INDEX COPERNICUS INTERNATIONAL

ORIGINAL ARTICLE

Association of breathing patterns and quality of life in patients with nasal obstruction

Adam Gałązka[1,4], Ewa Migacz[2], Andrzej Kukwa[3,4], Anna Czarnecka[5], Antoni Krzeski[2], Wojciech Kukwa[2,4]

[1]Department of Head and Neck Cancers, Memorial Cancer Center, Warsaw, Poland
[2]Department of Otorhinolaryngology, Faculty of Medicine and Dentistry, Medical University of Warsaw, Warsaw, Poland
[3]Department of Otolaryngology and Head and Neck Diseases, School of Medicine, University of Warmia and Mazury, Olsztyn, Poland
[4]Fundacja Zdrowy Sen, Warsaw, Poland
[5]Laboratory of Molecular Oncology, Department of Oncology, Military Institute of Medicine, Warsaw, Poland

Article history: Received: 03.08.2017 Accepted: 11.09.2017 Published: 28.02.2018

ABSTRACT:

Introduction: In the general population, nasal obstruction is a common complaint. However, an objective evaluation of nasal obstruction is difficult. Nose examination, computed tomography (CT), acoustic rhinometry, and anterior rhinomanometry do not accurately reflect the discomfort reported by patients with nasal obstruction. In patients with nasal obstruction, this study evaluated nasal breathing with a unique device for continuous nasal-oral spirometry – a nasal-oral flow analyzer (NOFA); moreover, quality of life was compared between patients with normal nasal breathing on NOFA and of those with impaired nasal breathing on NOFA.

Methods: Of 181 adult patients admitted to an ENT department due to nasal obstruction that were enrolled in the study, 97 (53.6%) completed all per-protocol assessments, including the SF-36 questionnaire and 3-hour, continuous nasal-oral spirometry with NOFA. Based on the presence of normal nasal breathing defined as ≥95% of nasal flow, the 97 patients were divided into those with normal nasal breathing (n=31) and impaired nasal breathing (n=66).

Results: Patients with normal nasal breathing differed from those with impaired nasal breathing with respect to all SF-36 subscales (physical functioning, p=0.004; role-physical, p=0.009; bodily pain, p<0.001; general health, p=0.007; vitality, p=0.002; social functioning, p=0.008; mental health, p=0.009; physical component summary, p<0.001; mental component summary, p=0.02), except for the role-emotional subscale (p=0.1).

Conclusions: Among patients with symptoms of nasal obstruction, compared to patients with normal nasal breathing, those with impaired nasal breathing had significantly lower quality of life in the physical and mental domains. Further research needs to determine whether NOFA can be used to diagnose nasal obstruction.

KEYWORDS: nasal- oral spirometry, quality of life, nasal breathing, oral breathing.

INTRODUCTION

In daily ENT practice, patients commonly complain of nasal obstruction. Nasal obstruction is defined as a subjective feeling of limitation of airflow through the nasal cavities, and it can be associated with nasal congestion or blockage, stuffiness, poor sleep quality, or difficulty with breathing during sleep [1]. Nasal obstruction can change the breathing pattern from the nasal to the nasal-oral or oral breathing patterns, which leads to many local symptoms, such as disturbed eating or smell, and general symptoms, such as sleep difficulties, stress, or impaired quality of life [1]. Nasal obstruction has many anatomical and physiological causes such as septal deviation, turbinate hypertrophy, nasal valve collapse, concha bullosa, nasal polyposis or choanal atresia, allergic rhinitis, chronic sinusitis, or medication-induced rhinitis. Mechanisms underlying nasal obstruction are complex; therefore, treating patients with nasal obstruction can be challenging, and surgery is not always effective [2]. No gold-standard method exists for an objective evaluation of nasal airway obstruction, the Nasal Obstruction

and Septoplasty Effectiveness (NOSE) scale or the visual analog scale (VAS) [3] can, however, determine symptom severity [4]. Because the existing diagnostic tools, such as anterior rhinomanometry or acoustic rhinometry, show insufficient agreement with subjective assessments of nasal obstruction [5], they are seldom used in clinical practice. Computed tomography (CT) and endoscopy may show anatomical blockades in the nasal cavities. However, these methods cannot adequately determine the obstruction level or predict the effect of surgical interventions because no normal range for nasal patency exists [6]. Nasal obstruction naturally leads to nasal-oral breathing. To date, no study has determined the proportion of nasal breathing to oral breathing in patients with nasal obstruction.

Among patients with nasal obstruction, this study aimed to compare quality of life measured with the SF-36 questionnaire depending on the breathing pattern assessed with a novel nasal-oral flow analyzer NOFA (Fig.1) [7].

METHODS

This prospective, cross-sectional study enrolled 181 patients admitted to an ENT office with complaints of nasal obstruction who were scheduled for septoplasty, with or without turbinoplasty. Of those 181 patients, 97 underwent all per-protocol assessments. These 97 patients provided basic demographic data (age, sex, weight, and height), completed the SF-36 questionnaire, and underwent nasal-oral spirometry with NOFA. Consent was obtained before enrolment.

Based on the presence of normal nasal breathing on NOFA that was defined as ≥ 95% of total airflow through the nose, the studied patients were divided into those with normal nasal breathing (n=31) and with impaired nasal breathing, i.e. <95% of total airflow through the nose (n=66).

SF-36

Among the studied patients, quality of life was assessed with the SF-36v2® Health Survey, licensed by Quality Metric; we used a validated version of SF-36v2® that was adapted for Polish patients. Each subject completed a hard copy of the questionnaire according to the producer's instructions, and SF-36v2®-related data were analyzed with an application available on the Quality Metric website.

The SF-36 survey consists of 36 items that measure functional health and well-being. SF-36 a generic health survey can be employed irrespective of age, diseases, and treatment. It provides scores for eight health domains: physical functioning (PF), 10 items; role-physical (RP), 4 questions; bodily pain (BP), 2 items; general health (GH), 5 items; vitality (VT), 4 items; social functioning (SF), 2 items; role-emotional (RE), 3 items; and mental health (MH), 5 items [1]. One question regarding health changes within one year is not included in the score. Of 36 items, 35 are used to calculate physical component summary (PCS) and mental component summary (MCS) scores. Higher scores represent better quality of life, with a maximal possible score of 100.

Ryc. 1. Urządzenie NOFA – jednoczęściowa silikonowa maska twarzowa (seria masek 7900 firmy Hans Rudolph Inc., USA) z przegrodą do przepływu powietrza drogą nosową i ustną. Przestrzeń martwa ustnych i nosowych głowic pneumotachograficznych wynosiła odpowiednio 40 i 3,4 ml. Zakres mierzonych przepływów wynosił odpowiednio 18 i 2 litry/sekundę. Dokładność pomiaru wynosiła ponad 98% dla każdego z nich.

NOFA

The NOFA method evaluates continuous flow of separated nasal and oral ventilations. The system is based on oral (MES DV40) and nasal (MES DV33) pneumotachographic transducers connected to a silicone facemask (Fig. 1) that separates the oral and nasal breathing routes.

Patients underwent the NOFA assessments in a supine position. Tidal volume, inspiratory time, expiratory time, and peak inspiratory and expiratory flow were recorded for each breath. The recorded data were processed with a custom, Windows-compatible computer software and presented numerically and graphically. The NOFA assessments lasted 3 hours to account for the nasal-cycle-associated airflow changes and other potential flow disturbances.

RESULTS

The mean patient age was 47.7±2.3 years, the mean BMI, 28.4±0.8. Table 1 presents demographic and clinical characteristics of patients with normal and impaired nasal breathing.

Tab. I. Demographic and clinical characteristics of patients with normal and impaired nasal breathing (N=97).

VARIABLE	NORMAL BREATHING	IMPAIRED BREATHING	P – VALUE
N	31	66	-
Sex (female/male)	9/22	27/39	0,26
Mean age (SD)	48,1 (17,1)	44,3 (15,4)	0,26
BMI (SD)	28,2 (6,4)	29,1 (6,2)	0,49
Mean nasal tidal volume (l)	0,38 (0,15)	0,26 (0,16)	<0,001
Mean nasal tidal volume / Mean tidal volume	0,98 (0,01)	0,62 (0,26)	<0,001

Normal breathing defined as ≥95% of total airflow through the nose
Impaired breathing defined as <95% of total airflow through the nose

Table 2 presents quality-of-lie scores for patients with normal and impaired nasal breathing.

Table 2 presents quality of life scores for each group. Patients with normal nasal breathing differed from those with impaired nasal breathing with respect to all SF-36 subscales, except for the role-emotional subscale (p=0.1). Between these two groups, the mean differences of SF-36 subscale scores ranged from 3.8 (RE) to 8.8 points (BP); the mean difference of PCS scores was 5.9 points, and of MCS scores, 4.5.

DISCUSSION

Because the nose and the nasal airway are complex structures, evaluation of nasal obstruction is challenging. There are three types of tools for measuring nasal obstruction: patient-derived (VAS, NOSE scale), physician-observed (anterior rhinoscopy, Cottle maneuver), and objective tools (pure nasal flow [PNF], rhinomanometry). Thus, choosing an appropriate method to evaluate nasal obstruction can be difficult [9]. Among the many causes of nasal obstruction, nasal septum deviation is the most common, and it can be treated with surgery. However, evidence from studies that used objective airway assessments for determining the benefit of septal surgery is insufficient [10, 11]. Moreover, methods measuring nasal obstruction such as acoustic rhinometry, anterior rhinomanometry, and peak nasal inspiratory flowmetry are seldom used pre- and post-operatively due to a lack of established reference values [12]. Thus, new methods for assessing nasal flow that could overcome these drawback are needed.

Among patients with nasal obstruction, this study showed that the NOFA method distinguished between patients with nasal and those with nasal-oral breathing, which could serve as a measure of nasal obstruction. NOFA-based assessments are simple, non-invasive, and inexpensive. In patients with nasal obstruction, the NOFA method, being complimentary to imaging studies, could be included in pre- and postoperative workups. The main disadvantage of the NOFA procedure is its 3-hour duration. Moreover, the NOFA, being purely functional, cannot locate the obstruction site. To date, few published studies have assessed upper-airway flow patterns; these studies measured either peak nasal inspiratory flow or used bilateral simultaneous nasal spirometry [13-15]. Those methods might resemble the assessment of breathing patterns performed in this study; however, those are short-time studies or even single-breath analyses.

Patients complaining of nasal obstruction may have lower general quality of life [16], which does not necessarily improve after nasal surgery [2, 17, 18]. Among patients with nasal obstruction, this study found significant differences in quality of life between patients with normal breathing and those with impaired nasal breathing. The SF-36 questionnaire was used in our study because it measures general physical and mental health. In addition to assessing nasal symptoms, this study comprehensively evaluated the aspects of well-being. Patients with nasal-oral breathing scored lower than subjects diagnosed with nasal breathing in the questionnaire, which indicated that their quality of life was worse . Although many scales assess quality of life and symptoms in patients with nasal obstruction, such as the NOSE scale, VAS, Rhinoconjunctivitis Quality of Life Questionnaire, Sinonasal Outcome Test-16, or 20-Item Sino-Nasal Outcome Test [19-23], this study used the SF-36 survey to assess both physical and mental health. Our findings show that, in patients with nasal obstruction and impaired nasal breathing, both physical and mental health is impaired, with the physical health affected to a greater extent.

CONCLUSIONS

Among patients with symptoms of nasal obstruction, those with impaired nasal breathing determined with objective measurements had a significantly lower general quality of

Tab. II. Mean SF-36 scores in patients with normal and impaired nasal breathing (N=97).

SF-36 QUESTION SCORE	NORMAL BREATHING	IMPAIRED BREATHING	P-VALUE
Physical functioning	51.6 (6.56)	47.4 (8.24)	0.0036
Role-physical	46.0 (10.76)	41.7 (8.57)	0.0098
Bodily pain	52.6 (8.90)	43.7 (10.47)	0.0001
General health	47.5 (9.45)	42.4 (9.33)	0.0075
Vitality	51.9 (11.73)	45.6 (9.41)	0.0016
Social functioning	48.2 (12.52)	42.7 (11.30)	0.0083
Role-emotional	48.8 (10.94)	45.0 (11.78)	0.0989
Mental health	47.8 (10.78)	42.7 (9.33)	0.0088
Physical component summary	50.5 (6.00)	44.6 (8.33)	0.0004
Mental component summary	48.2 (12.39)	43.6 (11.26)	0.0200

Normal breathing defined as ≥95% of total airflow through the nose
Impaired breathing defined as <95% of total airflow through the nose

life compared to patients with normal nasal breathing. The NOFA method might be a valuable diagnostic tool for assessing breathing patterns in patients with breathing difficulties due to nasal obstruction. The NOFA method can also be considered for an overnight evaluation of breathing dysfunction during sleep.

REFERENCES

1. Trabalon M., Schaal B.: It takes a mouth to eat and a nose to breathe: abnormal oral respiration affects neonates' oral competence and systemic adaptation. Int. J. Pediatr. 2012. 2012: 207605.
2. Akduman D. et al.: Patients` evaluation for the surgical management of nasal obstruction. Rhinology. 2013; 51 (4): 361–367.
3. Ng M. et al.: Global, regional, and national prevalence of overweight and obesity in children and adults during 1980-2013: a systematic analysis for the Global Burden of Disease Study 2013. Lancet. 2014; 384 (9945): 766–781.
4. Rhee J.S. et al.: A Systematic Review of Patient-Reported Nasal Obstruction Scores: Defining Normative and Symptomatic Ranges in Surgical Patients. JAMA Facial Plast. Surg., 2014.
5. Yepes-Nunez J.J. et al.: Assessment of nasal obstruction: correlation between subjective and objective techniques. Allergol. Immunopathol. (Madr.). 2013; 41 (6): 397–401.
6. Moore M., Eccles R.: Normal nasal patency: problems in obtaining standard reference values for the surgeon. J. Laryngol. Otol. 2012; 126 (6): 563–569.
7. Kukwa A., Galazka A., Krzeski A., Kukwa W.: A new approach to studying the nasal and oral breathing routes. Otolaryngologia Polska. 2014; 68 (3): 112–118.
8. Stuck B.A., Maurer J.T.: Recent developments in the diagnosis and treatment of obstructive sleep apnea: English version. HNO. 2017; 65 (1): 13–18.
9. Keeler J., Most S.P.: Measuring Nasal Obstruction. Facial Plast. Surg. Clin. North Am. 2016; 24 (3): 315–322.
10. Singh A. et al.: Is there objective evidence that septal surgery improves nasal airflow? J. Laryngol. Otol. 2006; 120 (11): 916–920.
11. Thulesius H.L., Thulesius H.O., Jessen M.: What happens to patients with nasal stuffiness and pathological rhinomanometry left without surgery? Rhinology. 2009; 47 (1): 24–27.
12. Pirila T., Tikanto J.: Acoustic rhinometry and rhinomanometry in the preoperative screening of septal surgery patients. Am. J. Rhinol. Allergy. 2009; 23 (6): 605–609.
13. Larsen K., Kristensen S.: The peak flow nasal patency index. Ear Nose Throat. J. 1992; 71 (1): 23–25.
14. Hanif J., Jawad S.S., Eccles R.: A study to assess the usefulness of a portable spirometer to quantify the severity of nasal septal deviation. Rhinology. 2003; 41 (1): 11–15.
15. Fyrmpas G. et al.: The value of bilateral simultaneous nasal spirometry in the assessment of patients undergoing septoplasty. Rhinology. 2011; 49 (3): 297–303.
16. Valls-Mateus M. et al.: Nasal obstructive disorders impair health-related quality of life in adolescents with persistent allergic rhinitis: A real-life study. Pediatr. Allergy Immunol., 2017.
17. Bulut O.C. et al.: Quality of life after primary septorhinoplasty in deviated- and non-deviated nose measured with ROE, FROI-17 and SF-36. Rhinology. 2017; 55 (1): 75–80.
18. Siegel N.S. et al.: Outcomes of septoplasty. Otolaryngol. Head Neck Surg. 2000; 122 (2): 228–232.
19. Stewart M.G. et al.: Development and validation of the Nasal Obstruction Symptom Evaluation (NOSE) scale. Otolaryngol. Head Neck Surg. 2004; 130 (2): 157–163.

20. Neck Surg. 2014; 150 (1): 139–147.
21. Juniper E.F., Guyatt G.H.: Development and testing of a new measure of health status for clinical trials in rhinoconjunctivitis. Clin. Exp. Allergy. 1991; 21 (1): 77–83.
22. Anderson E.R., Murphy M.P., Weymuller E.A. Jr.: Clinimetric evaluation of the Sinonasal Outcome Test-16. Student Research Award 1998. Otolaryngol. Head Neck Surg. 1999; 121 (6): 702–707.
23. Piccirillo J.F., Merritt M.G. Jr., Richards M.L.: Psychometric and clinimetric validity of the 20-Item Sino-Nasal Outcome Test (SNOT-20). Otolaryngol. Head Neck Surg. 2002; 126 (1): 41–47.

Word count: 1600 Tables: 2 Figures: 1 References: 23

Access the article online: DOI: 10.5604/01.3001.0011.5927 Table of content: https://otolaryngologypl.com/issue/11091

Corresponding author: Wojciech Kukwa, M.D., Ph.D.; Department of Otorhinolaryngology, Medical University of Warsaw, 19/25 Stepinska Street, 00-739 Warsaw, Poland; Phone/fax: +48 22 3186266; E-mail: wojciechkukwa@gmail.com

Competing interests: The authors declare that they have no competing interests.

Cite this article as: Galazka A., Migacz E., Kukwa A., Czarnecka A. M., Krzeski A., Kukwa W.: Association of breathing patterns and quality of life in patients with nasal obstruction; Otolaryngol Pol 2018; 72 (1): 11-15