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Rhinomanometric Assessment of Nasal Airflow in Deviated Nasal Septoplasty and Coblation Turbinate Reduction

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ABSTRACT

Objective: *This research was carried out to study rhinomanometrically the nasal airflow in cases of deviated nasal septum linked with inferior turbinate hypertrophy. It also compared rhinomanometric improvement following surgery on nasal septoplasty and coblation associated with inferior turbinate reduction.* ***Materials and methods:*** *A descriptive cross-sectional method was used from January 2017 to September 2017 at ENT Hospital in Ho Chi Minh City, Vietnam. The study included 42 patients who underwent nasal septoplasty and coblation inferior turbinate reduction. The patients were interviewed and observations were noted down in SNOT-22 questionnaires. Rhinomanometry was used to carry out the assessments of preoperative and postoperative nasal airflow.* ***Results:*** *The total number of patients was 42, including 31 males and 11 females, and their average age was 33.56 ± 11.59 years. The preoperative assessment results show that the SNOT-22 mean score was 6.38 ± 3.10, the nasal airflow value was 461.17 ± 110.84 cm^3/s, and its resistance value was 0.35 ± 0.07 $Pa/cm^3/s$. The postoperative assessment results indicate that the SNOT-22 mean score was 1.78 ± 1.66, the nasal airflow value was 977.26 ± 155.84 cm^3/s, and its resistance value was 0.16 ± 0.03 $Pa/cm^3/s$. The results suggest that nasal airflow and resistance improved by 2.12 and 2.18 times, respectively.* ***Conclusion:*** *Rhinomanometry is an objective, reliable and useful method to evaluate preoperative and postoperative nasal obstruction condition of patients. It should be used as a routine assessment instrument for patients who are selected for operation.*

Keywords: Coblation turbinate reduction, Nasal airflow, Nasal septoplasty, Rhinomanometric assessment

INTRODUCTION

The nasal septum comprises of bone and cartilage. These parts may be deviated, causing obstruction. Because of the unbalanced development of the nasal septal cartilages and bones, the palatine crest and nasal septum fail to merge. This trauma can happen when children are born. The nose, which is the most prominent feature of the face, can easily be deformed, caused by accidents.

The nose has 3 parts: the nasal vestibules, the valves, and the turbinates [1]. The nasal valves are part of the nasal septum. The turbinates, especially the inferior turbinates, are covered by mucus, with an expansive capacity that allows them to increase or decrease in size, enabling the nasal resistance [1]. Therefore, nasal septum and inferior turbinate hypertrophy can affect the nasal patency and increase the nasal resistance of patients who suffer from nasal congestion.

Active or passive techniques may be used to perform rhinomanometry [2]. The active rhinomanometry is used to measure the airflow and air pressure during spontaneous breathing. The passive rhinomanometry, on the other hand, is used to measure a fixed amount of air that the patient blows through one or both nostrils via an external nozzle, while holding his/her breath. Passive rhinomanometry is rarely used because it causes the hypertrophy of the nasal mucous membrane. Active rhinomanometry, however, depending on the position of the sensor, may be used to perform anterior or posterior approaches.

The purpose of our study was to evaluate the outcome of nasal septoplasty through inferior turbinate reduction. The results of this study can help in evaluating patients' improvement and inform future studies. It can particularly help evaluate rhinomanometry improvement following nasal septoplasty and collation inferior turbinate reduction. It can also provide useful insights as to whether rhinomanometry is useful for better case selection in decisions concerning operations.

MATERIALS AND METHODS

Study Design

This research was conducted to study the nasal airflow by rhinomanometry in cases of the deviated nasal septum and inferior turbinate hypertrophy and to compare rhinomanometric improvement following surgery. The design involved a descriptive cross-sectional investigation in which 42 patients, aged 16 years old and above, were randomly sampled based on the ratio of patients who had improved nasal congestion after nasal septoplasty and turbinal reduction. Buckland, et al., the sampling method was used [3].

Study participants included individuals who had undergone nasal septoplasty together with coblation inferior turbinate reduction from January 2017-July 2017 at ENT Hospital in Ho Chi Minh City. The patients were interviewed, and the SNOT-22 questionnaire was used to make notes of observations. Preoperative and postoperative assessments of nasal airflow were also performed by rhinomanometry.

Selection and Exclusion Criteria

To participate in this research, all the patients were required to be over 16 years old and suffered from persistent nasal obstruction, which was unresponsive to medical treatment. They had to have nasal septal deviation and inferior turbinate hypertrophy, but without any other lesions connected to nasal obstruction. They were also required to have nasal septoplasty and coblation turbinate reduction. They were not admitted to the study if any of the following comorbid local lesions were present such as acute and chronic rhinosinusitis, nasal polyposis, nasal tumors, and nasal valve diseases.

Data Collection and Analysis

Software SPSS version 23 was used to analyze the data. All analyses were weighted according to their records and information forms. Results were displayed as the mean ± standard deviation (quantitative variables), or frequency and percentage (qualitative variables). Research progress was comprised of 4 main steps. First, symptoms before and one month after surgery were assessed by SNOT-22 questionnaire to be used as a record. Rigid nasal endoscopy was used to examine and evaluate the types of nasal deviation and inferior turbinate hypertrophy. The patients were also requested to have rhinomanometry before and one month after surgery, and apply local decongestant Naphazoline 0.05% twice and each time for 5 minutes before and after the surgery. Finally, the measurements were taken systematically. The measurements were explained to the patients, and they were asked to sit comfortably in a straight-backed office chair. Strict adherence to these instructions was required to achieve accurate data. In this sitting position, one of each patient's nostrils was sealed with a nasal olive, which was connected to the pressure tube; the other nostril was sealed off with a tube connected to the machine. The nose must not be pressed because it may cause a deformity. This can be prevented by choosing the nasal olive size that fits patients' noses best.

RESULTS AND DISCUSSIONS

Preoperative Assessment

Data analysis was carried out for 31 male and 11 female patients with an average (and standard deviation) age range of 33.56 (11.59%) years for both sexes. The preoperative assessment results show that the time of nasal congestion ranged between 2-60 months, with most cases lasting for 24 months (61.90%). Approximately one-third of the patients experienced nasal congestion (Figures 1 and 2).

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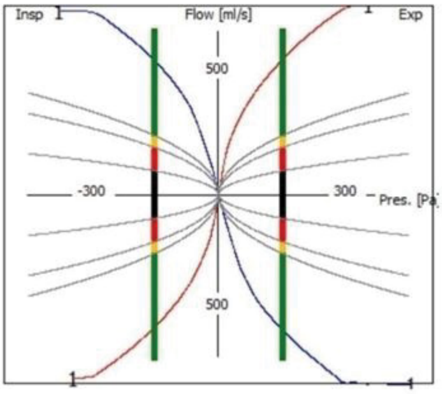

	Inspiration			Expiration			Unit
Pres.	75	150	300	75	150	300	Pa
Fl. L	398	570	774	400	576	800	ml/s
Fl. R	400	564	771	405	573	792	ml/s
Fl. L+R	798	1134	1545	805	1149	1592	ml/s
Fl. L/R	1.00	1.01	1.00	0.99	1.01	1.01	
Fl. L-R	-2.0	6.0	3.0	-5.0	3.0	8.0	ml/s
Fl. inc L		43	36		44	39	%
Fl. inc R		41	37		41	38	%
Fl.L/(R+L)	50	50	50	50	50	50	%
Fl.R/(R+L)	50	50	50	50	50	50	%
Res L	0.64	0.89	1.31	0.63	0.88	1.26	
Res R	0.63	0.90	1.31	0.62	0.88	1.28	

Total Obst. 1 :

Figure 1 Total 42 patients, 31 males and 11 females, with an average age range of 33.56 ± 11.59

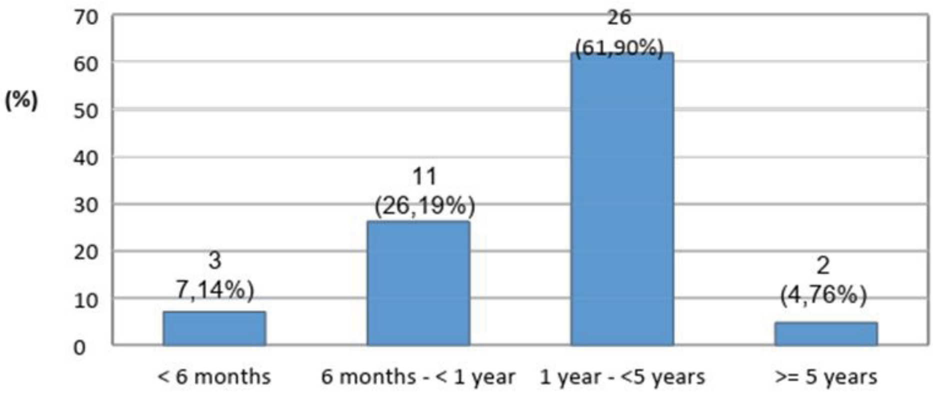

Figure 2 Time of nasal congestion

Before surgery, the SNOT-22 mean score was 6.38 (score range: 2-15) (Figures 3 and 4).

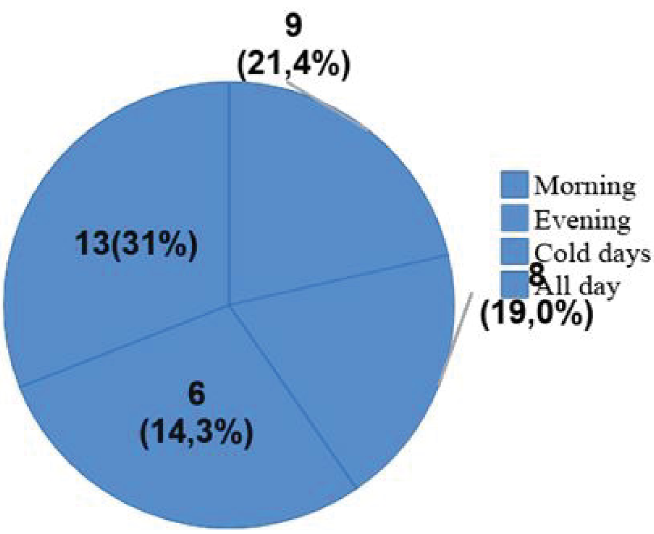

Figure 3 Time of nasal congestion

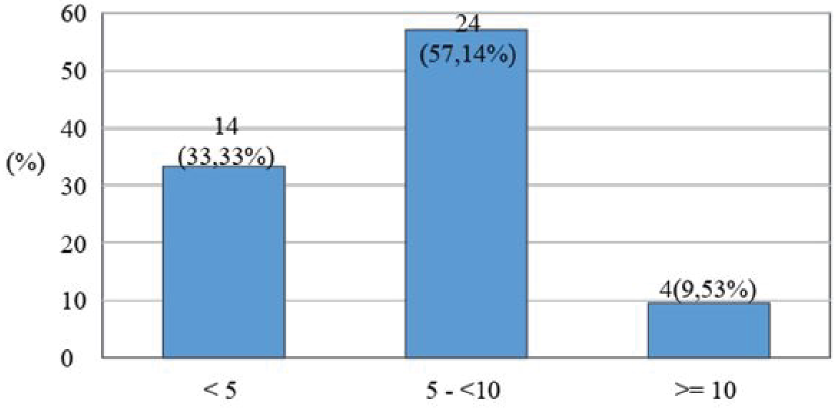

Figure 4 SNOT-22 scores

The most frequent symptom in 95.24% of the cases was the nasal obstruction, whereas a headache, facial pain, and insomnia ranked second (53.38%). These were followed by 26.19% of complaints about nasal discharge and fatigue, no record was found of mucous discharge, purulent discharge, hyposmia, tinnitus, earache, dizziness, nocturnal awakening, morning fatigue, arousal, and sadness (Figure 5).

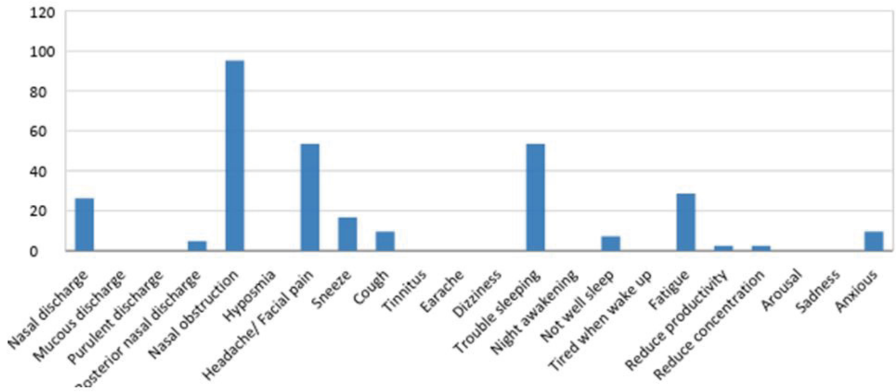

Figure 5 Frequency of symptoms

Compared with Buckland's, Pannu's, and Ha's studies, nasal obstruction, headache/facial pain, and nasal discharge were found to be the most common symptoms (Table 1) [3-5].

Table 1 The most common symptoms

Study	Symptoms		
	Nasal Obstruction	Headache/facial Pain	Nasal Discharge
Buckland (2003) [3]	72.50%	7.50%	20.00%
Pannu (2009) [4]	80.00%	12.50%	32.50%
Ha (2017) [5]	88.10%	30.95%	35.71%
Our study	95.24%	53.38%	26.19%

Types of the nasal spectrum, with 16 cases on the right side and 26 cases on the left, were divided into 4 groups: (a) C shape, (b) S shape, (c) Spur, and (d) Crest (Table 2).

Table 2 Types of nasal septum deviation

Side	Types of nasal septum deviation				
	C shape	S shape	Spur	Crest	Total (N=42)
Right	7 (28.0%)	1 (50.0%)	2 (100.0%)	6 (46.2%)	16 (38.1%)
Left	18 (72.0%)	1 (50.0%)	0 (0.0%)	7 (53.8%)	26 (61.9%)

SNOT-22 was used to score the postoperative assessment. The average score was 1.78, ranging from 0-6. This finding indicates that the SNOT-22 score for 27 patients (64.29%) decreased postoperatively, and the score for 11 patients (26.19%) was 0; while for one patient (2.38%) the SNOT-22 score remained unchanged postoperatively, for another patient it showed an increase (Figures 6-8).

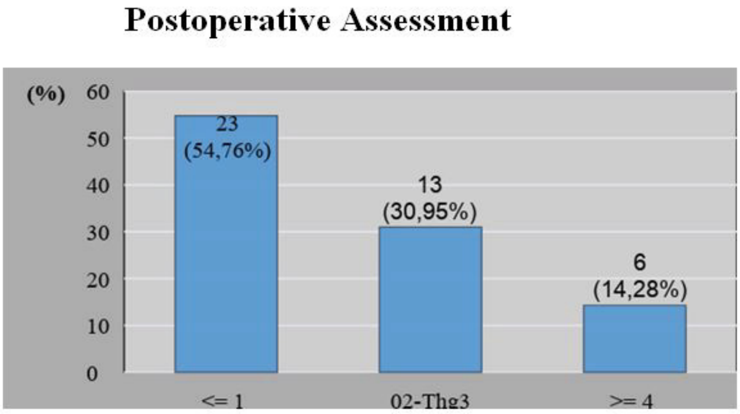

Figure 6 SNOT-22 scores

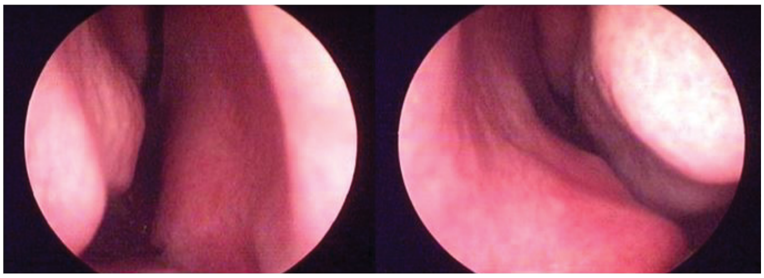

Figure 7 Preoperative nasal endoscopy

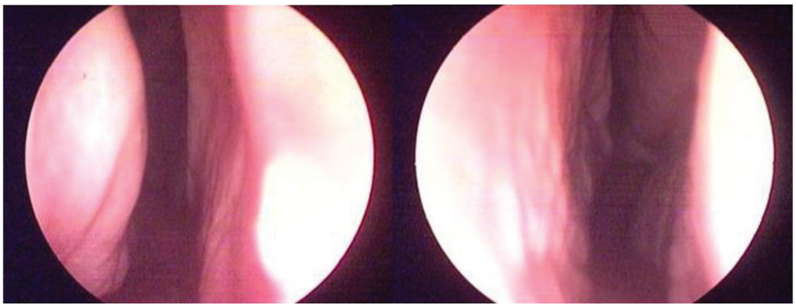

Figure 8 Post-operative nasal endoscopy

The findings of this study echo those of Buckland, Pannu, and Ha, in that the SNOT-22 scores sharply fall after operation (Table 3) [3-5].

Table 3 Comparison of SNOT-22 scores

Study	N	Preoperative	Postoperative
Buckland (2003) [3]	40	3.90	1.20
Pannu (2009) [4]	60	3.42	1.30
Statish (2013) [6]	70	3.30	1.10
Our study	42	3.25	1.25

The total pre and postoperative scores of FL.150 (average ± SD) were 461.17 ± 110.84 and 977.26 ± 155.84, respectively; the total scores of RES.150 (average ± SD) were 0.35 ± 0.07 and 0.16 ± 0.03, respectively (Table 4).

Table 4 Characteristics of rhinomanometry

Variables	Preoperative	Postoperative	p-value	Improvement (%)
FL.150L	221.93 ± 40.62	482.71 ± 76.67	<0.001	54.00%
FL.150R	240.12 ± 43.30	494.55 ± 82.45	<0.001	51.47%
Total FL.150	461.17 ± 110.84	977.26 ± 155.84	<0.050	52.81%
RES.150L	0.70 ± 0.14	0.32 ± 0.06	<0.001	54.26%

CONCLUSION

In conclusion, these data indicate that SNOT-22 scores (average ± SD) declined from 6.38 ± 3.10 to 1.78 ± 1.66 after surgery. Specifically, nasal airflow improved 2.12 times from 461.17 ± 110.84 cm^3/second to 977.26 ± 155.84 cm^3/second. Nasal air resistance, on the other hand, relieved 2.18 times from 0.35 ± 0.07 Pa/cm^3/second to 0.16 ± 0.03 Pa/cm^3/second. These data also suggest that patients' nasal patency nearly returned to normal, which means that the usual methods of nasal examination and rhinomanometry, in association with clinical evaluation, play a key role in selecting the right patients for surgery and evaluating the postoperative results.

DECLARATIONS

Conflict of Interest

The authors declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

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