Sodium hypochlorite at 5% has been widely used as antiseptic in patients on dialysis as well as for irrigation of wounds and burns. Hence it is used in highly sensitive conditions like skin preparation for hemodialysis.

***REFERENCES***

[21] Cashman AL; Warshaw EM. Dermatitis, 2005, 16(2), 57-56.