

THE EFFECT OF CIGARETTE SMOKE ON MUCOCILIARY TRANSPORT IN ALLERGIC RHINITIS PATIENTS AT PHC SURABAYA HOSPITAL

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ABSTRACT

Introduction: Tobacco is one of the biggest public health threats in the world. According to the World Health Organization (WHO), the use of cigarettes causes the death of ± 8 million people per year worldwide. About 1.2 million are passive smokers who are exposed to cigarette smoke. Mucociliary transport is the first line in the defense mechanism of the nose that works actively to keep the respiratory tract always clean. Exposure to cigarette smoke can increase mucus secretion. Ciliary movement can also be obstructed, thereby interfering with nasal mucociliary transport. Inflammation of the nasal mucosa due to Allergic Rhinitis will obstruct the nose, which can interfere with the work of mucociliary transport.

Purpose: This study aims to analyze the effect of cigarette smoke on mucociliary transport in Allergic Rhinitis patients.

Method: This research is an observational study using a cross-sectional research method that was carried out at PHC Surabaya Hospital.

Result: 20 RA patients were divided into two groups: ten smokers and ten non-smokers. The saccharin test measured mucociliary transport time. The mucociliary transport time for smokers was 8.72 minutes and 4.82 minutes for non-smokers. The results of the Mann-Whitney test obtained a significance value of $p = 0.019 < \alpha = 0.05$.

Conclusion: There is a significant difference in mucociliary transport time between smoking RA patients, where the mucociliary transport time of smoking patients is longer than that of non-smokers.

Keyword: Cigarette Smoke, Mucociliary Transport, Allergic Rhinitis, Smokers, Non-smokers

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INTRODUCTION

Tobacco is one of the biggest public health threats in the world. According to the World Health Organization (WHO), the use of cigarettes causes the death of \pm 8 million people per year in the world. About 1.2 million are passive smokers who are exposed to cigarette smoke^[1]. Indonesia is now in third place with the most active smokers in the world. Smoking habits in the adolescent population aged 10-18 years have started to increase since 2013. Riset Kesehatan Dasar (Riskesdas) reported that the smoking prevalence of adolescents aged 10-18 years increased from 7.2% in 2013 to 9.1% in 2018^[2]. The percentage of the population aged 15-24 years in East Java Province who smoked in the last month was 26.4% and in the City of Surabaya it was 20.7%^[3].

The nose has a function to filter air containing bacteria and pollutants that enter during inspiration, one of which is the mucociliary transport system. The mucociliary transport system consists of mucous membrane cilia, mucus-secreting glands, and respiratory epithelial cells. This system works actively and simultaneously by pushing mucus lumps and foreign bodies that enter when air is inhaled into the throat to the digestive tract. If the incoming pathogenic particles are not immediately eliminated, a buildup of foreign bodies or bacteria can occur in the respiratory system. Mucociliary transport is the first line in the defense mechanism of the nose that works actively to keep the respiratory tract always clean. The saccharin test can be used to check the function of mucociliary transport. This test is easy to perform and simple, and is the gold standard for comparative examination of mucociliary transport time^[4].

Allergic Rhinitis (RA) is a disease that occurs in the nose due to an inflammatory process mediated by Immunoglobulin E (IgE) in the nasal mucosa due to allergen exposure. Symptoms of RA are repeated sneezing, runny nose, itchy nose and stuffy nose^[5].

Other symptoms can include coughing, itchy throat and difficulty concentrating. The prevalence of RA reaches 40% of the general population. RA symptoms can worsen the sufferer's quality of life, which can range from disruption of daily activities to sleep disturbances^[6].

Impaired mucociliary transport may occur in patients with RA. The severity of RA symptoms that occur is an indicator of impaired mucociliary transport. The more severe the symptoms of RA, the longer the mucociliary transport in the nose^[7]. Cigarette smoke is one of the triggering factors that can exacerbate RA^[4,8]. Exposure to cigarette smoke can increase mucus secretion. Ciliary movement can also be obstructed, thereby interfering with nasal mucociliary transport. Inflammation of the nasal mucosa due to RA will cause obstruction in the nose which can interfere with the work of mucociliary transport^[9].

METHOD

Sampling was carried out using non-probability consecutive sampling, each patient who met the inclusion and exclusion criteria was used in the study until the specified period of time, so that the required number of samples was fulfilled. Sampling was carried out by conducting a saccharin test on smoking and non-smoker RA patients who came to the Otorhinolaryngologist at PHC Hospital Surabaya in August-September 2022.

This study was conducted by comparing the results of the saccharin test in groups of smokers and non-smokers. The patients are asked to rinse their mouth with mineral water and then sit in a chair with his back straight and head down approximately 10°. An anterior rhinoscopy examination will be conducted and cleaning of nasal secretions if necessary. Next, make saccharin particles with a size of \pm 2 mm, then take them with a small spoon and place them on the front end of the inferior turbinate (\pm 1 cm posteriorly from the anterior border of the inferior turbinate). The patient is asked to swallow every half

or one minute. The length of time between when saccharin is placed on the nasal mucosa until it tastes sweet for the first time is calculated using a stopwatch.

RESULTS

Table 1. Data on the Gender of RA Patients at PHC Surabaya Hospital for the Period of August-September 2022

| Gender | Frequency (n) | Percentage (%) |
|--------------|---------------|----------------|
| Man | 12 | 60 |
| Woman | 8 | 40 |
| Total | 20 | 100 |

Table 2. Data on the Smoking Status of RA Patients at PHC Surabaya Hospital for the Period of August-September 2022

| Smoking Status | Frequency (n) | Percentage (%) |
|----------------|---------------|----------------|
| Smokers | 10 | 50 |
| Non-Smokers | 10 | 50 |
| Total | 20 | 100 |

The total population obtained for this study was 20 patients, consisting of 12 (60%) male patients and 8 (40%) female patients. For the number of smoking patients and non-smoker patients, each was 10 (50%) patients. All smoking RA patients were male, whereas in non-smoker RA patients as many as 8 patients were women and 2 other patients were men.

Table 3. Results of the Saccharin Test on Mucociliary Transport Time in Smokers and Non-Smokers

| Smokers (minute) | Non-Smokers (minute) |
|------------------|----------------------|
| 12,7 | 5,34 |
| 11,12 | 5,57 |
| 4,17 | 6,42 |
| 6,43 | 1,47 |
| 10,34 | 4,19 |
| 15,7 | 5,58 |
| 6,08 | 6,36 |
| 9,23 | 6,52 |

| | |
|------|------|
| 7,21 | 2,36 |
| 4,23 | 4,41 |

Through the results of the saccharin test above, the average value and standard deviation are obtained which are written in table 1.4:

Table 4. Mean and Standard Deviation of Mucociliary Transport Time

| Group | Average Mucociliary Transport Time (minute) | Standard Deviation (minute) |
|-------------|---|-----------------------------|
| Smokers | 8,72 | ±2,09 |
| Non-Smokers | 4,82 | ±1,73 |

Table 5. Hypothetical Test Results Using the Mann-Whitney Test

| Variable | Smoker mean ± SD (minute) | Non-Smoker mean ± SD (minute) | P (<0,05) | Note |
|----------------------------|---------------------------|-------------------------------|-----------|-------------|
| Mucociliary Transport Time | 8,72 ± 2,09 | 4,82 ± 1,73 | 0,019 | Significant |

The results of the hypothesis test using the Mann-Whitney test show that there is a significant difference. Based on table 1.5 it can be seen that the significance value of mucociliary transport time is 0.019 where the magnitude is <0.05. It can be concluded that there is a significant difference between the mucociliary transport time in smokers and non-smokers.

DISCUSSION

This study analyzed the effect of cigarette smoke on mucociliary transport in RA patients by comparing the results of the average mucociliary transport time in RA patients of smokers and non-smokers. According to the results from Riskesdas conducted by the Ministry of Health in 2013, the number of male smokers was 64.9% while female smokers were 2.1%^[2]. This is in accordance with the data obtained, namely all smoking RA patients in this study were male. Nasal mucociliary

transport is a cleaning system of the nasal mucosa that works by transporting foreign pathogens trapped in the mucous membrane and pushing them towards the nasopharynx. Mucociliary transport is a local defense function of the nasal mucosa [10]. Cigarette smoke reduces air resistance in the nose. Nasal mucosa exposed to cigarette smoke causes the nose to become runny and irritated. This is caused by allergic and hypersensitive responses. The nasal mucosa which is frequently exposed to cigarette smoke will have a longer mucociliary transport time. Decreased mucociliary transport function can be caused by changes in the composition and viscoelasticity of the mucous membrane or a decrease in the number of cilia. [11].

Mucociliary transport time under normal or healthy conditions has different results in several studies. Nasal septal deviation, chronic sinusitis, allergic rhinitis and smoking are considered ill conditions in adults [12]. According Sakakura et al (1992), the average mucociliary transport time in the age group 15-59 years is 13.7 ± 8.9 minutes [13]. According to research by Pandya et al (2006) in the age group of 18-60 years, the average mucociliary transport time in a healthy state is 9.5 ± 3.9 minutes [12]. In a study conducted by Sun et al (2002) the average mucociliary transport time in the healthy group was 4.30 ± 1.35 minutes and in the RA group it was 2.77 ± 0.76 minutes [13]. Through previous studies it can be concluded that the average mucociliary transport time under normal circumstances varies with an average of the fastest time of 4.30 minutes and an average of the longest time of 13.7 minutes.

The results of the saccharin test showed that the average nasal mucociliary transport time in smoking patients was 8.72 ± 2.09 minutes and in non-smokers patients was 4.82 ± 1.73 . According to research by Stanley et al (1986), the average result for smokers

was 20.8 ± 9.3 minutes. This proves that the average result of mucociliary transport in smokers is no more than 30 minutes [11].

There is a difference between the average mucociliary transport time of smokers and non-smokers, which is 3.89 minutes. This proves that there is a lengthening of the mucociliary transport time. This theory is supported by research from Stanley et al (1986) which shows an average difference of 9.7 minutes [11]. The results of this study prove the theory that cigarette smoke inhibits the mucociliary transport system, which can be seen from the lengthening of the mucociliary transport time.

In the study Proenca et al (2012) also showed a difference in the average mucociliary transport time in smokers and non-smokers of 2 minutes. in this study classified the degree of smoking from heavy, moderate and light smokers. Based on the results of a study by Proenca et al (2012) it was found that 13 heavy smokers, 22 moderate smokers, and 17 light smokers [15]. In this study the researchers did not divide the degree of smokers, so they could not know the degree of RA patients who were smokers. It is possible that there are more RA patients who are light smokers because in the results of the saccharin test, most of the results are not much different from the results of the saccharin test in non-smoker patients.

The results of the average mucociliary transport time in non-smoker RA patients can also be influenced by the degree of RA symptoms. Most non-smoker patients present with moderate symptoms so that the results of mucociliary transport time are close to those of smoker RA patients. [7]. Based on the results obtained, the mucociliary transport time in RA patients who smoke has been prolonged compared to non-smoker RA patients. When compared with the results of other

studies, the results of mucociliary transport time in RA patients who smoke are still within normal limits so they do not have a major clinical impact.

Through the Mann-Whitney statistical test, significant results were obtained with a significance value of 0.019. This is consistent with research conducted by Stanley et al (1986) with a significance value of 0.001^[11] and Proenca et al (2012) with a significance value of 0.04^[15] which showed a significant difference between the average mucociliary transport time in smokers and non-smokers.

CONCLUSIONS

There is a significant difference in mucociliary transport time between smoking RA patients where the mucociliary transport time of smoking patients are longer than that of non-smokers.

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