

IOT BASED NEBULIZER THERAPY FOR CHILDREN SUFFERING FROM BRONCHIAL ASTHMA

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Abstract: This Project describes the enhancement of ultrasonic nebulizer that is being made for monitoring asthma attacks frequency and dynamics of its treatment. The improvement is presented by intercalation of an indicator that registers time, duration of an attack and dosage of an inhaled medicament. The reason why the research is regarded to children below the age of 3 years is that nebulizer therapy is the only one they can use, unlike adults, who use nebulizers on prescription (using jet sprays through the day). This fact allows us to track all cases of asthma attacks.

Keywords: based iot children nebulizer therapy

I. INTRODUCTION

Asthma is a chronic or long-term disease which with air passage inflammation in the lungs due to the increased sensitiveness in the nerve endings in airways, induced the high irritability in airways. In an asthma attack, airway swells and narrow which reduce the airflow passage in and out of lungs. It can cause short of breath, difficult of breathing, coughing, wheezing and producing extra mucus which triggers by various factors such as allergen, infection, air pollution, food, some medications, psychology factors, cold air, inappropriate exercises and hyperventilation. (WHO 2017, Käypä hoito 2017.) As a major non communicable diseases, according to the latest WHO (2017) estimates which published in December 2016, there are 235 million people currently suffering from asthma and it is a common disease among children, meanwhile, there were 383 000 deaths due to asthma in 2015. According to AAAAI (Asthma Statistics | AAAAI 2017), the prevalence of asthma in US is increasing as well. There was a research conducted in North Sweden, it showed the population of schoolchildren with allergic sensitization was increased from 1999 to 2009, and the more and more population were multisensitized (Ronmark, Bjerg et al. 2009). Meanwhile, the cost of asthma is growing globally, which is greater than the total cost of HIV and tuberculosis (Nunes, Pereira et al. 2017). Currently, asthma shows an increasing prevalence in China, there is a research was done in 2010, which is about asthma prevalence in three cities of China. Research had done in Beijing, Chongqing and Guangzhou, the population focused on 0-14 year's children. It showed that the value of asthma morbidity is much higher than the value which obtained 10 years ago by national epidemiological survey in 2000 which used the same method of investigation and the same diagnostic criteria. (BAI, ZHAO et al. 2010.)

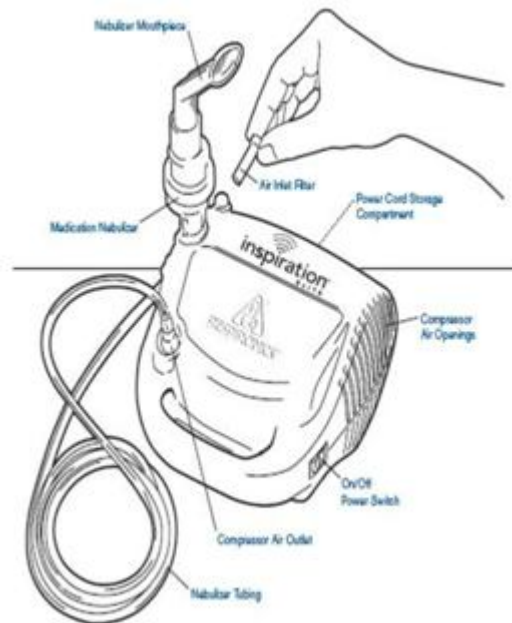
II. METHODOLOGY

The literature review is the main method of this thesis. Literature review is a research articles written by researchers who study by using previous articles to analyze the related topic.

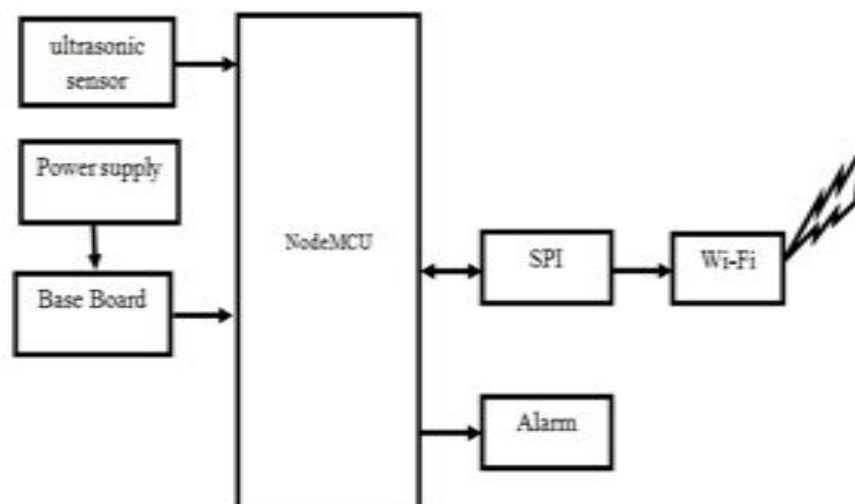
Normally, the literature reviews could be found in books, journals and all manner of research writing. (Jaidka, Christopher S.G. Khoo et al. 2013.) The most important part of literature review is to establish the research questions, once the questions have been confirmed the next step is to search what other researcher have already found and reported about these research question, each good research articles would be included a purpose which related to the research questions. This could be done by collect articles through the major databases. (Neill2017.) These articles were collected through several of useful database, Cinahl Complete, EBSCO host and Science Direct. Furthermore, the statistic which has been mentioned in this thesis was from the international organization such as WHO and published articles.

III. PROPOSED METHOD

The proposed method describes the enhancement of ultrasonic nebulizer that is being made for monitoring asthma attacks frequency and dynamics of its treatment. The improvement is presented by intercalation of an indicator that registers time, duration of an attack and dosage of an inhaled medicament. The reason why the research is regarded to children below the age of 3 years is that nebulizer therapy is the only one they can use, unlike adults, who use nebulizers on prescription (using jet sprays through the day). This fact allows us to track all cases of asthma attacks.



IV. BLOCK DIAGRAM



V. THE PURPOSE OF THIS TREATMENT AND RESEARCH PROBLEMS

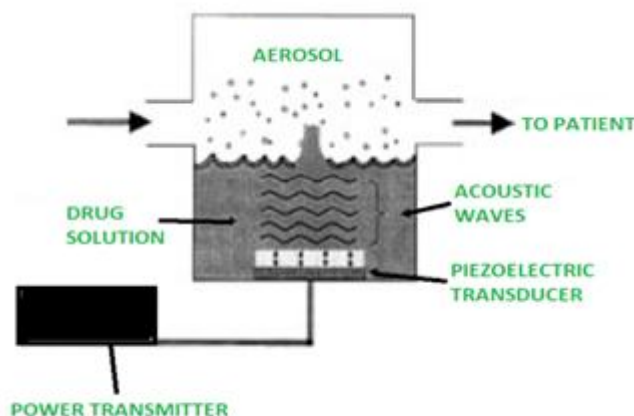
The purposes of this thesis are to investigate the health education needs of asthmatic patients, and how and what nurses should educate asthmatic patients in order to improve their quality of life.

VI. RESEARCH PROBLEMS

- 1) What is nurses' mission and role in asthmatic patients' and care givers health education according to research?
- 2) What are the health education needs of asthmatic patients and caregivers based on literature?
- 3) What is the relevant knowledge of health education nurses should provide to asthmatic patients and caregivers based on literature?

VII. WORKING

The principle of an ultrasonic nebulizer is based on the vibrations of a piezoelectric crystal driven by an alternating electrical field. These periodic vibrations are characterized by their frequency, their amplitude, and their intensity, which corresponds to the energy transmitted per surface unit. Ultrasonic nebulizers use a piezoelectric crystal vibrating at high frequency to create the aerosol, and do not require gas flow. The vibrations are transmitted through a buffer to the drug solution and form a fountain of liquid in the nebulisation chamber.



VIII. EXPERIMENTAL SET UP

Ultrasonic nebulizer is based on the vibrations of a piezoelectric crystal driven by an alternating electrical field. These periodic vibrations are characterized by their frequency, their amplitude, and their intensity, which corresponds to the energy transmitted per surface unit. When the vibration intensity is sufficient, cavitation occurs, and droplets are generated. Ventilation enables airflow to cross the nebulizer and to expel the aerosol droplets. For a given nebulizer, the vibration frequency of the piezoelectric crystal is fixed, often in the range 1-2.5MHz. In most cases, an adjustment in vibration intensity is possible by modifying vibration amplitude. The ventilation level is adjustable. The vibrations may be transmitted through a coupling liquid commonly water to a nebulizer cup containing the solution to be aerosolized. In this work, we studied the influence of the technological parameters of ultrasonic nebulization on nebulization quality. Our study was carried out with a 9% sodium chloride solution and a 2% protein solution (alpha1 protease inhibitor). Three different ultrasonic nebulizers were used. An increase in vibration frequency decreased the size of droplets emitted. The coupling liquid absorbed the energy produced by the ultrasonic vibrations and canceled out any heating of the solution, which is particularly interesting for thermo sensitive drugs.

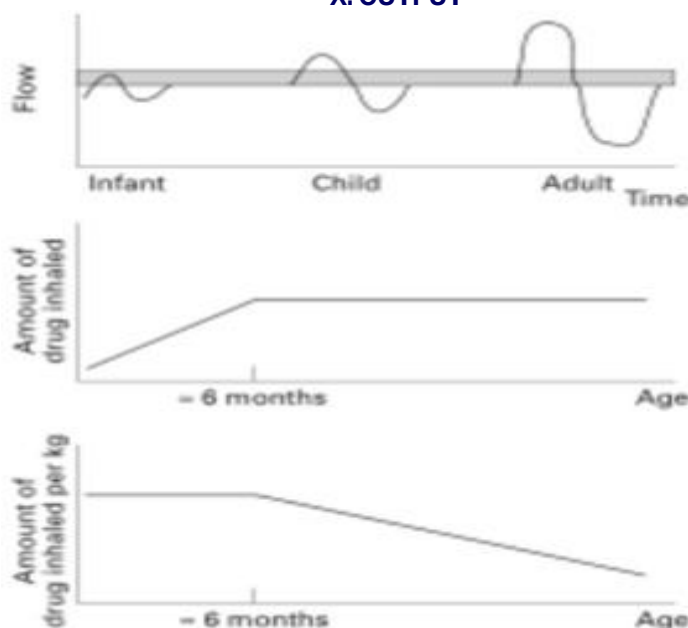


An increase in vibration intensity did not modify the size of droplets emitted, but decreased nebulization time and raised the quantity of protein nebulized, thus improving performance. On the other hand, an increase in ventilation increased the size of emitted droplets and decreased nebulization time and the quantity of protein nebulized because more drug was lost on the walls of the nebulizer. High intensity associated with low ventilation favors drug delivery deep into the lungs.

IX. RESULT

The nebulizer was operated from a single compressed air or oxygen source and found to provide from 10 to 15 L/min of aerosol with 38 to 50 microL of aerosolized medicine per liter of air (or oxygen) and utilize from 30 to 56 mL/hour of medicinal liquid. The mass media aerodynamic diameter of the aerosol droplets was found to be about 2.0 microm ($\sigma(g) = 2.7$). Delivery efficiency to the patient mask was about 90%. The aerosolized medicine delivered to the patient can be increased by adjusting the flow rate of the gas source or changing the solution concentration of medicine. Typically, several milligrams of drug can be delivered to the patient as inhaled aerosol per hour of treatment of which about one-quarter can be expected to be deposited in the lungs. During eight hours of operation the concentration of medicinal solution increased by about a factor of two because of water evaporation.

X. OUTPUT



ADVANTAGES

- Invaluable for children who just cannot use any other inhalation device.
- It relaxes the breathing muscles and permits air to flow more easily in and out of the lungs.
- It also helps to loosen mucus in the lungs.

DISADVANTAGES

- Implementation cost is too high.
- A lot of drug is wasted- that vapour which is coming out from the side.

APPLICATIONS

- Hospitals
- Home

XI. CONCLUSION

During nebulization with noninvasive ventilation in healthy volunteers, there was an increase in V_t associated to a higher inspiratory flow rate, without resulting in a significant increase in pulmonary radioaerosol deposition. Continuous nebulization therapy is an important means of treating patients with severe asthma. Dosage criteria can be established based on the operating characteristics of the nebulizer system, drug solution concentration, and patient respiration. Nebulizer use by inner-city children with asthma is higher than anticipated but is not associated with reduced asthma morbidity. This group of high-risk children was undertreated with inhaled corticosteroids for long-term control of asthma despite reports of adequate monitoring by a primary care physician.

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