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Submission date: 24-Oct-2022 04:16PM (UTC+0700)

Submission ID: 1933840677

File name: The_decrease_in_bacterialcount_in_adult_chronic_rh.pdf (692.05K)

Word count: 2925

Character count: 15551

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To cite this article: N Qamariah *et al* 2019 *J. Phys.: Conf. Ser.* **1374** 012053

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The decrease in bacterial count in adult chronic rhinosinusitis patients after nasal irrigation therapy with NaCl 0,9% Solution

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Abstract. Rhinosinusitis is a disease in which there is inflammation of the nasal mucosa and paranasal sinuses. One of the treatments suggested by several ENT specialists for chronic rhinosinusitis is nasal irrigation. In nasal irrigation therapy, 0.9% NaCl solution has been shown to accelerate the time of mucociliary transport which has an indirect effect on bacterial growth, and to remove inflammatory mediators leading to a decrease in inflammation. This study aimed to provide evidence of a decrease in bacterial count in chronic rhinosinusitis patients after nasal irrigation therapy. The research method was descriptive analytical with a cross sectional approach. The study sample originated from adult chronic rhinosinusitis who were treated at the ENT Polyclinic of RSUD Ulin Banjarmasin, TK III Hospital, dr. Soeharsono Banjarmasin, and Banjarmasin harmony clinic in the period December 2018. Sampling was done by purposive sampling technique. The results showed that of the 7 samples tested there was a decrease in the number of bacteria after nasal irrigation therapy, showed a decrease of 38.08% and statistical tests showed a significant decrease in the number of bacteria after nasal irrigation therapy 0.9% NaCl solution ($p=0,0001$).

1. Introduction

Rhinosinusitis is a disease where inflammation of the nasal mucosa and paranasal sinuses occurs. Some of the causes of inflammation in rhinosinusitis are allergens, virus or bacterial infections, irritant substances, air pollution, extreme temperature changes, drought or high humidity. Inflammation of the mucosa causes stenotic sticking to the two opposite sides of the mucosa and cause mucociliary transport disorders, resulting in mucus retention and increasing bacterial colonization [1,2]

Chronic rhinosinusitis in adult patients is defined as an inflammatory disease involving inflammation of the nasal mucosa and paranasal sinuses with two or more symptoms more than 12 weeks, such as facial pain, facial congestion, nasal congestion, mucopurulent secretions, decreased olfactory ability and endoscopic or CT Scan examination findings. The incidence of rhinosinusitis in the United States based on National Health Interview Surveillance is estimated to be around 12.5% of the entire population of the United States or 31 million patients each year [3,4]



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The rhinosinusitis case in Indonesia based on data from the Ministry of Health of the Republic of Indonesia in 2003 stated that nasal and sinus disease was ranked 25th of 50 major ranking diseases or around 102,817 outpatients in hospitals. Data from the Department of Health, Ear, Nose, Throat, Head and Neck Surgery of Cipto Mangunkusumo Hospital showed a high incidence of rhinosinusitis, there were 300 (69%) out of 435 outpatients in rhinology polyclinic who came during the period of January-August 2005. In Banjarmasin the incidence of rhinosinusitis was quite high; in 2015 there were 303 sufferers. Based on the results of the medical record, the Ulin General Hospital in Banjarmasin shows that there are still many chronic rhinosinusitis patients with an average of 349 patients each year [3-5]

The bacteria that often cause rhinosinusitis are *Streptococcus pneumonia* (30-50%), *Haemophilus influenza* (20-40%), *Moraxella catarrhalis* (4%), and others such as *Staphylococcus aureus*, *Streptococcus haemolyticus*, and *Pseudomonas sp.* The results of the study by Kamath et al in 2013 were conducted on 100 people with common symptoms of headaches, other symptoms such as nasal congestion, repeated sneezing, and olfactory disorders, resulted 51.24% of anaerobic bacteria with the most bacteria were *Staphylococcus aureus* and *Klebsiella*. The results of the 2010 Mantovani et al study in patients with chronic rhinosinusitis were found to be 27.6% of *Pseudomonas aeruginosa*, 13.9% of *Staphylococcus aureus* and 10.4% of *Streptococcus pneumonia* [6]

The treatment of chronic rhinosinusitis has the aim of restoring the physiological function of the nose that is disrupted and overcoming the symptoms. The principle of managing chronic rhinosinusitis is to avoid, eliminate the causes of irritation and inflammation, and improve the defence function of nasal mucosilia. Standard therapy to relieve complaints of chronic rhinosinusitis is by giving antibiotics, decongestants, and anti-inflammatory; while the additional therapy is nasal irrigation. Nasal irrigation helps prevent intranasal stasis and reduces crusting, while increasing the efficacy of intranasal topical drugs and improving ciliary function. Increased cilia function can inhibit the growth of bacteria that cause chronic rhinosinusitis [3,7]

Some ENT experts recommend nasal irrigation as being treated for patients with acute and chronic rhinosinusitis, post nose and sinus surgery. But there is no consensus on uniformity regarding the protocols for nasal irrigation and how to use them, including the tools used for irrigation such as nasal spray, bulb syringe, snuffing, and cupped hand and other commercial tools [8,9]

It has been reported that saline solutions with various tonicity have an influence on the time of mucociliary transport. The results of the study suggesting that irrigation using soluble hypertonic saline improves the time of mucociliary transport, but that hypertonic solutions cause side effects in their use, including nasal burning, nasal irritation and irritation of the pharyngeal wall [10,11]

Min et al. (2001) conducted a study using saline solutions with various tonicity ranging from 0.06% - 7% to ciliary beat frequency (CBF) in vitro to the human nasal mucosa. It is reported that isotonic and hypotonic solutions such as 0.9% NaCl do not slow down cilia while hypertonic solutions (3% and 7%) result in ciliostatic. The use of 0.9% of NaCl solution will improve mucosilier clearance function which causes a decrease in bacterial colonization [10-13].

This study was conducted to prove a decrease in the number of bacteria in adult chronic rhinosinusitis patients after nasal irrigation therapy of 0.9% of NaCl solution. There has never been a previous study that examined the number of bacteria after the nasal irrigation therapy with 0.9% of NaCl solution, therefore this study was conducted as primary research.

2. Subject and methods

The method of this research is descriptive analytic with paired T-test and cross-sectional approach, here the study was conducted with the intention to determine the decrease in the number of bacteria in adult chronic rhinosinusitis patients after nasal irrigation therapy of 0.9% of NaCl solution. Sample collecting was done by doing a nose swab by an ENT specialist using a sterile cotton stick. After that, the cotton stick was put into the transport medium of the container and wrapped in aluminum foil, and put in an ice flask to be taken to the Microbiology Laboratory of the Medical Faculty, Lambung Mangkurat University, Banjarmasin. The samples were then planted on nutrient agar media and incubated for 24 hours at room temperature (27°C)

The calculation of the number of bacteria was conducted by counting the amount of bacterial colony that grew on nutrient agar media using colony counter. The next sample collecting was after the the nasal irrigation therapy with 0.9% of NaCl solution, in every day for a week.

3. Result and discussion

Research on decreasing the number of bacteria in adult chronic rhinosinusitis patients before and after nasal irrigation therapy has been carried out at ENT Polyclinics of Ulin General Hospital, TK III dr. Soeharsono Hospital, Harmoni Medical Clinic Banjarmasin in December 2018. The results of the research had seven samples of chronic rhinosinusitis patients that were given 0.9% of NaCl solutions therapy, with the calculation of bacteria's number shown in table 1. below.

Table 1. The amount of bacterial colony in adult chronic rhinosinusitis patients before and after the nasal irrigation therapy with 0.9% of NaCl solution.

Patient	The amount of bacterial colony		Decreasing percentage (%)
	Before nasal irrigation therapy	After nasal irrigation therapy	
1	68	44	35,29
2	42	29	30,95
3	31	17	45,16
4	47	28	40,43
5	52	31	40,38
6	65	36	44,62
7	37	26	29,73
	Decreasing average		38,08

Table 1 above shows that there was decreasing of the amount of bacterial colony in adult chronic rhinosinusitis patients after the nasal irrigation therapy with 0.9% of NaCl solution. The decreasing was at the average 38.08% of the total amount of the bacteri before given by nasal irrigation therapy, with the highest decreasing was at 45.16% and the lowest was at 29.73%.

Based on a research by Sofyan and Tabary, the decreasing happened because nasal irrigation therapy can fix the nasal mucocilier function by clearance irrigation, eliminate the inflammation mediator, moisturizing cavum nasi, and fixing mucocilier function that shown by increasing cilia's movement frequency. The fixing of mucocilier will prevent mucus retention and the forming of bacterial colony, as of there will be a decreasing of the amount of bacteria in that area. This is in accordance with the clinical conditions of these patients after being given irrigation therapy by using 0.9% of NaCL, the patient's complaints are reduced.[13-17]

The average decrease of the amount of bacterial colony in adult chronic rhinosinusitis patients after the nasal irrigation therapy with 0.9% of NaCl solution can be seen in Table 2 below.

Table 2. The average decrease of the amount of bacterial colony in adult chronic rhinosinusitis patients after the nasal irrigation therapy with 0.9% of NaCl solution.

	Before (Mean+SD)	After (Mean+SD)	P
N=7	48,86+13,825	30,14+8,395	0.0001

Statistical analysis result using paired T-test shows significant differences between before and after nasal irrigation therapy in adult chronic rhinosinusitis patients with value $p=0,0001$. This result showed that there was significant differences after being given by irrigation therapy of 0,9% of NaCl solution.

This result has a resemblance as Ferryan Sofyan research in 2017 that studied the effect of nasal irrigation therapy to the pH of nasal discharge; and also Hauptman research in 2007 of nasal irrigation to mucociliary clearance in chronic rhinosinusitis patients. That research resulted significant effect from nasal irrigation therapy to mucociliary clearance and the pH of nasal discharge. For normal people, nasal ciliary always should be covered by some mucus layer to keep it active, and the ciliary only works optimally in normal pH, 7 – 9. Outside that pH range, there will be decreasing of frequency and dryness that can harm ciliary. People with inflammation in nasal mucosa will have pH decreasing to range 5.5 – 6.5. Thus cause a decrease in the function of mucociliary transport. Within the increasing of nasal discharge pH after the therapy, ciliary in nasal can work effectively again. It also make the function of mucociliary improved and prevent mucus retention that can make the bacterial growth inoptimally.[17]

A research by Georitis et al reported that nasal irrigation therapy with normal saline solution can reduce the amount of histamine and leukotriene nasal significantly ($p < 0,5$) measured in rhinitis allergy patient at the 30 minutes, 4 and 6 hours after nasal irrigation. While a research by Tabary et al had result nasal irrigation with sea water physiologically can reduce kemokin IL-8 in order to reduce the inflammation in respiratory mucosa. Nasal irrigation with 0,9% NaCl solution has not been proved having effect in decreasing the amount of eosinofil. This happened because 0,9% NaCl solution only consists of natrium 3500 mg/L ion and chloride 5500 mg/L, while reducing inflammation mediator secretion and cell degranulation needs magnesium ion which are only contained in physiological seawater. The decrease of eosinofil amount in nasal irrigation therapy might happen because of the mechanical clearance by NaCl in nasal cavity. By the reduce of inflammation mediator in nasal irrigation therapy, the inflammation in nasal mucosa and paranasal sinus will be reduced, and prevent mucosa retention that leads to the reducing of bacterial colony and the decreasing of bacteria's amount.[18-20]

4. Conclusion

Based on the results, it can be concluded that there was a decreasing in the amount of bacteria in the samples from adult chronic rhinosinusitis after having nasal irrigation therapy of 0,9% NaCl solution, with the average decreasing was 38,09% and there was also significant decreasing of the amount of bacteria from statistic test results, $p = 0,0001$

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