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Research Article

Objective and Subjective Evaluation of Nasal Patency Post Septal Surgery: A Single Center Case Series

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Abstract

Introduction: Nasal obstruction due to a deviated nasal septum is a common indication for nasal septal surgery. Thus, septoplasty is one of the most common procedures in otolaryngology practice. This is a clinical prospective case series study that subjectively and objectively assessed the impact of septoplasty and septorhinoplasty on nasal obstruction.

Materials and Methods: Patients undergoing septoplasty or functional septorhinoplasty after no clinical improvement of nasal obstruction with medical treatment were assessed by measuring the Peak Nasal Inspiratory Flow and using Sino-nasal Outcome Test-22 questionnaire before and three months after surgery.

Results: Twenty-five patients were included in the study. Pre- and post-operative measures showed statistically significant difference in the Peak Nasal Inspiratory Flow measurements with a mean increase of 38 (99% CI24-52, SD 24, $p < 0.001$) and in the Sino-nasal Outcome Test-22 questionnaire scores before and after surgery with a mean decrease of 26 (99% CI 32-19, SD 12, $p < 0.001$).

Conclusion: This study suggests that septoplasty and septorhinoplasty improve nasal breathing as well as related disease specific quality of life.

Keywords: Nasal Obstruction; Deviated Nasal Septum; Septoplasty; Septorhinoplasty; PNIF; SNOT-22

Abbreviations

PNIF: Peak Nasal Inspiratory Flow; SNOT-22: Sino-nasal Outcome Test-22

Introduction

Nasal airway obstruction can be defined as impaired nasal breathing described by patients as subjective uncomfortable feeling of insufficient nasal airflow [1,2]. It is a commonly reported symptom with a published prevalence of 26.7% in urban centers [2]. It can be attributed to anatomical or functional causes. Where anatomical causes mainly include [1-3]: deviated nasal septum, nasal valve dysfunction and hypertrophied inferior turbinates. Septal deviation is considered the commonest cause by many [3-5]. In a clinical survey [1] of 1906 patients published in 2018, nasal airway obstruction was attributed to septal deviation only and septal deviation combined with other anatomical factors in 5% and 76% of patients respectively. Deviated nasal septum if identified as an etiology can be corrected with nasal septal surgery as septoplasty, submucosal resection or functional septorhinoplasty. Thus, septal surgery is one of the most common procedures in otolaryngology practice. In England and Wales more than 20,000 septal corrections were performed between 2008 - 2009 [4]. In the United States, it ranked the third in the most commonly performed otolaryngology procedures [3]. Outcome of nasal septal surgery has been previously questioned due to the concern of no functional improvement versus sole cosmetic results [4,5]. Many studies investigated the

change in nasal patency post-surgical intervention. However, they varied in the outcome measure utilized. Several objective versus subjective tools have been described. Objective measures include: rhinomanometry, acoustic rhinometry and Peak Nasal Inspiratory Flow (PNIF) [4]. On the other hand, subjective measures are various standardized disease specific quality of life questionnaires and symptom severity scales. In our study we aimed to assess the impact of septoplasty and septorhinoplasty on nasal obstruction by comparing pre- and post-operative values of the Sino-nasal Outcome Test-22 (SNOT-22) questionnaire as a subjective measure and PNIF measurements as an objective measure.

Materials and Methods

Study design

The study was designed as a clinical prospective case series. Preoperatively the patients had to provide an informed consent indicating their free will to be enrolled in the study (form authorized by the Ethics committee of the hospital no. 15/31). They underwent nasal surgery as per their clinical indication where their enrollment did not affect their surgical management option. Post operatively, they received the standard post-operative nasal surgery care both in the inpatient and outpatient setting; where no intranasal splints were used, intranasal packs were used for the first 24 hours post op, the patient was kept in the hospital for the first post op day then discharged home and the follow up visits were scheduled at week one, first month and three months post op. The primary aim of the study was to subjectively and objectively assess the clinical outcome of septal corrective surgery namely: septoplasty and functional septorhinoplasty for those with nasal obstruction secondary to a deviated nasal septum that was not improving with medical treatment.

Patients sample

The patients were consecutively enrolled in the study from January to October 2015. Twenty-five patients referred to the otolaryngology out patients department with a complaint of nasal obstruction due to septal deviation planned to undergo septoplasty or septorhinoplasty were selected. We excluded patients: aged below 18 years, with previous septo- or septorhinoplasty, unable to understand the English SNOT-22 questionnaire, with concomitant functional endoscopic sinus surgery and who had contraindication for general anesthesia.

Intervention

Primary septoplasty or primary functional septorhinoplasty as per the clinical indication of each patient to correct the deviated nasal septum was done. Patients were operated under general anesthesia. Septoplasty was done using open classical hemitransfixation approach with correction of deviated septal parts. Rhinoplasty was done via an external approach.

Outcome measures

The primary outcome of interest was change of nasal patency and improvement of nasal breathing. We measured two outcome measures: objectively the PNIF and subjectively the SNOT-22 quality of life questionnaire. Both were measured pre-operatively and at three months post-operative follow up visit. PNIF measurements were taken using a portable peak inspiratory flow meter by the principal investigator in all the cases. Patients were asked to exhale fully and hold their breath then inhale forcibly through the nose for one second. Measurement was repeated three times and the highest result was recorded. Mask was disinfected between the patients. Pre-operatively readings were recorded before and five minutes after decongesting the nose using a nasal spray of combined lignocaine and phenylephrine with concentration of 50mg/ml and 5mg/ml respectively. Pre-operatively post decongestion measurement was used for analysis. The SNOT-22 questionnaire was handed to the patients to be filled independently. Surgical improvement was evaluated based on the total score.

Statistical analysis

The data analysis was done using Stata 15 statistics/data analysis package. Data was tested for normality using skewness/kurtosis tests for normality and Shapiro-Wilk test for normal data. Our null hypothesis stated that there is no statistical difference in the means before and after surgery. It was tested using paired t test. A p-value lower than 0.01 was defined for significance.

Results

Our study sample included twenty-five patients with twenty males and five females. Their age ranged between 18 and 63 years with a mean of 36 +/- 13 years. Nine cases underwent primary functional septorhinoplasty and sixteen underwent primary septoplasty. PNIF measurement preoperatively ranged between 30 - 150 L/min with mean 88 +/- 34 compared to 70 - 180 L/min with mean

126 +/- 33 post op. SNOT-22 score preoperatively had a range of 13 - 69 with mean 44+/-17 compared to 1-29 with mean 18 +/- 8 postop (Table 1). Our PNIF pre and postop and questionnaire scores are normally distributed with p values more than 0.05 in the Shapiro-wilk test and kurtosis and skewness values between 2 and -2. Statistical testing of difference in the means before and after surgery showed statistically significant difference in the PNIF measurements (Graph 1) before and after surgery with a mean increase of 38 (99% CI24-52, SD 24, $p < 0.001$) and in the SNOT-22 scores before and after surgery with a mean decrease of 26 (99% CI 32-19, SD 12, $p < 0.001$).

	SNOT before	SNOT after	PNIF before	PNIF after
Mean	44	18	88	126
Range	13 - 69	1 - 29	30 - 150	70 - 180
SD	17	8	34	33

Table 1: SNOT-22 scores and PNIF measurements pre and postop.

Graph 1: PNIF measurements pre and postop ($P < 0.001$).

Discussion

Published systematic review [4] of English literature from 1950 - 2000 revealed multiple studies with objective measures utilized to demonstrate nasal patency changes: rhinomanometry, acoustic rhinometry and PNIF. Manual search of literature also showed several other studies that utilized subjective disease specific quality of life questionnaires [2,6]. Where all of them showed an evidence of improved nasal airway and breathing. We utilized PNIF measurements as an objective measure and SNOT-22 questionnaire as a subjective measure believing they suited our research question. PNIF is a physiological measure of maximal nasal airflow at maximum effort [4] measured using a portable peak inspiratory flow meter that is inexpensive and readily available. It was first described in the 1990s. It has a reported sensitivity of 0.66 detecting changes in nasal obstruction [7]. It was proven to be simple, inexpensive and reproducible [7]. Although PNIF measurements is limited by the fact that it does not give a unilateral nasal measurement, it has been previously demonstrated to be as sensitive as rhinometry and acoustic rhinometry for evaluating nasal obstruction [2]. It is dependent on a patient's age, sex, height and lower airway function and normal values for a population can range widely with published range of 80 - 174 L/min [8]. However, PNIF measurements do correlate with changes in nasal patency in an individual, making PNIF a reliable and sensitive method for assessing changes in nasal obstruction achieved by any form of treatment over a short period. A systematic review of the objective evidence for the efficacy of septoplasty in the treatment of nasal obstruction in 2011 [9] could only find one study that used PNIF to assess patients objectively pre and post septal correction surgery not combined with other nasal interventions. It worth mention that it is advisable to measure PNIF post-nasal decongestion using a topical nasal decongestant or exercise to eliminate turbinate engorgement as a vascular component of nasal obstruction and better asses anatomical or hard tissue component [4]. Our second outcome measure, SNOT-22 is a disease specific quality of life assessment questionnaire with 22 items and graded scale out of five. It was first described in 2000. It has been previously validated for the clinical follow up of both septoplasty [4] and septorhinoplasty [10]. In a systematic review of 15 published tools of sinonasal outcomes, it was reported as a: "suitable outcome tool for assessment of quality of life as sino-nasal outcome due to inclusion of both sinonasal specific and general health questions, can be done individually pre and post op, shown to have good reliability, validity, responsiveness and ease of use" [10]. It was also labeled to be the most suitable sinonasal outcome scoring system [7].

Our study results using both PNIF and SNOT-22 came in line with published literature demonstrating significant post-operative improvement. We could not identify a published expected range of change in PNIF measurements post intervention to serve for comparison. However, we found our mean change similar to another

published paper where we had a mean increase of 38 versus 35 [4]. Mean SNOT-22 score in normal population is estimated to be 9.3 and minimally important change post any intervention is 8.9 [6]. Our observed mean decrease is 26 which is markedly higher than 8.9. In another published study that used SNOT-22 as a tool, they demonstrated mean decrease of SNOT-22 score to be 9.9 [6]. Variation in the numbers published can be attributed to population characteristics, severity of pre-operative condition, degree of intervention and duration of follow up at which the post-operative measure was taken.

We believe the strength of this paper arises from its prospective design, use of combined objective and subjective outcome measures, use of validated disease specific quality of life questionnaire and having no loss to follow up at all.

The limitations that need to be mentioned is the non-randomized sample with no controls for comparison. Nonetheless this can be answered keeping in mind that current practice assumes septal corrective surgery the standard of care of such patients provided failure of medical treatment making it unethical to randomize the patients to not be operated. Controls can be easily utilized from literature instead of a control arm in a prospective hospital-based study. On top of that, one can debate that our study did not address for confounders such as effect of allergic rhinitis. And recall bias could have affected our patients SNOT-22 scores as it is based on them filling it in an instance reflecting on the whole course of their disease process. Though, no correlations could be inferred due to the small study population, we can claim that both PNIF and SNOT-22 can be utilized as easy tools to guide preoperative patient selection. A larger population similar study is recommended to statistically investigate correlations and possible predictors of better or worse outcomes [11].

Conclusion

Nasal obstruction secondary to deviated nasal septum is significantly improved with septoplasty or functional septorhinoplasty. The outcome can be assessed objectively with physiological measures as PNIF measurement and subjectively with the standardized quality of life questionnaires like SNOT-22. Our study results came in line with published evidence showing the significant statistical improvement in both nasal airway and breathing. Further larger scale studies would serve better evaluate specific better outcome predictors.

Conflict of Interest

We have no conflict of interest to declare and we received no financial fund to complete this study.

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