A Study on Pollution of Prefilled Oxygen Humidifiers When Applied to Multiple Patients in Emergency Room

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Abstract. This study has been carried out to figure out the safety of prefilled oxygen humidifiers (POH) by investigating the level of pollution when they are applied to multiple patients. Bacterial culture tests revealed no aerobic microorganisms including Peudomonas aeruginosa or Staphylococcus aureus when 20 prefilled oxygen humidifiers (POH) were used for each session for 7, 14, and 28 days respectively out of total 60 humidifiers. Therefore, applying prefilled oxygen humidifiers (POH) to the respiratory distress patients in the emergency room by the nurse for a prompt arrangement is believed to contribute to reducing her workload in future because of their pollution-free and time saving effect.

Keywords: Oxygen Humidifier, Pollution, Oxygen therapy

1 Introduction

1.1 Necessity

Emergency room has a purpose to reduce the death rate of emergency patients by appropriately diagnosing and treating them and to prevent serious after-effects. Not only seriously affected patients but also patients who need only a temporary first aid come to the emergency room. However, in many cases, patients cannot be promptly treated due to a long queue of patients and shortage of medical staffs in the emergency room. Therefore, there needs to be improvement in provision of appropriate first aids to mild cases as well as serious cases, which is an important index for assessing the performance of the emergency room [1]. Presently, the work load of nurses in the emergency room in Korea is extremely heavy because of increase of emergency patients, their preference for general hospitals, increase of patients waiting for hospitalization due to lack of hospital wards after first aids, and increasing numbers of non-emergency patients using the emergency rooms [2]. Dyspneic patients coming to the emergency room have various conditions from manageable by themselves to life-threatening. When such patients come to the emergency room, the nurse shall promptly observe and assess them and arrange...
mitigation of dyspneic symptom to increase the survival rate [3]. Since the respiratory organ directly contacts air, it is sensitive to temperature and humidity, dropping its resistance due to dryness of nasal mucous membrane in an arid condition and suddenly increasing infection rate of respiratory diseases in case of increase of viral droplets.

A big capacity humidifier, an apparatus to adjust humidity for the respiratory organ of a patient, mainly used in local medical institutions, has been known to be related with hospital-acquired pneumonia in some studies [4], and the water in the humidifier creates an environment where the molds and bacteria could grow easily and may adversely affect the patient when the humidifier is used without removing the microorganisms completely in the humidifier.

Since the prefilled oxygen humidifier (POH) does not need to fill or replace distilled water each time unlike reusable oxygen humidifiers, it may perfectly block the infection of the respiratory organ of a patient. It needs just setting a new bottle of distilled water after use and thus save the manpower needed for controlling reusable devices [5]. Therefore, the authors want to provide basic data for safety of using POH on dyspneic patients in the emergency room through cultivation tests of supply water in POH.

1.2. Purpose

This study is intended to investigate safety of POH when they are applied to multiple patients who need oxygen in the emergency room.

1.3. Definition of Terms

Prefilled Oxygen Humidifiers (POH)

A POH (AQUAPAK, Hudson RCI, USA) refers to a device used for an oxygen inhalation therapy to a dyspneic patient, a system which does not require the replacement or supplementation of distilled water. In this study, it refers to a prefilled sterilized distilled water oxygen supply device with 340ml capacity.

2 Method

2.1. Design

The research design is a time-series analysis, which is done after using POH. Odd numbered patients who arrived at the emergency room were randomly selected as the research subjects.
2.2. Selection of Research Subjects

The subjects of this study are adult patients over the age of 19 who require oxygen supply treatment in the emergency room.

2.3. Procedures

A total 60 POH were used in 3 groups for this study after obtaining IRB approval of K university hospital in Seoul in 2013. 20 POH in each group were provided to the individual beds for 7 days (August 2 to August 8), 14 days (August 9 to August 22) and 28 days (August 27 to September 23) respectively for investigation. In addition, a standard form to monitor the humidifier was attached to the bed. The inlet part of prefilled oxygen flow regulator and the outlet of humidifier removed from the humidifier were sealed before sending to Korea Testing & Research Institute (KTR) for test. Microbial limit tests were done to find the limit of a certain microorganisms with multiplying capacity in medicines and further to know a total number of aerobic microbes and the presence of pseudomonas aeruginosa and staphylococcus aureus in the distilled water remained inside the humidifiers after use.

The nurses participated in the research were educated how to use the POH in advance and were told to write the opening date of the humidifiers. The patients were instructed to write the removal date of the humidifiers. All humidifiers were checked on a designated date and sent to KTR while new POH were provided again in the same way.

3 Result

3.1. Result of Bacterial Culture of POH

As a result of bacterial culture after use of POH, no microorganisms were found in all 3 groups as shown on Table 1:

Table 1. Result of Bacterial Culture of POH

<table>
<thead>
<tr>
<th>Group</th>
<th>POH using the term (day)</th>
<th>Number of POH (n)</th>
<th>Total number of aerobic microorganisms</th>
<th>Pseudomonas aeruginosa</th>
<th>Staphylococcus aureus</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>7</td>
<td>20</td>
<td>N.D</td>
<td>Negative</td>
<td>Negative</td>
</tr>
<tr>
<td>II</td>
<td>14</td>
<td>20</td>
<td>N.D</td>
<td>Negative</td>
<td>Negative</td>
</tr>
</tbody>
</table>
4 Discussion

No microorganisms were detected in the distilled water left inside the prefilled oxygen humidifiers after their use for 7 days, 14 days and 28 days respectively. According to a previous study [6], there was no microorganism detected for 24 and 48 hours when the vibrators and water containers of humidifiers were dried for 1 day, and then sterilized with Deconex 50FF diluted by 1:100 and refilled with tap water. Further, it reported that no microorganism was detected for 24 and 48 hours even when the water collected from the spraying outlet was cultured, which is similar to the result of this study. However, microorganisms were detected after 24 and 48 hours when the vibrators and water containers were washed and rinsed with tap water or sterilized distilled water only without drying the humidifiers. It was reported that the number of such microorganisms gradually increased as time elapsed. Min [7] reported that no germ was cultured for 7 days when a humidifier in a university hospital was sterilized with diluted Lax containing chloride and was filled with distilled water mixed with a sterilizing agent (Humidifier Mate) as supply water. Kim [8] also reported that no germ was cultured for 3 days when a humidifier was sterilized with diluted Lax and filled with tap water. These reports show the same result as that of this study. This tells us that sterilizing the inside of a humidifier is important to prevent infection when nurses prepare humidifiers. Since the prefilled oxygen humidifier used in this study has such a structure that no germ could enter into it from outside and the internal container is produced safely under sterilization, it is believed to be safe even for long time use if the internal environment is thoroughly controlled from the preparation stage.

References


