A Clinical Study on Bacterial Contamination of Low-noise Anti-bacteria AF-C Type Oxygen Pipe and Traditional Oxygen Pipe

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Abstract — In our study reported in this paper we aimed to explore the clinical effect of the Low-noise Anti-bacteria AF-C Type Oxygen Pipe in order to provide comfortable and safe oxygen therapy devices for certain patient and make hospital-acquired infection effectively controlled. The study involved 120 patients receiving long term oxygen therapy who were divided into two groups: the experiment group and the control group. Half of them were assigned to use the AF-C Type Oxygen Pipe for oxygen therapy as experiment group, the other half used traditional Oxygen Pipe as control group. On this basis, bacterial culture which was performed on day 5 and the comfortable degree of the two groups were compared. The results showed positive detection rate of the control group of 18.3%, while that of experiment group was 0%. Also, the comfortable degree of experiment group was significantly higher than the control group. We conclude that the AF-C Type Oxygen Pipe is effective in controlling hospital infection as it can prevent nosocomial infection and improve patient comfort.

Keywords—bacterial infection, low-noise anti-bacteria AF-C type oxygen pipe, nosocomial infection control

I. INTRODUCTION

The infection control of medical device is an important part in the control of nosocomial infection. Oxygen therapy treatment, which could improve hypoxemia and metabolism to maintain normal physical activity, is widely used in clinic as a primary or adjuvant therapeutic method[1, 2]. Current clinical findings indicates that respiratory infections caused by oxygen therapy is a prevalent way to nosocomial infection[3]. How to effectively control this infection has become the focus of attention of many researchers. At present, most hospitals in China are taking traditional oxygen treatment. In this way, oxygen is taken by patients through humidification fluid with distilled water. Researches showed that this kind of ventilation has many shortcomings including higher infection rate, noisy gurgling sounds, nasopharynx discomfort, pipe odors, etc[4]. AF-C Type Oxygen Pipe is newly developed disposable airtight oxypath or designed to remedy above mentioned deficiency of traditional pipe. A satisfactory effect was obtained after its clinical application and now report as follows.

II. MATERIALS AND METHODS

A. General Information

120 patients that admitted to Department of Respiratory of our hospital during the period from May to August 2012 were taken as test subjects. All of them has taken oxygen therapy for more than 7 days with the oxygen flow of 2-5 L/min and has been divided randomly into two groups, of 60 cases. Experiment group included 36 men and 24 women with the age of 66-85. Control group included 32 men and 28 women with the age of 65-84. No significant differences between two groups existed in terms of age, gender and treatment.

B. Materials

Low-noise anti-bacteria AF-C type oxygen pipe consists of disposable oxygen pipe, disposable humidification bottle with humidified fluid. Traditional oxygen therapy device consists of humidification bottle, sterilized distilled water and disposable oxygen pipe. Sterilized distilled water is made by hospital preparation department and humidification bottle has been immersed in "84" disinfectant for at least 30mins for use.

C. Method

Use sterile syringe (5ml) to extract 1ml humidification fluid, add it to the broth tube (9ml with 0.5% sodium thiosulfate), strictly perform no-germ operation in the process. After 24 hours’ culture, switched it to blood agar plates. In terms of the criteria of the Ministry of Health of China, the qualified amount of bacteria is less than 250 CFU/ ml. Automatic analyzer was used to perform strains identification.

D. Statistical method

All data were analyzed statistically with SPSS10.0 software and significant difference was shown with statistical meanings (P<0.05).

III. RESULTS

A. Positive rate of bile bacteria

On the fifth day of oxygen therapy, test of the humidified fluid were conducted. Bacterial culture yielded negative results in experiment group. In control group, 11 of 60 cases were detected contaminated by staphylococcus, Escherichia coli and Pseudomonas with contamination rate of 18.3%. There were significant difference between the two groups (P <0.01), Table 1.

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**B. Patient's satisfaction**

The index of patient’s satisfaction of experiment group were 96.75, which is much higher than the control group (60%), significant difference were clear (P<0.01). The sleep of experiment group patients were unaffected. Only 2 patients felt discomfort about nasopharynx.

**IV. DISCUSSION AND CONCLUSION**

Oxygen therapy is a common effective treatment to hypoxemia and plays an important role in increasing body’s blood oxygen. Nevertheless, respiratory infections still ranked top in hospital infection [6]. Research shows that the contaminate of medical devices such as humidification bottle is a key factor to lung complications which should not be neglected [7]. How to reduce respiratory infections caused by oxygen therapy is a concern in nosocomial infection control field. For years, many new oxygen therapy devices have been applied to clinical practice. One such example is the low-noise anti-bacteria AF-C Type oxygen pipe used in our hospital.

There are many shortcomings of the traditional oxygen pipe. (1) the flow gauge and humidification bottle are directly connected. As a result, the cover as well as the vent hole of humidification bottle suffers high humidity. Repeated cross use of bottle will encourage the growth of bacteria as much as 80 percent[8], according to relevant data. In addition, disinfection can not be implemented in the process. Thus the bacteria can easily be transferred to other patients and cause cross-infection. (2) there is no protective isolation of traditional pipe and humidified fluid will be contaminated after 24 hours. (3) during the operating of screwing bottle cover, health workers may cause inevitable contamination. (4) during the oxygen treatment, the noise of the gas - liquid impinging is very loud. This may exert certain degree of negative psychological impact on the patients and affect their rest. (5) as the oxygen pipes are made of smelly polymer plastics, patients may feel uncomfortable the very first time they use it. Pipe has to be replaced everyday in traditional oxygen therapy, so it is not easy to eliminate the odors.(6) the humidification bottle is periodically sterilized with chlorine-containing disinfectant. Chlorine-containing disinfectant is a disinfectant with a sharp odor which has bad effect on nasal mucosa. Nevertheless, the sharp odor can not be eliminated completely despite the water-washing or dipping.

Compared with the traditional oxygen therapy pipe, the low-noise anti-bacteria AF-C type oxygen pipe has the following advantages: (1) the flow device and humidification bottle are separated. In this way, the cover as well as the vent hole of humidification bottle keeps dry during the oxygen therapy. Cross contamination was avoided. (2) the AF-C type oxygen pipe has bidirectional anti-bacteria device, which has a millipore filter with the aperture less than 0.22 μm. The main bacteria know that could cause nosocomial infection, such as coccus, bacillus and spirillum, are more than 0.33 μm in length. Apparently, these bacteria can not pass the millipore filter and cross-infection is effectively avoided. (3) the AF-C type oxygen pipe can be directly used without installation. (4) it has advanced humidifying device with low noisy and better humidification faction. Thus, both the oxygen therapy and comfort index of patients are effectively improved. (5) the pipe is designed diagonal so as to prevent bucking caused by the flow of water and oxygen. (6) this AF-C type oxygen pipe is one-off designed as its body and cover are interlocked to avoid repeated use. (7) it is made of PET1 materials that can be used for food packaging. The flower-like nasal oxygen cannula can rule out the risk of oxygen uptake stop.

This research showed that the bacteria contamination rate of patients using AF-C type oxygen pipe is 0 and index of patient’s comfort is greatly improved (96.7%, only two patients felt discomfort about nasopharynx). It is an undeniable fact that this kind of pipe could avoid cross infection and decrease nosocomial infection. In comparison, the bacteria contamination rate of patients using traditional pipe reached up to 18.3%.

Based on the research above, whether in the decrease of bacteria or the improvement of patients’ comfort, the low-noise anti-bacteria AF-C Type oxygen pipe is much better than the traditional pipe. It is suggested that it should be used in the clinical treatment.

**REFERENCES**


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**TABLE I**

<table>
<thead>
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<th>Group</th>
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<th>Positive cases</th>
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<td>0</td>
<td>0</td>
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<tr>
<td>Control group</td>
<td>60</td>
<td>11</td>
<td>18.3</td>
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**TABLE II**

<table>
<thead>
<tr>
<th>Group</th>
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<th>Satisfaction Index</th>
<th>Sleep disruption</th>
<th>Nasopharynx discomfort</th>
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<td>38 (60%)</td>
<td>0</td>
<td>2</td>
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<tr>
<td>Control group</td>
<td>60</td>
<td>36 (60%)</td>
<td>32</td>
<td>36</td>
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</tbody>
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