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The role of Functional Endoscopic Sinus Surgery (FESS) to improve olfactory function in chronic rhinosinusitis patients without polyps



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ABSTRACT

Background: Olfactory dysfunction is one of the chronic rhinosinusitis symptoms. A large number of patients with chronic rhinosinusitis without polyps whose treated by Functional Endoscopic Sinus Surgery (FESS) need to be investigated using Sniffin' sticks test before and after surgery.

Objective: The aim of this study is to investigate the role of olfactory function improvement after FESS in patients with chronic rhinosinusitis without polyps.

Methods: This study is an experimental study using one group pre-post test design. The measurement of the threshold, discrimination, identification, and TDI scores were assessed by Sniffin' stick test in 3 periods (before FESS, 2 weeks and 4 weeks after FESS intervention).

Results: The mean value of the TDI score before FESS performed was 19.43 ± 7.32 (hyposmia), 2 weeks after the operation was 26.9 ± 5.78 (hyposmia), and 4 weeks after the operation was 33.25 ± 3.86 (normosmia). There is a significant mean difference in thresholds, discrimination, identification, and olfactory function (TDI) scores in patients with chronic rhinosinusitis without polyps before FESS, 2 weeks after the procedure, and 4 weeks after FESS.

Conclusion: There was a significant improvement in olfactory function after FESS performed in patients with chronic rhinosinusitis without polyps.

Keywords: Chronic rhinosinusitis, functional endoscopic sinus surgery, olfactory function, Sniffin sticks test

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INTRODUCTION

Chronic rhinosinusitis is a mucosal inflammatory disease that consist of inflammation of nasal and paranasal sinuses mucosa with symptoms occur in more than 12 weeks.^{1,2} High prevalence of chronic rhinosinusitis was reported by National Health Interview Survey in the United States (1996), reaching an estimate of 12.5% from the total population or 31 million cases per year.³ In Ciptomangunkusumo Hospital (RSCM) Jakarta (1995), chronic rhinosinusitis was reported to be at 2.8% from all of the polyclinic patients; meanwhile in Dr. Karyadi Hospital, Semarang, the prevalence was reported 2.6% from all ear nose throat (ENT) polyclinic patients.

In Dr. Sardjito Hospital, Yogyakarta from 2000-2006 the incidence was reported to at 2.5% - 4.6% of patients with RSK.⁴ According to Multazar (2011) chronic rhinosinusitis was reported to be 296 cases from 783 patients in H. Adam Malik General Hospital, Medan from 2008-2011.⁵

Chronic rhinosinusitis known as one of the causes of olfactory dysfunction. The diagnosis of chronic rhinosinusitis with olfactory dysfunction (hyposmia) is based on symptoms of rhinosinusitis for more than 3 months, nasal examination with endoscopy, paranasalis sinus computer tomography,

and olfactory dysfunction test. The nasal endoscopic examination was performed before the surgery was done.⁶ Delank and Stoll reported that out of 80% of patients with chronic rhinosinusitis who were treated by Functional Endoscopic Sinus Surgery (FESS) for either hyposmia or anosmia treatment, 70% of them had shown improvements in olfactory function after the surgery.⁷

Hyposmia in sinonasal diseases such as chronic rhinosinusitis is caused by inflammation of the airway which reduced airflow and odor to the olfactory mucosa. Olfactory dysfunction both of hyposmia and anosmia in chronic rhinosinusitis can be either conductive or nerve disorders.⁸ The olfactory examination is divided into the subjective and objective examination. The subjective olfactory examination is performed using Sniffin' sticks test.

Sniffin' sticks test is done by using many fix pen-shaped n-butanol pens, which contain specific odors in different concentration. This test assesses the ability to detect odor threshold, distinguish different odor discrimination, and the ability to identify odor identification. Objective olfactory examination consists of odor event-related potentials (OERPs) and electro-olfactogram (EOG).⁹ The composite of odor threshold (OT), odor

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discrimination (OD), and odor identification (OI) score are calculated as TDI score, which is ≤ 15 for anosmia, ≥ 30 for normosmia, and among for hyposmia.¹⁰

A study conducted by Nohong et al. (2014) checking olfactory function using Sniffin 'sticks test in pre and post operative shows an increasing mean of OT score between pre-operation (2.92 ± 1.27) and post-operation (13.18 ± 2.55). Olfactory dysfunction in chronic rhinosinusitis is conducted by inflammation and blocking of air flow conduction from the nasal cavity to olfactory neuroepithelial. This is the leading cause of hyposmia in chronic rhinosinusitis patients with TDI score of 25.52 in pre-operation. After the operation, the TDI score increased to 43.41 (normosmia).¹¹

Katotomichelakis et. al (2012) also found an increasing OT score post FESS intervention. The study was performed on 116 patients at 36-55 years old using Sniffin 'sticks test before and after four weeks post FESS surgery. The mean threshold score before surgery in a patient with age less than 35 y.o was 13.87 ± 7.21 and after FESS increased to 26.87 ± 9.65 . For patients aged 36-55 years old, the mean was 9.00 ± 5.99 and after FESS was 22.10 ± 11.03 . For patients aged more than 55 years old, the mean TDI before surgery was 10.71 ± 8.58 and after operation was increased to 20.00 ± 11.91 .¹²

An early decline in olfactory function can be found on the 10th day after surgery; it is due to post operation blood clotting accompanied by wound healing period. After that period, quality of olfactory function increased significantly compared before FESS, and the best results were seen 3 months after FESS intervention.¹³

Age is an important factor of olfactory dysfunction, the high prevalence of olfactory dysfunction ($> 80\%$) was found at 65-80 years old. Characteristics and etiology of cognitive impairment in chronic rhinosinusitis are generally at 20-60 years old, and over 65 years old, there is significant decreasing of olfactory function.^{8,14} Congenital factors, verbal ability, and hormonal effects are believed to be important factors of higher olfactory sensitivity in women than men.¹⁵

Since the data of FESS surgery in chronic rhinosinusitis has not been completed in previous decades and the role of FESS was remained uncompleted, this research aimed to study the role of FESS to improve olfactory function in chronic rhinosinusitis patients without polyps before and after the procedure was done.

METHODS

This study is an experimental study using pre-post-test design and was conducted in H. Adam Malik

Hospital, Medan from June to July 2016. Many olfactory function scores (OT, OD, OI, and TDI) was measured before FESS performed. A sample of 10 chronic rhinosinusitis without polyps patients who were indicated for surgery and had fulfilled the inclusion criteria was selected by consecutive sampling.

The inclusion criteria were: the range of age of the participants should be between 20 – 60 years old, indicated for FESS intervention, and have signed the inform consent. The exclusion criteria were patients with hypertension, allergic history, smokers, history of exposure to the toxic substance, had a history of head trauma, patients with intranasal and intracranial tumors, chronic rhinosinusitis with polyps.

Measurement of threshold, discrimination and identification score were done 3 times, before the intervention, two weeks after FESS, and four weeks after FESS using Sniffin 'sticks test. The variables in this study consist of independent variables (FESS) and main dependent variable (OT, OD, OI, and TDI scores). The additional dependent variable was age, sex, and main complaint. The data were analyzed in SPSS.22.

RESULT

The study result showed that most patients with chronic rhinosinusitis were 31-40 years old as many as 6 patients (60%), 2 patients (20%) aged between 20-30 years old and 2 patients (20%) aged between 51-60 years old. Most of the sample were women (60%). The most common complaints were a nasal blockage, headache, and post nasal drip which found in all samples (100%), followed by a runny nose (60%), and halitosis (40%).

Table 1 Baseline Characteristics of the Samples

Characteristics of Respondents	N	%
Age		
20 – 30 Years	2	20
31 – 40 Years	6	60
41 – 50 Years	0	0
51 – 60 Years	2	20
Gender		
Male	4	40
Female	6	60
Complaint		
Blocked nose	10	100
Headache	10	100
Runny nose	6	60
Post-Nasal Drip	10	100
Breath odor	4	40

Table 2 Mean difference of OT score before FESS intervention, 2 weeks, and 4 weeks after FESS

	Right Nose	p	Left Nose	p
Pre-operation	3.35±1.65	<0.001 ^a	2.43±1.37	<0.001 ^b
2 Weeks Post-FESS	6.85±2.52		6.1±3.49	
4 Weeks Post-FESS	9.45±3.25		8.95±3.33	

a.Friedman, b.Repeated ANOVA

Table 3 Mean difference of OD score before FESS, 2 weeks and 4 weeks after FESS

	Right Nose	P	Left Nose	p
Pre-Operation	7.6±4.45	0.007 [*]	7.2±3.71	0.001 [*]
2 Weeks Post-FESS	10.4±2.68		9.4±2.41	
4 Weeks Post-FESS	11.9±2.33		11.±2.08	

*Repeated ANOVA

Table 4 Mean difference of OI score before FESS, 2 weeks and 4 weeks after FESS

	Right Nose	p	Left Nose	p
Pre-operation	10.2±3.19	<0.001 [*]	9.8±3.05	<0.001 [*]
2 Weeks Post-FESS	11.6±2.07		11.5±2.07	
4 Weeks Post-FESS	12.9±1.52		12.8±1.4	

*Friedman

Table 5 Mean difference of smelling function (TDI) score before FESS, 2 weeks and 4 weeks after FESS

	Right Nose	p	Left Nose	P
Pre-Operation	21.15±8.49	0.004 [*]	19.43±7.32	0.001 [*]
2 Weeks Post-FESS	28.95±4.79		26.9±5.78	
4 Weeks Post-FESS	34.25±2.7		33.25±3.86	

*Repeated ANOVA

Table 2 shows an increasing olfactory threshold score, as seen improvement after the second week of surgery through the fourth week. The result of statistical analysis showed there was a significant difference among mean of the OT score from three observational periods ($p < 0.05$).

Table 3 showed improvement of odor discriminating in patients treated by FESS. Based on a statistical test using repeated ANOVA showed that there are significant mean differences of OD score before the operation, 2 weeks, and 4 weeks after FESS intervention ($p < 0.05$).

Increasing of OI score in patients who were treated by FESS was reported in table 4, as seen from the significant increase after the second week of surgery through the fourth week ($p < 0.05$). Table 5 shows improvement in the olfactory function, as seen from the mean of TDI score which increased after the second week of surgery until the

fourth week. There are significant mean differences of TDI score ($p < 0.05$) after analyzed by repeated ANOVA test.

DISCUSSION

Our study was conducted in patients with chronic rhinosinusitis without polyps in 10 subjects. All the OT, OD, OI, and TDI scores before FESS, two weeks after, and four weeks after FESS performed was measured and showed a significant improvement in olfactory function.

Most of the chronic rhinosinusitis patients were in middle year grouping (31-40 years old), and most of the patients are female. Many symptoms indicate chronic rhinosinusitis. In our study, we found that the most common complaints were a nasal blockage, headache, and post nasal drip which presents in all patients (100%). These results were similar to a study conducted by Nohong et al. (2014) from 40 subjects of chronic rhinosinusitis with the acquisition of the highest number of subjects aged 16-55 years old, clogged nasal complaints found in 18 patients (45%).¹⁰

This result also supported by Polzehl et al. (2006). This study was conducted in patients with chronic rhinosinusitis without a polyp. Mean age of the subjects was 39 years old (30-46 years) with major symptoms of nasal blockage in chronic rhinosinusitis patients without polyps, while in chronic rhinosinusitis with polyps obtained 78 subjects (91.8%) with no olfactory dysfunction (normosmia).¹⁶

The study results also showed significant mean differences of OT, OD, OI, and TDI scores pre-operation, 2 weeks after and 4 weeks after the operation. These were similar to study obtained by Nohong (2014) in 40 patients examined 2-times olfactory function using Sniffin Sticks test before FESS and 2 weeks after FESS. Almost all patients with chronic rhinosinusitis had hyposmia with pre-operative TDI score was 25.52 and TDI score post-operative was 43.41 (normosmia).¹¹ It concluded that there was a significant improvement in olfactory function in patients with chronic rhinosinusitis.

The study conducted by Katotomichelakis et al. (2012) also found increasing the TDI scores in patients treated by FESS, 116 patients (36.8%) obtained the mean of TDI score before FESS was 8.33 ± 7.16 (anosmia), one month after FESS was 19.18 ± 13.46 (hyposmia), and 3 months after FESS TDI score was 23.69 ± 12.40 (hyposmia), and 6 months after FESS the mean of TDI score was 26.94 ± 12.63 . It indicates an improvement of olfactory function in patients with chronic rhinosinusitis after FESS intervention.¹¹

CONCLUSION

This study showed a significant difference of overall and subscale scores of olfactory function before and after FESS performed, with TDI mean score before FESS was 19.43 ± 7.32 (hyposmia), 2 weeks after FESS was 26.9 ± 5.78 (hyposmia), and 4 weeks after FESS was 33.25 ± 3.86 (normosmia). Sniffin 'sticks test can be considered as an indicator of olfactory function improvement after FESS in chronic rhinosinusitis patients without polyps. It can be concluded that FESS plays an important role to improve olfactory function in chronic rhinosinusitis patients.

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