



Evaluation of Pulmonary Function Tests and Nasal Symptoms Pre and Post Endoscopic Sinus Surgery in Patients with Ethmoidal Polyposis

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Abstract

Ethmoidal polyposis (EP) is a frequent form of chronic rhinosinusitis. Medical therapy is the main modality of treatment. Non responders to medical treatment require surgical removal of polyps by Endoscopic Sinus Surgery (ESS). Many studies showed worsening of the lung function following ESS whereas few studies showed improvement in the symptoms and better quality of life. Hence this study is an attempt to assess the effect of ethmoidal polyps on the pulmonary function and also the change in the lung function in the patients with ethmoidal polyps post ESS.

Methods: *A prospective observational study was conducted in a tertiary care hospital on 50 subjects with ethmoidal polyposis who were unresponsive to medical treatment and hence underwent ESS. Pulmonary function tests were assessed using spirometry and nasal symptoms were scored as per TNSS system prior to surgery and 3 months post surgery and compared with the pre op values and analysed.*

Results: *There were 30 males and 20 females with majority of them in the age group of 41-50 yrs. The mean pre op FVC, FEV1, MEFV were 2.94liters, 2.41 liters and 2.51 liters respectively whereas the mean post operative values were 2.95 liters, 2.39 liters and 2.49 liters respectively.. The ratio of FEV1 and FVC was more than 0.7 in 98 % patients pre operatively and 94% post operatively. There was no statistically significant change in lung function tests following ESS. Pre operatively majority (35) had TNSS value between 6-9 where as post operatively the score was reduced to 2-3 in many patients (38). The mean TNSS was 7.24 before surgery which declined to 2.82 after surgery with a p value <0.0001 indicating a statistically significant improvement in the nasal symptoms post ESS.*

Conclusion: *Our study shows that ESS benefits patients with nasal polyps by improving the symptoms and there by the quality of life without any adverse effects on the lower airways.*

Keywords: *Ethmoidal Polyps (EP), Endoscopic Sinus Surgery (ESS), Pulmonary Function Tests (PFT), Total Nasal Symptom Score (TNSS).*

Introduction

Ethmoidal polyposis (EP) is a form of chronic rhino-sinusitis, always arise from the lateral wall of nose, usually from the middle meatus. Aetiology of nasal polypi is very complex and may arise in inflammatory conditions of nasal mucosa (rhinosinusitis), disorders of ciliary

motility or abnormal composition of nasal mucus (cystic fibrosis). Persistence of infection causes mucosal changes, such as loss of cilia, oedema and polyp formation, thus continuing the vicious cycle in the pathology chronic rhino sinusitis¹. EP cause persistent nasal obstruction, hyposmia, infection, hypoxia, hypercapnia, snoring, sleep

disorders, increased risk of hypertension and impaired quality of life². Various mechanisms have been proposed to explain how rhinosinusitis may affect the lower airways. Some of them are aspiration of infected sinus secretions into the lower airways during sleep, enhanced vagal stimulation in the infected sinus producing bronchospasm and excessive drying of the lower airways by mouth breathing because of nasal obstruction^{2,3}. Treatment of EP consists of medical therapy with intranasal steroids or a short course of systemic steroids, antibiotics, leukotriene modifiers, mast cell stabilizers and acetylsalicylic acid avoidance³. Subjects who do not respond to topical steroids require Functional Endoscopic Sinus Surgery which aims to restore normal nasal function, mucociliary clearance and promotes sinus ventilation and sinus drainage.

Rationale of Study

The benefits after surgery in relation with the pulmonary function is a debate. Certain studies like Lamblin C et al⁴ and Van der Veer et al⁵ reported that the patients who did not respond to medical treatment exhibited a significant decrease of FEV1 and FEV1/FVC ratio post-surgery. Whereas, studies by YoungjinAhn⁶ et al, and colleagues showed no significant change in the bronchial hyperactivity and other studies by, Gillian Dunlop et al⁷, Marleen Vleming⁸ showed improvement in the lung parameters post surgery for ethmoidal polyps. So the present study aimed at benefits of endoscopic surgery in cases of ethmoidal polyp in terms of nasal symptoms and pulmonary function in the present setting.

Aims and Objectives

The main aim of this study is to assess the pulmonary function in patients with Ethmoidal polyposis who did not respond to medical treatment and to evaluate the effect of endoscopic sinus surgery on the lung function in these patients.

Material and Methods

Study Area: Study conducted in E.N.T department, Gandhi General Hospital, Warangal, Telangana.

Study Design: This current study is comparative prospective observational, hospital based study.

Time Frame: The study is conducted From DEC 2017 to NOV 2018 for a period of 1 year.

Study Population: Sample Size 50.

Inclusion Criteria: Patients of all age groups who were diagnosed endoscopically with bilateral ethmoidal polyps and who were - unresponsive to medical treatment (oral steroids for 1 week, broad spectrum antibiotics for 1-2 weeks, anti-histamines for 1 month, steroid nasal spray for 1 month and saline nasal irrigation) for 1 month were subjected to ESS. **Exclusion Criteria:-** Patients with h/o nasal surgery, pulmonary symptoms and lung pathology not attributed to allergy and asthma like COPD, pneumonia/lung abscess, ciliary dyskinesia syndromes etc. and patients lost to follow up were excluded from the study.

Study Setting

The 4 point total nasal symptom scoring (TNSS) and the pulmonary function tests which include FVC, FEV1, MEF_R were done 48 hours prior to surgery and 3 months post operatively and were compared. Forced vital capacity (FVC) is the volume change of the lung between a full inspiration to total lung capacity and a maximal expiration to residual volume⁹.

Forced expiratory volume in first second (FEV₁) is the volume exhaled during the first second of a forced expiratory manoeuvre started from the level of total lung capacity. The FEV₁/FVC ratio, also called Tiffeneau-Pinelli index represents the proportion of a person's vital capacity that they are able to expire in the first second. Maximum mid expiratory flow rate (MEFR) is the forced expiratory flow between 25% and 75% of the FVC (FEF_{25-75%}). The MEFR is also used as an index of airway obstruction^{9, 10, 11}. These lung function tests are assessed by spirometry and compared with the predetermined value based on

the patient's age, sex and BMI and the degree of derangement is calculated as mild, moderate, severe and very severe (table I)^{9,10,11}. TNSS is a 12-point scale derived by summing and averaging all scores for four symptoms: Rhinorrhea, nasal obstruction, sneezing, and nasal itching. Each symptom is given a score - 0 (none), 1 (mild), 2 (moderate) or 3 (severe) - resulting in a maximum recorded mean TNSS of 12 (table II). The scoring is done by the patients depending on the frequency of the symptoms and interference with daily activity. None - no symptom, mild - symptom present but was not annoying or troublesome, moderate - symptom frequently troublesome but does not interfere with either routine daily activity or sleep, severe - symptom was sufficiently troublesome to have interfered with routine daily activity or sleep based on patients' assessment of severity¹².

Data Collection Technique: Data was collected from the semi structured proforma sheets and spirometry charts. Data was entered in MS-excel 2007 and data was analysed using SPSS software trail version 22. The results were assessed with a paired student - T test and the p- value was calculated for the FVC, FEV1, MEFR and TNSS (total nasal symptom scoring). $p < 0.05$ is considered as statistical significance.

Ethical Clearance: A clearance from the institutional ethics committee was obtained for carrying out this study. Informed consent was taken from the patients.

Conflict of Interest: There was No conflict of interest in this study. No funding or support was taken from any organization.

Observations and Results

Age & Sex: 50 patients were taken for the study of which 60% (30) were males and 40% (20) were females. Majority were in the age group of 41-50 yrs -32% (16) with the least being in the age group of >60 yrs 4%(2).

Symptoms

Pre operatively majority of patients, that is 36 had mild and moderate degree of rhinorrhea, 11 had

severe rhinorrhea (total n=47) and 3 did not have the symptom at all. Post operatively 26 people did not have the symptom, 24 patients had mild and moderate degree of rhinorrhea. Whereas none of the patients had severe rhinorrhea (Table. No.1).

Pre operatively 39 patients had mild and moderate itching of the nose, 1 had severe itching (Total= 40) and 10 did not have the symptom at all. Post operatively 44 people did not have the symptom and 6 patients had mild itching. Whereas none of the patients had moderate and severe intensity of the symptom (Table. No.1).

Pre operatively 25 patients had severe blockade of nose, 24 had mild and moderate degree of nasal blockade (Total= 49), only 1 patient did not have the symptom at all. Post operatively 29 patients had mild and moderate severity of the symptom, 21 patients had no symptom at all, whereas none of the patients had severe intensity of the symptom (Table. No.1).

Pre operatively 36 patients had mild and moderate intensity of sneezing, 10 had severe sneezing (Total n=46), and 4 patient did not have the symptom at all. Post operatively 28 patients had mild intensity of sneezing and 22 patients had no symptom at all. Whereas none of the patients had moderate and severe intensity of the symptom (Table.No.1).

The difference between the distribution of all symptoms pre and post op were found to be statistically significant.

TNSS scoring

Preoperatively the mean symptom scoring of all the 50 patients was 7.24 and the postoperative mean score was 2.82 with a difference of 4.42. The standard deviation was 3.017 and p value calculated for these mean pre and post operative total TNSS systems was < 0.0001 which is statistically significant.

Table.No.1 Distribution of symptoms Pre and Post operatively (ESS)

SYMPTOMS		PRE OP	POST OP	SIGNIFICANCE
RHINORRHEA	PRESENT	47	24	p <0.00001 (McNemar's Test)
	ABSENT	3	26	
ITCHING	PRESENT	40	6	p <0.00001 (McNemar's Test)
	ABSENT	10	44	
BLOCKED NOSE	PRESENT	49	29	p <0.00001 (McNemar's Test)
	ABSENT	1	21	
SNEEZING	PRESENT	46	50	p <0.00001 (McNemar's Test)
	ABSENT	4	0	
TNSS SCORE (MEAN)		7.24	2.82	p <0.00001 (Difference between the mean)

Pulmonary Function

Preoperatively around 98% (49) had mild and moderate decrease in FVC and 2 % (1) patient had severe derangement. Post operatively, about 96% (48) of patients had mild and moderate decrease in FVC whereas 4% (2) had severe decrease in FVC(table III). The mean preoperative FVC was 2.9446 lit/sec and the mean postoperative value is 2.9562 lit/sec with a difference of -0.01160 and mean difference in standard deviation is 0.46068. The p value is 0.859 (Table no.2).

Preoperatively around 96% (48) had mild and moderate derangement of FEV1 and 4% (2) patients had severe derangement of the FEV1. Postoperatively also 96% (48) had mild and moderate derangement of FEV1 and 4% (2) patients had severe derangement (table IV). The mean preoperative FEV1 was 2.4122 lit/sec and

the mean postoperative value is 2.3918 lit/sec with a difference of 0.02040 and mean difference in standard deviation is 0.36800. The p value is 0.697 (Table no.2).

Preoperatively 80% (40) had mild and moderate impairment of MEFR and 20 % (10) patients had severe derangement. Postoperatively 78% (39) had mild and moderate impairment of MEFR, 22 % (11) patients had severe derangement (table V). The mean preoperative MEFR was 2.5182 lit/sec and the mean postoperative value is 2.4988 lit/sec with a difference of 0.01940 and mean difference in standard deviation is 0.43926. The p value is 0.756 (Table no.2).

The ratio of FEV1 and FVC was more than 0.7 in 98 % patients pre operatively and 94% post operatively.

Table No. 2 Comparisons of Pulmonary Function Tests in Pre and Post ESS Cases

PULMONARY FUNCTION TESTS		PRE OP		POST OP		SIGNIFICANCE (DIFFERENCE BETWEEN THE MEAN)
		NUMBER	MEAN	NUMBER	MEAN	
FVC	MILD TO MAEDRATE	49	2.9446 lit/sec	48	2.9562 lit/sec	p Value 0.859
	SEVERE	1		2		
FEV1	MILD TO MODERATE	48	2.4122 lit/sec	48	2.3918 lit/sec	p Value 0.697
	SEVERE	2		2		
MEFR	MILD TO MODERATE	40	2.5182 lit/sec	39	2.4988 lit/sec	p Value 0.756.
	SEVERE	10		11		

Discussion

Many studies have been done previously which showed either a subjective or objective worsening/

improvement/no change in the lung functions and nasal symptoms in patients who underwent FESS for ethmoidal polyposis. But no definite

conclusions have been made whether the surgery has any impact on the lower respiratory tract and quality of life on a long term basis. This study is an attempt to supplement data for coming to a conclusion regarding the surgical treatment of the nasal polyposis. Our study is based on objective evaluation of the lung volumes and subjective assessment of the nasal symptoms in patients with ethmoidal polyposis. 50 non-responder patients were taken into the study. The lung function tests and nasal symptoms scoring were done preoperatively and 3 months post operatively, compared and analyzed.

Age and Sex: Male predominance is seen in the present study (Male to female ratio is 1.5: 1, M-60% , F-40%) with Majority of 41-50 yrs of age group. Nearly Similar finding were seen in study done by Sridevi Karuthedath et al¹³ where 57% were males, 43% were females with predominant (47%) age group of 30 to 40 years. Male predominance seen in many other studies^{5,14,15}

Nasal Symptoms: Post operative improvement of nasal symptoms like Rhinorrhea, itching, sneezing were significant (statistically), making the endoscopic sinus surgery, the reliable choice of treatment for ethmoidal polyposis who are not responding to medical treatment. But Vander Veer⁵ et al was the first investigator to report that

polypectomy might aggravate asthma in terms of frequency of attacks, which may not coincide with the present study findings.

Slavin et al¹⁶ in their study conducted at St. Louis University Health Sciences Centre observed that, of the patients who underwent bilateral intranasal sphenoidectomy, 65% showed significant improvement in their asthmatic state. More than 80% of the patients reported that they had experienced moderately or greatly improved nasal symptomatology, and 60% felt that asthma symptoms had improved.

Pulmonary Function: Post operatively there was no significant difference (statistically) or change in FVC, FEV1, and MEFR in the present study. However the difference in the mean pre op and post op FVC and FEV1 is 0.0116 and 0.02040 respectively the p value is 0.859 and 0.697 respectively, It clearly indicates that there is no worsening of parameters in the lower airways by the endoscopic sinus surgery.

Some Relevant studies have been compared with the present study in relation with pulmonary function, in Table no.3. Alexander J. Osborn et al¹⁴ study showed similar findings with the present study. Most of the other studies^{13,16,17,18} showed improvement postoperatively in any one parameter (FVC, FEV1, FEV1/FVC).

Table No.3 Post operative improvement of pulmonary parameters comparison with other studies

STUDIES	YEAR	Post Operative		
		FVC	FEV1	FEV1/FVC
Present Study	2018	No Change	No Change	No Change
Ahmed M. Youssef, MD et al ¹⁶	2017	Improved	Improved	Improved
LIAO H et al ¹⁷	2015	Improved	Improved	-
Sridevi Karuthedath et al ¹³	2014	No Change	Improved	Improved
PAN S et al ¹⁸	2014	Improved	Improved	-
Alexander J. Osborn et al ¹⁴	2011	No Change	No Change	No Change
Pete S Batra MD et al ¹⁹	2010	-	Improved	-

Conclusions

This study is intended to assess the pulmonary function in patients with ethmoidal polyposis who did not respond to medical treatment and to evaluate the effect of endoscopic sinus surgery on the lung function and nasal symptoms in these patients. There is a significant clinical

improvement in the nasal symptoms (p value of TNSS- <0.0001) of the subjects taken into the study, post ESS and medical treatment as depicted by the TNSS system. However, there was no statistically significant change in the pulmonary function tests as all the three values FVC, FEV1, MEFR had p value far more than 0.05(0.859,

0.697, 0.756 respectively). This concludes that ESS benefits the patients with nasal polyps who did not respond to medical treatment by improving the symptoms and there by the quality of life without any adverse effects on the lower airways.

Recommendation

As this study has used plain PFT without causing any broncho-provocation via methacholine/carbachol challenge and also a small nasal symptom scoring system- TNSS and had only limited follow up period - 3 month and small size. Hence further elaborative studies with large sample size and longer follow up periods are recommended to evaluate the effect of ESS on lower airway in nasal polyps patients.

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