ORIGINAL ARTICLE

AL-ANBAR MEDICAL JOURNAL
Anb. Med. J. 17(2): 55–58, 2021

Rhinomanometric Evaluation of Patients with Nasal Obstruction Before and After Nasal Surgery

Thenoon Y A. Alkuder[1,*] and Husam H. Salman[2]

[1] *Department of Surgery, Basrah Teaching Hospital, Basrah Health Directorate, Basrah, Iraq.*
[2] *Independent Researcher, Basrah, Iraq.*

(Received : 20 August 2020; Accepted : 16 November 2020; First published online: 24 November 2020)

ABSTRACT

Background: Nasal obstruction is a common complaint in daily Otolaryngology practice. Rhinomanometric study is an objective tool for the evaluation of nasal obstruction.
Objectives: To evaluate whether a correlation exists between the rhinomanomatric measurement of nasal resistance, nasal airflow, and the subjective sensation of airflow, pre and postoperatively.
Materials and methods: This study was conducted in the Otolaryngology Department at Basrah Teaching Hospital on 23 patients who prepared for nasal surgeries to improve their nasal obstruction complain. The study was covered the period of the 2004 year. The anterior rhinomanometry was done for all patients preoperatively (with and without decongestant) and post-operatively without decongestant.
Results: Out of 23 patients, 15 (65.2%) were males. The age ranged from 17 to 45 years with a mean of 25.5 years ± 7.019. The most common associated symptom with nasal obstruction was rhinorrhea (n=15, 65.2%). Only 12 cases were attended by the postoperative evaluation. Three-quarters of them were showed clinical improvement, but 4 patients (34%) were showed rhinomanometric improvement (P-value = 0.002). There was no statistically significant difference between the pre- and postoperative rhinomanometric values without decongestant and the subjective sensation (P-value>0.05).
Conclusion: The anterior rhinomanometry results didn't add a significant value to the clinical evaluation of the patients with nasal obstruction.

Keywords: Nasal obstruction; Rhinomanometry; Nasal surgery; Evaluation.

DOI: 10.33091/amj.2021.171070

INTRODUCTION

One of the most complaints in sinonasal lesions is a nasal obstruction which usually a subjective feeling is not completely matched with nasal cavity anatomical abnormalities. It can be defined as a discomfortable airflow either to inadequacy or increase the resistance of nasal airflow [1, 2]. To achieve a successful nasal surgery in these cases, one needs to formulate a surgical plan based on the relation between the underlying anatomical variations and the site of nasal obstruction [3]. In the past, the Otolaryngologist faced many technical difficulties in objective measuring of nasal flow resistance, in l870, they used the size of spot condensation on a cool mirror or glass slide as a quantitative measure of nasal airflow [4]. Rhinomanometry is an objective way of measuring the transnasal airflow and the pressure gradient. It can be done through the nose or mouth (anterior or posterior rhinomanometry). Recently, acoustic rhinomanometry is the most favored way in assessing the nasal airflow, resistance, and understanding of nasal airflow physiology [5–7]. We aimed to detect whether an association exists between the rhinomanomatric results of nasal resistance, nasal airflow, and the subjective sensation of airflow, before and after nasal surgery.

MATERIALS AND METHODS

This prospective study was conducted in the Otolaryngology Department at Basrah Teaching Hospital. 23 pa-

* Corresponding author: E-mail: thenoonyaseen@yahoo.com
Phone number: +964 07801274242

http://doi.org/10.33091/amj.2021.171070

tients were prepared for nasal surgeries (septoplasty or inferior turbinate surgeries or both) to improve their nasal obstruction complain. The study was covered the period from 1^{st} of January to 31^{st} December 2004. Informed consent was taken from each participant. The study was approved by the Iraqi Board for Medical Specialization.

Full history and ENT examinations were performed. Before we have progressed through our study, we used the ATMOS Rhinomanometer 300 on some patients and some normal persons to get familiar with the procedure and apparatus. The basic clinical technique of an anterior mask was chosen because it is reproducible and provides the data necessary for the clinical evaluation of nasal resistance. Nasal airflow was measured with a tightly fitted face mask applied to the subjects' faces. The trans-nasal pressure was measured at the nostril. The pressure measuring catheter passes through the mask and is attached to the nostril with a soft sponge bulb. A pressure-tight seal must be achieved at the nostril. The exclusion criteria were included in any subject with sinonasal tumors, nasal polyposis, pregnancy, hypothyroidism, and if the patients are taking aspirin

The method of Rhinomanometry was performed as follow: The patient waits for 30 minutes before the start of measurement, no tobacco or coffee taken before the test and sits in a comfortable chair, the procedure was explained to the patient to alleviate anxiety then the measurement of nasal resistance was done in the following sequence:

A. Right-sided nasal resistance (no decongestion).
B. left-sided nasal resistance (no decongestion).
C. 1% phenylephrine nasal drops on the cotton wick and wait 10 minutes.
D. Right-sided nasal resistance (after decongestion).
E. left-sided nasal resistance (after decongestion).

At the end of the procedure, all patients were given an appointment for postoperative assessment both clinically and rhinomanometrically, 3 months later. The data were analyzed using SPSS version 13. The results were put in simple tables as numbers and percentages.

RESULTS

The age of the patients was ranged between 17-45 years with a mean of 25.5 years ± 7.019. Fifteen of the subjects were males and 8 were females with a ratio of 1.8:1. Thirteen patients were from urban and 10 patients were from rural areas. The chief complaint of all patients (23) was nasal obstruction. The other associated symptoms were shown in Table 1.

Out of 23 patients, 19 had a positive correlation with Cottle's sign (82.6%). As seen in Table 2, 12 patients attended post-operatively, 9 (75%) of them had subjective improvement but only 4 of those 9 were documented their improvement rhinomanometricaly. Two patients (17%) remained in the same condition clinically but rhinomanometricaly had higher postoperative nasal airway resistance than preoperative value. One patient (8%) became worse postoperatively in both subjectively and objectively .

There was no significant difference between the preoperative and postoperative rhinomanometric values without decongestant and the subjective sensation as shown in Table 3.

Table 1. Associated symptoms of the 23 patients.

Associated symptom	Number	Percentage
Rhinorrhea	15	65.2
Postnasal drip	18	78.2
Sneezing	13	56.5
Snoring	11	47.8
Itching	14	60.8
Headache	18	78.2
Epistaxis	2	0.2

Table 2. Postoperative clinical and rhinomanometric results of the 12 patients.

Outcome	Clinical results Number/%	Rhinomanometric results Number/%	P-value
Improvement	9 (75)	4 (34)	0.002
Same condition	2 (17)	7 (58)	0.02
Worse	1 (8)	1 (8)	0.67
Total	12 (100)	12 (100)	

DISCUSSION

Obstruction of the nose is considered one of the most common problems during daily clinical Otolaryngology practice, and the surgical options of this complaint are included mainly septoplasty and/or inferior turbinate surgeries. Objective measurement of nasal resistance is crucial to the diagnosis of nasal dysfunction. It allows for the planning of appropriate treatment and the relation of the result after medical or surgical treatment [8]. The sensation of comfortable nasal breathing is usually affected by several physiological and pathological conditions that regulate the sum of airflow through the nasal cavity [9]. Several methods have been employed to study the correlation between the results of objective testing of the nasal airway and the symptoms of nasal obstruction. One method is to determine whether there is a difference between normal subjects and others with nasal obstruction. Another procedure is to study the relationship between nasal symptoms and objective test results with the aid of statistical methods that consider each person studied [9].

Roithmann et al. (1994) have correlated the subjective results of nasal patency and objective tests in 78 patients suffering from nasal obstruction [10]. Clement (1997) has emphasized the objective measurement of nasal obstruction by rhinomanometry, taking into consideration that the nasal obstruction is one of the cardinal symptoms in allergic rhinitis and the major symptom of the late-phase reaction by nasal provocation test [11]. Guyette and Smith (1997) have studied the effect of septal perforations on posterior and anterior rhinomanometric measures of nasal resistance in an analog model [12]. Kim et al. (1998) have used acoustic rhinometry and conventional rhinomanometry to investigate the relationship between the results of these objective tools and nasal obstruction [13].

Although there was a subjective improvement in the nasal airway in the majority of our patients, there was no statistically significant difference between pre-and post-operative rhinomanometric values (P-value>0.05). The reason for this subjective improvement postoperatively is unclear; it is prob-

http://doi.org/10.33091/amj.2021.171070

Table 3. Comparison between preoperative, postoperative values (without decongestant), and subjective sensation.*

Number of patients	Preoperative value			Postoperative value			Subjective sensation
	Left	Right	Total	Left	Right	Total	
1	7.5	0.81	0.73	1.25	0.32	0.26	Improvement
2	18.75	0.19	0.18	0.50	0.41	0.22	Improvement
3	0.25	0.47	0.16	0.60	0.38	0.23	Improvement
4	0.59	0.36	0.22	0.47	0.55	0.25	Improvement
5	0.28	0.24	0.24	0.44	0.45	0.22	Improvement
6	0.34	7.50	0.33	0.81	3.40	0.65	Improvement
7	0.64	4.16	0.55	0.83	1.63	0.55	Improvement
8	2.08	1.20	0.76	3.12	0.57	0.48	Improvement
9	0.54	1.04	0.35	0.64	1.97	0.48	Improvement
10	0.43	2.50	0.36	1.33	12.50	1.20	Same condition
11	0.55	0.42	0.23	1.38	0.38	0.52	Same condition
12	0.62	0.61	0.30	1.33	1.17	0.62	worse

* P-value >0.05

ably a placebo effect. Besides, Two patients (17%) didnt have any subjective improvement in the nasal patency and they were stayed in the same condition, while objectively they had high postoperative unilateral nasal airway resistance than preoperative values. Both of them were given a history of the prolonged application of nasal drops i.e. rhinitis medicamentosa might be the cause of such a result. One patient (8%) who was complained of nasal obstruction with normal airway resistance preoperatively was become worse postoperatively both subjectively and objectively which difficult to be explained, this finding might be attributed to a faulty surgical technique.

In our study, we were noticed that the correlation between the subjective sensation of nasal obstruction and rhinomanometric finding was better for unilateral than for total resistance, and this finding is consistent with John F. [9], Sipila [14], and R. Roithmann et al. [10]. We were found rhinomanometry after decongestion is a useful tool for selecting patients with structural abnormality who might benefit from septal surgery. Therefore, patients with high unilateral nasal airway resistance preoperatively had more subjective satisfaction postoperatively, although the difference between the use of decongestant and not statistically significant (P-value>0.05). Jone F. and his colleagues have thought that the large changes in resistance might be correlated symptoms, but small changes did not [9]. Dinis P.D and Haider H. (2002) have studied a long-term evaluation of results of septoplasty in 10 years retrospective study and concluded that the patients satisfaction didnt improve if rhinomanometry was included in the preoperative evaluation [15].

Rhinomanometry is particularly useful in the diagnosis of nasal obstruction due to dynamic changes in the nasal airway because rhinoscopic examination may not detect such abnormalities. This phenomenon may be due to localized obstruction in the nares region that leads to excessive negative pressure in the region of the vestibule and nasal valve during inspiration. The typical finding with such collapse in rhinometry is an asymmetric nasal pressure-flow curve. Because collapse occurs only during inspiration, inspiratory resistance is higher than expiratory resistance. Besides, collapse produces flow limitation that could be detected as a plateau on the pressure-flow curve. This phenomenon had not seen in our study. Rhinoscopy and objective test results could both provide different information about the nasal airway so by using both; the clinician might obtain a more complete understanding of the patient's nasal airway.

Despite rhinomanometry is an objective tool for detecting the severity of nasal obstruction, the clinical assessment is included anterior rhinoscopy and nasal endoscopy (flexible or rigid) remain essential tools for the identification and treatment of the causes of such problem. Besides, rhinomanometry doesn't add a diagnostic value to surgical treatment. Therefore, we need further investigations to identify a simple, easy, cheap, and effective clinical objective tool for the assessment of the nasal obstruction before and after surgery [16].

The limitation of the study was a small sample size. In conclusion, the objective evaluation by rhinomanometry had no significant role over the clinical evaluation by anterior rhinoscopy and/or nasal endoscopy in patients with nasal obstruction.

CONFLICT OF INTEREST

The authors declare that there is no conflict of interest.

REFERENCES

[1] H. Lara-Sánchez, C. Á. Nuño, E. G.-C. Sañudo, A. M. Iscar, and L. Á. V. Valdezate. Assessment of nasal obstruction with rhinomanometry and subjective scales and outcomes of surgical and medical treatment. *Acta Otorrinolaringol*, 68(3):145–150, 2017.

[2] J. J. Yepes-Nuñez *et al.* Assessment of nasal obstruction: correlation between subjective and objective techniques. *Allergol. Immunopathol. (Madr)*, 41(6):397–401, 2013.

[3] D. Widiarni, W. W. Paramyta, R. S. Wardani, and A. Bachtiar. Comparison of nasal obstruction symptom evaluation, peak nasal inspiratory flowmeter, and rhino-

http://doi.org/10.33091/amj.2021.171070

manometry in patients with nasal deformities. *Journal of Physics: Conference Series*, 1073(2):22024, 2018.

[4] S. Brescovici and R. Roithmann. Modified glatzel mirror test reproducibility in the evaluation of nasal patency. *Braz. J. Otorhinolaryngol*, 74(2):215–222, 2008.

[5] S. Canakcioglu, R. Tahamiler, G. Saritzali, H. Isildak, and Y. Alimoglu. Nasal patency by rhinomanometry in patients with sensation of nasal obstruction. *Am. J. Rhinol. Allergy*, 23(3):300–302, 2003.

[6] D. Demirbas, C. Cingi, H. Cakli, and E. Kaya. Use of rhinomanometry in common rhinologic disorders. *Expert Rev. Med. Devices*, 8(6):769–777, 2011.

[7] A. I. Mendes, G. F. Wandalsen, and D. Solé. Objective and subjective assessments of nasal obstruction in children and adolescents with allergic rhinitis. *J. Pediatr. (Rio. J)*, 88(5):389–395, 2012.

[8] L. Shemen and R. Hamburg. Preoperative and postoperative nasal septal surgery assessment with acoustic rhinometry. *Otolaryngol. Neck Surg.*, 117(4):338–342, 1997.

[9] J. F. Pallanch, T. V Mccaffrey, and E. B. Kern. Evaluation of nasal breathing function with objective airway testing. u: Cummings cw; fredrickson jm; harker al la [ur.]. *Otolaryngol. Head Neck Surgery, St. Louis, MO Mosby-Year Book*, 1998.

[10] R. Roithmann, P. Cole, J. Chapnik, S. M. Barreto, J. P. Szalai, and N. Zamel. Acoustic rhinometry, rhinomanometry, and the sensation of nasal patency: a correlative study. *J. Otolaryngol.*, 23(6):454–458, 1994.

[11] P. A. R. Clement. Rhinomanometry. *Allergy*, 52(26-27), 1997.

[12] T. W. Guyette and B. E. Smith. Effect of septal perforations on measures of nasal resistance. *Cleft palate-craniofacial J.*, 34(2):129–134, 1997.

[13] C. S. Kim, B. K. Moon, D. H. Jung, and Y.-G. Min. Correlation between nasal obstruction symptoms and objective parameters of acoustic rhinometry and rhinomanometry. *Auris Nasus Larynx*, 25(1):45–48, 1998.

[14] J. Sipilä, J. Suonpää, P. Silvoniemi, and P. Laippala. Correlations between subjective sensation of nasal patency and rhinomanometry in both unilateral and total nasal assessment. *ORL*, 57(5):260–263, 1995.

[15] P. B. Dinis and H. Haider. Septoplasty: long-term evaluation of results. *Am. J. Otolaryngol.*, 23(2):85–90, 2002.

[16] M. H. Dadgarnia, M. H. Baradaranfar, and M. Mazidi. Assessment of septoplasty effectiveness using acoustic rhinometry and rhinomanometry. *Iran. J. Otorhinolaryngol.*, 25(2):71, 2013.

http://doi.org/10.33091/amj.2021.171070