

Original Research Article

Peak nasal inspiratory flow: a comparative study in our day to day practice

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ABSTRACT

Background: The peak nasal inspiratory flow is an objective measurement of nasal airway obstruction. It also helps in assessing response to treatment regardless of etiology. With this background this study was undertaken to establish diagnosis and monitoring treatment efficacy of PNIF in patients of allergic rhinitis and deviated nasal septum.

Methods: This prospective observational study involved 150 subjects who were selected among the patients attending the outpatient department of ENT and Head-Neck surgery, All India Institute of Medical Sciences, Patna. Thorough history was taken of all patients followed by general systemic and ENT examination. Each subject was asked to complete a SNOT 20 questionnaire. SPSS software was used for data analysis.

Results: Out of total 150 subjects, 50 had deviated nasal septum (DNS), 50 had allergic rhinitis and 50 were normal subjects. Normal subjects had mean PNIF value 80 liter per minute with a range of minimum to maximum; 60 L/min to 150 L/min. Patients with symptomatic deviated nasal septum (DNS) had mean PNIF value 50 L/min with a range 20–80 L/min. Patients with symptomatic allergic rhinitis had mean PNIF value 65 L/min with a range of minimum 40 L/min to maximum 90 L/min.

Conclusions: On OPD basis, measurements of PNIF using Youlten peak flow meter can easily suggest anatomical & pathological variations in the nose and nasal cavity and can correlated well with patient's symptoms and severity.

Keywords: PNIF, Nasal obstruction

INTRODUCTION

Nasal breathing is a natural and fundamental way of breathing in human being after birth.¹ Apart from proper lung functioning and respiratory wellbeing other functions such as vocal resonance, nasal reflexes, swallowing, sleep quality, olfaction, aeration of paranasal sinuses and middle ear health depend on proper way of nasal breathing.¹

Due to this reason, measurement of nasal airway patency becomes important topic among otorhinologist worldwide. Therefore, the development of an objective

assessment technique for nasal function or nasal airway patency is fundamental to diagnose deviations from normal function.

Nasal permeability objective evaluation tests should be reliable, consistent, patient comfortable, accurate, standardizable, easily to perform, reproducible, clinically applicable and they should not interfere with the nasal anatomophysiology.^{2,3}

Rhinomanometry (RMM), acoustic rhinometry (ARM) and peak nasal inspiratory flow (PNIF) are popular objective methods currently used worldwide.

Rhinomanometry is a quick and reliable method which works on measurement of air flow velocity and pressure difference between atmospheric pressure and pressure at choanae.⁴ Acoustic rhinometry is a recognized method which works on computer analysis of reflection of sound which is created in nasal cavity. The analysis explains regarding geometry or cross sectional area of nasal cavity.

Both rhinomanometry (RMM) and peak nasal inspiratory flow (PNIF) have a good accuracy to detect nasal obstruction with sensitivity of 0.77 and 0.66 along with specificity of 0.8.^{1,5}

Peak nasal inspiratory flow (PNIF) is very simple, noninvasive, quick, easily applicable, inexpensive, and has sharp visible measurement with good reproducibility. The result obtain by peak nasal inspiratory flow (PNIF) is obvious and does not depend upon software analysis.

The peak nasal inspiratory flow is an objective measurement of nasal airway obstruction. It also helps in assessing response to treatment regardless of etiology.

With this background this study was undertaken to establish diagnosis and monitoring treatment efficacy of PNIF in patients of allergic rhinitis and deviated nasal septum.

METHODS

Study area

Department of ENT & Head Neck Surgery, All India Institute of Medical Sciences, Patna.

Study population

150 subjects were selected among patients attending the out-patient department of ENT and Head & Neck surgery, All India Institute of Medical sciences, Patna.

Sample design

- 50 subjects were normal volunteers having no nasal symptoms.
- 50 patients having allergic rhinitis without nasal polyposis.
- 50 patients having symptomatic deviated nasal septum.

Exclusion criteria

Exclusion criteria were patients with nasal polyposis; patients with bronchial asthma and other pulmonary diseases; subjects with smoking habit; patients /subjects having previous surgery for nose and paranasal sinuses.

Study period

1 year from November 2015 to November 2016.

Measurements

150 subjects were selected among the patients attending the outpatient department of ENT and Head-Neck surgery, All India Institute of Medical Sciences, Patna. All of them were in age group between 15 to 55 years.

It is a prospective observational study. Thorough history was taken of all patients followed by general systemic and ENT examination. Each subject was asked to complete a SNOT 20 questionnaire.⁵ A portable youlten peak flow meter was used for measurement of peak nasal inspiratory flow.⁵ The mask attached to the peak flow meter were chosen according to size of patients face. It has to be tightly fit on each subjects face without touching the nose. All subjects were tested while sitting and were encouraged to inhale as deep and fast as possible through the mask, keeping the mouth closed starting from the end of full expiration.⁵ Three satisfactory maximal inspirations were obtained and the highest of the three results was taken as the PNIF.⁵ SPSS software was used for data analysis.

RESULTS

Out of total 150 subjects, 50 had deviated nasal septum (DNS), 50 had allergic rhinitis and 50 were normal subjects. In these results, normal subjects had mean PNIF value 80 liter per minute with a range of minimum to maximum; 60 L/min to 150 L/min. patients with symptomatic deviated nasal septum (DNS) had mean PNIF value 50 L/min with a range 20 – 80 L/min. Patients with symptomatic allergic rhinitis had mean PNIF value 65 L/min with a range of minimum 40 L/min to maximum 90 L/min. On OPD basis measurements of PNIF using Youlten peak flow meter can easily suggest anatomical and pathological variations in the nose and nasal cavity and can correlated well with patient's symptoms and severity (Table 1).

Table 1: Distribution of subjects according to PNIF value.

Cases	n	Maximum PNIF (L/min)	Minimum PNIF (L/min)	Mean (L/min)
Deviated nasal septum (DNS)	50	80	20	50
Allergic rhinitis (AR)	50	90	40	65
Normal individual	50	150	60	80

DISCUSSION

PNIF collaborates with nasal pathology and the value can later act as reference value to measure effect of management both therapeutic and surgical. Purpose of study is to do objective and subjective evaluation of nasal obstruction and its severity with the help of PNIF.

In this study we focused on two conditions that contribute to nasal obstruction. Anatomical (deviated nasal septum) and mucosal inflammation (allergic rhinitis). PNIF value data obtained in maximum and minimum value. Patients of symptomatic nasal obstruction with structural deviation (DNS) have PNIF range 20-80 L/min, in which 80 L/min is maximum and 20 L/min is minimum with a mean 50 L/min. decreasing from 80 to 20 L/min designate the severity of deviated septum and nasal inflow. In Allergic rhinitis, nasal obstruction is because of mucosal inflammation, mucosal hypertrophy and mucosal hyper secretion. PNIF data obtained in range of 40-90 L/min, in which 90L/min is maximum value and 40 L/min is minimum value with a mean of 65 L/min. in allergic rhinitis PNIF value correlates with the severity of symptoms in sense of excessiveness of mucosal hypertrophy and hyper secretion. 50 volunteers included in this study without any nasal symptoms having PNIF range 60-150 L/min.

Range indicates the severity of symptoms and inspiratory effort in patients having nasal obstruction and in normal volunteers it indicates the maximal inspiratory effort for individuals.

Starling-Schwanz et al reported in their study that each subject has three satisfactory measurement of PNIF taken. The first one was lower than second and third significantly suggested that the raining effect. But there is no significant difference between second and third PNIF value.⁶ Wihl et al reported that repeated PNIF measurements had difference of 5 L/min one from another.⁷

Many article and research paper were published on PNIF in last few years which clearly indicate that evaluation of nasal patency by PNIF method is reliable and appreciable and Youtlen peak flow meter proved to be a reliable tool.⁸

Teixeira et al reported that PNIF value in nasal obstruction before and after using topical vasoconstrictor agent found that the PNIF value in pre-vasoconstriction was 151 L/min and in post-vasoconstriction was 178 L/min that measuring an average increase in 20%.¹ PNIF value tends to increase in proportion with age for boys and girls.⁸

Teixeira et al reported that PNIF study on 78 volunteers both male and female found mean PNIF for allergic rhinitis was 114.0 L/min, mean PNIF for deviated nasal septum was 135.3 L/min and mean PNIF for normal asymptomatic individuals was 154.3 L/min. the

difference was statistically significant which corroborates to the use of PNIF in the diagnosis of obstruction.¹ In contrast to this study, our study shows a comparative study of PNIF on 150 individuals both male and female. Out of 150 cases 50 had deviated nasal septum (DNS) and 50 had allergic rhinitis (AR). 50 asymptomatic volunteers were participated. The mean PNIF value for deviated septum (DNS) is 50 L/min and the mean PNIF for AR is 65 L/min. Normal volunteers has 80 L/min. These data definitely proved that the PNIF method is an excellent tool for the objective evaluation and diagnosis of nasal obstruction. Fairley et al 1993 achieved a good correlation by using PNIF and subjective scales of nasal symptoms in 169 individuals.⁹

PNIF is a simple procedure which can be used for all the patients having nasal obstruction and can assess the severity of symptoms objectively. It can be used as screening tool in opd or in home for the evaluation of nasal obstruction and assess its severity.^{10,11} It can be also used to assess the improvement after medical and surgical treatment of nasal obstruction and early recognize recurrence objectively in patients having nasal pathology. It can be used to counsel patients better.

PNIF also use to evaluate the efficacy of intranasal medication and assess nasal challenge test for allergen. In 2006 Munch SM reported in their study that PNIF become a useful tool to evaluate nasal obstruction in case of allergic rhinitis before and after treatment.¹²

Lund et al utilized the NIPF, together with the acoustic rhinometry to compare the response to intranasal treatment with fluticasone and beclometasone in the severe nasal polyposis. They found a mean NIPF increase after treatment, from 76 L/min after the symptomatic use of fluticasone and 69 l/min with beclometasone in relation to the basal values, showing a statistically significant difference between the two groups.¹³

The objective evaluation can also be accomplished by RMM and ARM. Previous studies of RMM and ARM demonstrated good correlation with nasal obstruction-related symptoms.¹⁴ RMM and ARM not only used for objective evaluation and monitor treatment response rather also contribute to fulfilling one of the criteria for diagnosing allergic rhinitis using the nasal provocation test.¹⁵

RMM and ARM is a worldwide recognized method to assess nasal obstruction and its severity. Although these methods are excellent to assess nasal obstruction but they are time consuming, expensive and need skilled. The use of a simple, easily applicable, inexpensive and reliable method for assessing nasal obstruction would be of value.¹⁶

Although the subjective evaluation can be made by SNOT questionnaire, VAS, anterior rhinoscopy, posterior

rhinoscopy and endoscopic examination. Otorhinolaryngologist always looks for objective evaluation.

We can increase our subjects for objective evaluation with the help of PNIF method regarding nasal obstruction by including patients of nasal obstruction other than DNS and AR as nasal polyposis, nasal bone fracture with hematoma, adenoid hypertrophy in children, non allergic rhinitis of all types and benign and malignant mass of nasal cavity initial stage.

PNIF method also uses to assess improvement or success of surgery in postoperative case of septoplasty and nasal polyposis.

CONCLUSION

This study clearly proved that PNIF is a reliable tool to assess nasal obstruction and its severity objectively and also have valuable role to assess the improvement of nasal obstruction after medical and surgical treatment.

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Ethical approval: The study was approved by the Institutional Ethics Committee

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