Abstract:
Objective - To compare the efficacy of 3 different methods of hand drying in hand hygiene. Efficacy is defined as quantitative reduction in bacterial growth following hand drying. Subjects and Methods - 25 Health care personnel comprising of doctors and nurses participated in this Single blinded Randomized Prospective study in a tertiary care newborn unit. After 2 minute hand washing using ordinary soap, personnel were randomly allocated to 3 different methodologies of hand drying (air drying till hands were felt to be dry, air drying for 3 minutes and drying using autoclaved newspaper). After 24 hours incubation bacterial colony counts from wet and dry hands were determined in both Nutrient agar and Mac Conkeys medium. The mean difference between the bacterial colony count on wet hands and after drying were analyzed using a nonparametric analysis. Results - In Mac- Conkeys medium the mean reduction in bacterial colony count in air drying for 3 minutes was more (55.8), followed by air drying till hands were felt to be dry (30.2) and less in autoclaved newspaper method (9.8). This difference was statistically significant (p<0.03). Conclusion - Air drying for 3 minutes is more efficient in reducing bacterial colony count than the other methodologies used in this study.

Keyword: Hand drying, air drying, autoclaved newspaper, bacterial colony count, wet hands, and dry hands

Introduction
Handwashing for two minutes followed by hand drying is mandatory in preventing Infection in newborns. In resource limited setting only ordinary soaps that do not contain antiseptic are available for hand washing. Sterile paper towels as recommended by CDC for hand drying are also not available. Newspapers that are readily available and autoclavable may be a good alternative. Moisture is a key factor in determining the level of touch associated bacterial transfer. In Newborn units where emergencies are handled, due to time constraint
and impatience, hands are not thoroughly dried. Using autoclaved newspaper can hasten the process of drying and eliminate this problem. This study tests the efficacy of hand drying after hand washing. Efficacy is defined as quantitative reduction in bacterial colony count after hand drying. of drying and eliminate this problem. This study tests the efficacy of hand drying after hand washing. Efficacy is defined as quantitative reduction in bacterial colony count after hand drying.

**Methodology:**

**Study Design:** Single blinded Randomized control trial.

**Place of study:** Tertiary neonatal unit in Chennai.

**Period of study:** 3 months

**Method of randomization:** Random allocation using envelope method

**Subject Selection:** Doctors and Nurses of Newborn unit

**Inclusion Criteria:** Doctors and Nurses working in Newborn Unit of ICH

**Exclusion Criteria:** Individuals with skin infections of hand, Individuals not giving consent.

**No of personnel enrolled:** 25 health personnel were enrolled for the study after formal written consent. 4 participants were doctors and the rest were staff nurses.

**Randomization:** Using Envelope method, personnel were randomised into 3 groups. air drying till hands were felt to be dry; air drying for 3 minutes; drying using autoclaved newspaper. After 2 minutes hand washing using ordinary soap, swabs were taken from wet hands and subsequently after one assigned methodology of hand drying. Swab was taken from tips, webs of fingers, dorsum and plantar aspect of hands and wrist. Every third day the other two methodologies of hand drying were allocated to the same individual. Nutrient Agar and MacConkey's medium were used as culture media. Bacterial growth was evaluated by colony count after 24 hrs incubation at 37 degree C. Microbiologist was blinded to the methodologies of hand drying. Colony count, Gram's staining and Species identification was done by Microbiologist. The water used for hand washing and autoclaved newspaper to be used for the study were also subjected for culture and sensitivity. Separate soaps were given for hand washing. Autoclaved English newspapers sized 27 cm x 17.5 cm were issued using sterilized forceps to avoid cross contamination.

**Results:**
All the 25 participants completed the methodologies of hand drying randomized. We had controlled time only in air drying for 3 minutes. Personnel used 30-40 seconds for drying using autoclaved Newspaper. In air drying for unlimited time personnel took 3 to 10minutests for hand drying.

**Tables 1 and 2** gives the mean colony count in air drying for unlimited time, air drying for 3 minutes and drying using autoclaved newspaper in Nutrient Agar and in Mac Conkey’s medium

In Agar medium, the difference in mean reduction in colony count between the three Methodologies of hand drying was not significant. However, in Mac Conkey’s medium the mean reduction in colony count in air drying for 3 minutes was maximum which was statistically significant (p<0.03). The difference between air drying for
unlimited time versus drying using autoclaved newspaper (p<0.039) and the difference between air drying for 3 seconds versus drying using autoclaved newspaper (<0.022) was statistically significant.

**Tables 1 and 2** gives the mean colony count in air drying for unlimited time, air drying for 3 minutes and drying using autoclaved newspaper in Nutrient Agar and in Mac Conkey's medium.

### Tables 1 Colony count in three groups in Agar medium

<table>
<thead>
<tr>
<th>Groups</th>
<th>Wet colony count</th>
<th>P Value</th>
<th>Dry colony count</th>
<th>P Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Air drying unlimited time</td>
<td>49.6 ± 78.8</td>
<td></td>
<td>16.6 ± 40.3</td>
<td></td>
</tr>
<tr>
<td>Air drying 3 seconds</td>
<td>45.4 ± 67.9</td>
<td>672</td>
<td>20.8 ± 83.3</td>
<td>.542</td>
</tr>
<tr>
<td>Autoclaved newspaper drying</td>
<td>54.3 ± 132.4</td>
<td></td>
<td>38.6 ± 140.6</td>
<td></td>
</tr>
</tbody>
</table>

### Tables 2 Colony count in three groups in MacConkey's medium

<table>
<thead>
<tr>
<th>Groups</th>
<th>Wet colony count</th>
<th>P Value</th>
<th>Dry colony count</th>
<th>P Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Air drying unlimited time</td>
<td>39.6 ± 62.9</td>
<td>217</td>
<td>9.3 ± 30.3</td>
<td>.580</td>
</tr>
<tr>
<td>Air drying 3 seconds</td>
<td>59.9 ± 113.3</td>
<td></td>
<td>4.0 ± 12.1</td>
<td></td>
</tr>
<tr>
<td>Autoclaved newspaper drying</td>
<td>23.1 ± 36.4</td>
<td></td>
<td>13.2 ± 29.42</td>
<td></td>
</tr>
</tbody>
</table>

**Table 2** Colony count in three groups in MacConkey's medium

**Tables 3** Mean reduction in colony count between wet and dry hands (N=25) in Agar medium and Mac-Conkey's medium in three

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Hand washing has been identified as the single most important means of preventing the spread of infection. Hand drying is the critical last stage of the hand washing process and needs to be implemented in a way that reduces, rather than increases the risk of cross-contamination. Transient organisms including Gram negative bacteria acquired during random contact with various fomites are readily removed by hand washing. Resident flora are less easily removed and may be transferred by touch. Ansari et al. artificially contaminated finger pads with known quantities of Escherichia coli and demonstrated that warm air hand dryers performed better than paper towels or cloth towels. Blackmore assessed reduction in indigenous bacterial flora by directly contacting fingertips to a Petri dish containing nutrient agar and showed that either paper towels or cloth towels outperformed warm air hand dryers. Davis et al. observed no difference among these 3 hand-drying methods. In Mayo clinic study drying by 4 different methods (cloth towels accessed by a rotary dispenser, paper towels from a stack on the hand-washing sink, warm forced air from a mechanical hand-activated dryer, and spontaneous room air evaporation) showed no significant reduction in mean reduction of colonies. In the current study, swabs were used to take culture and all areas of the hand including the webs of finger were accessed by this method. Swabs were immediately streaked in Nutrient Agar and in MacConkey's medium and the plates were transported to the Microbiology lab for incubation. We dispensed papers using forceps to mitigate contamination. In the current study in MacConkey's medium, there was a statistically significant difference (p<0.03) in mean reduction in colony count in air drying for 3 minutes. The difference between air drying for unlimited time versus drying using autoclaved news paper (p<0.039) and the difference between air drying for 3 seconds versus drying using autoclaved news paper (<0.022) was statistically significant.

<table>
<thead>
<tr>
<th>Hand Drying Method</th>
<th>Mean Reduction of Colonies</th>
</tr>
</thead>
<tbody>
<tr>
<td>Air drying unlimited time</td>
<td>33.3 ± 66.2</td>
</tr>
<tr>
<td>Air drying 3 seconds</td>
<td>24.5 ± 111.1</td>
</tr>
<tr>
<td>Autoclaved newspaper drying</td>
<td>15.7 ± 53.8</td>
</tr>
</tbody>
</table>

**Conclusion:**

Air drying for 3 minutes is more efficient in reducing bacterial growth than air drying for unlimited time and drying hands using autoclaved newspaper.

Air drying for 3 minutes and air drying for unlimited time are more efficient in reducing bacterial growth compared to drying hands using autoclaved newspaper.
Elimination of moisture is probably better in air drying than drying using autoclaved news paper resulting in greater reduction in bacterial growth.

**KEY MESSAGE-AIR DRYING FOR 3 MINUTES IS MORE EFFICIENT IN REDUCING BACTERIAL GROWTH THAN DRYING HANDS USING AUTO-CLAVED NEWSPAPER**

References:


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