

The Effect of Functional Endoscopic Sinus Surgery on Pulmonary Functions of Patients with Pulmonary Diseases and Sinusitis.

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ABSTRACT

Background: Coexistence of upper and lower respiratory diseases is common. This coexistence of sinus disease and pulmonary diseases was first described by Galen in the second century. Since chronic sinusitis and pulmonary diseases are closely related, surgical treatment of chronic sinusitis could improve pulmonary functions and reduces the need for medication. This study was made to assess the efficacy of FESS on pulmonary functions of patients with chronic sinusitis and pulmonary diseases. **Methods:** The study was conducted in the Department of ENT of a tertiary care centre. Pulmonary function tests: Included forced vital capacity (FVC), forced expiratory volume in 1 second (FEV1) and mid expiratory phase of the forced expiratory flow (FEF 25%-75%) were observed of each patients before and after FESS using a spirometer. **Results:** Scoring results for COPD before and after FESS were shown in Table 5, the score for mild, moderate and severe COPD were 44.4%, 33.3%, 22.2%; and improved postoperatively to 11.1%, 16.6%, 11.1% respectively. Scoring results for asthma before and after FESS are the score for mild, moderate and severe asthma were 27.08%, 50%, 22.9%; and improved postoperatively to 8.3%, 25%, 29.1% respectively. The mean of spirometric parameters before and after FESS shows an improvement as follows: The FVC was improved from 72 ± 3.78 to 82 ± 4.12 , FEV1 from 70 ± 4.08 to 89 ± 4.56 and FEF 25-75% from 76 ± 2.92 to 88 ± 2.65 with statistical significance for all parameters $p < 0.001$. **Conclusion:** Findings of the current study suggest that FESS is effective in improving pulmonary functions in patients suffering from pulmonary diseases as well as sinusitis with or without nasal polyp. Therefore, we strongly suggest that surgery for the sinusitis earlier in the course of the disease gives a far better outcome and could be beneficial for the pulmonary diseases.

Keywords: Pulmonary diseases, COPD, Asthma, FESS.

INTRODUCTION

Coexistence of upper and lower respiratory diseases is common. This coexistence of sinus disease and pulmonary diseases was first described by Galen in the second century.^[1] Asthma and sinusitis are both recognized in ancient literature. Therefore for understanding these two conditions the theory of unified airway is the basic element. Amongst Asthmatic patients, 88% have symptoms of rhinitis and 50% of rhinitis patients have symptoms of acute bronchial hyperresponsiveness.^[2]

Nasal polyposis has been shown to be associated with asthma, especially if associated with aspirin intolerance. In patients with nasal polyposis, asthma was found in 30% of those referred to the ENT department, and in more than 70% of those referred

to allergy unit. A close association has been suggested between sinusitis and lower respiratory disorders like bronchial asthma. It is well known that chronic sinusitis coexists in as many as 40–75 % of patients with asthma. The study was done by Shaabanet al,^[3] had shown that allergic rhinitis was associated with the increased onset of bronchial hyperresponsiveness and less chance for remission except for those treated for rhinitis.

Although, the close association between pulmonary diseases and chronic sinusitis is confirmed; the pathogenesis still controversial. Sinobronchial reflex which is are flex bronchoconstriction by activation of a trigeminal afferent – vagal efferent neural arc is the most accepted theory.^[4] Other theories include increased tissue eosinophils in chronic sinusitis patient, that leads to inflammation of nose, sinuses, and lung.^[5] Also post nasal drip can lead to bronchial tree irritation and finally a reduction of nitric oxide, which is a potent modulator of bronchial arc; a characteristic of chronic sinusitis that may lead to acute bronchial hyper-responsiveness.^[6] According to current guidelines, the surgical approach is

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reserved for patients who fail to respond adequately to medical therapy. Since chronic sinusitis and pulmonary diseases are closely related, surgical treatment of chronic sinusitis could improve pulmonary functions and reduces the need for medication. This study was made to assess the efficacy of FESS on pulmonary functions of patients with chronic sinusitis and pulmonary diseases. We use the pulmonary function tests as an indicator of pulmonary diseases severity before and after FESS.

MATERIALS AND METHODS

The study was conducted in the he study was conducted in the Department of ENT of a tertiary care centre between October 2017 and March 2018.

Study Design

A prospective study.

Subjects

The study was conducted on 48 adult patients who fulfill the clinical criteria for CRS according to the CRS criteria. The patients belonged to the age group 18–55 years age group. Written consent was taken for all patients. The 43 patients (bronchial asthma: n = 48, COPD: n = 18) underwent functional endoscopic sinus surgery (FESS) for chronic sinusitis in the ENT- department. The patients were observed by pneumologists before being taken in the study and the pneumologists had outlined the definition of a diagnosis of asthma or COPD.

Exclusion criteria

- Pregnant women
- Coexistent systemic diseases like diabetes, cystic fibrosis, hypertension, neoplasia.
- Patients with known psychiatric illness.
- Prior paranasal sinus, nose or throat surgery.

Preparation for Surgery

No oral corticosteroid was given before surgery at least 2 weeks, topical steroid and broad spectrum antibiotics were given one week before surgery. Control of pulmonary diseases by maintenance of steroid inhalers.

FESS was done for all patients under general anesthesia with selection of surgery according to the extent of disease. To assess the effect of functional endoscopic surgery, the Sino-Nasal Outcome Test 20 German Adapted Version (SNOT-20 GAV) and St. George's Respiratory Questionnaire (SGRQ) were used one week preoperatively and for a minimum of three months postoperatively. In addition, the patients' medical treatment for bronchial asthma and COPD was evaluated The SGRQ has been developed by Jones et al.^[7] The SGRQ covers the quality of life of patients with COPD, bronchial asthma and bronchiectasis in three sub-scales (symptom, activity and strain) and has

been validated for a three month time frame.^[7] The SNOT-20 is a validated questionnaire reported by Piccirillo et al and the SNOT-20 GAV is validated by Baumann et al.^[8,9]

Pulmonary function tests: Included forced vital capacity (FVC), forced expiratory volume in 1 second (FEV1) and mid expiratory phase of the forced expiratory flow (FEF 25%-75%) were observed of each patients before and after FESS using a spirometer. (WellchAllyn, Medikro, 2010, 70460 kupio, Finland. A detailed information about performing lungs function test with spirometer were given. They were instructed to produce a hard, fast and long forced expiration for at least 6 seconds or as long as possible, as per directions of American Thoracic Society.

Statistical analysis

Statistical analysis was done by using a student t test and Chi-Square test. The p value <0.05 was considered as significant. Statistical Package for the Social Science (SPSS®, IBM Corporation, New York, NY, USA) was used to analyze the statistical calculations.

RESULTS

The age of patients involved in the present study ranged from 18 to 55 years with a mean of 33.46 ± 22.16 years. The maximum number of patients (14) were in the age group 31–40 years representing 29.16 % of the total. The age distribution is depicted in [Table 1].

Table 1: Distribution of patients with chronic sinusitis and pulmonary diseases.

Age (years)	Frequency	Percentage (%)
≤20	12	20%
21-30	4	8.3%
31-40	14	29.16%
> 40	18	37.5%
Total	48	100%

Table 2: Distribution of patients according to sex.

Age (years)	Frequency	Percentage (%)
Male	32	66.67%
Female	16	33.33%
Total	48	100%

Table 3: Characteristics of patients with chronic sinusitis and pulmonary diseases.

Disease	Frequency	Percentage (%)
Chronic sinusitis	48	100%
Chronic sinusitis Without polyp	28	58.33%
Chronic sinusitis With polyp	20	41.67%
Asthma	48	100%
Mild	16	33.33%
Moderate	24	50%
Severe	8	16.67%

Out of the 48 patients, males constituted the majority, accounting for 66.67 % of total study group. Thus, the male to female ratio is 2:1. The data is represented in [Tables 2].

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[Table 3] shows regarding chronic sinusitis symptoms there were 28 (58.33%) patient without nasal polyps and 20 (41.67%) patients with nasal polyps and regarding asthma symptoms there were 16 (33.33%) patients with mild symptoms, 24 (50%) with moderate symptoms and 8 (16.67%) with severe symptoms.

[Table 4] shows that scoring results for chronic sinusitis without and with polyp before and after FESS improved from 62.5% and 27.5% to 25% and 20.8% respectively. [Table 4]

Scoring results for COPD before and after FESS were shown in [Table 5], the score for mild, moderate and severe COPD were 44.4%, 33.3%, 22.2%; and improved postoperatively to 11.1%, 16.6%, 11.1% respectively.

Scoring results for asthma before and after FESS are shown in [Table 6], the score for mild, moderate and severe asthma were 27.08%, 50%, 22.9%; and improved postoperatively to 8.3%, 25%, 29.1% respectively.

Table 4: Sinusitis severity (symptoms) before and after FESS

Chronic sinusitis	Before FESS		After FESS		Chi Square	
	N	Percentage (%)	N	Percentage (%)	X2	p value
Chronic sinusitis Without polyp	30	62.5%	12	25%	0.537	0.45
Chronic sinusitis With polyp	18	27.5%	10	20.8%		

Table 5: COPD severity (symptoms) before and after FESS

	COPD				Chi Square	
	Before FESS		After FESS		X2	p value
	N	Percentage (%)	N	Percentage (%)		
Mild	8	44.4%	2	11.1%	1.98	0.64
Moderate	6	33.3%	3	16.6%		
Severe	4	22.2%	2	11.1%		
Total	18	100%	7	38.8%		

Table 6: Asthma severity (symptoms) before and after FESS

	Asthma				Chi Square	
	Before FESS		After FESS		X2	p value
	N	Percentage (%)	N	Percentage (%)		
Mild	13	27.08%	4	8.3%	2.89	0.23
Moderate	24	50%	12	25%		
Severe	11	22.91%	14	29.1%		
Total	48	100	30	62.5%		

Table 7: Dyspnea severity (symptoms) before and after FESS

	Dyspnea				Chi Square	
	Before FESS		After FESS		X2	p value
	N	Percentage (%)	N	Percentage (%)		
Mild	12	30%	4	10%	2.32	0.43
Moderate	20	50%	4	10%		
Severe	8	20%	6	15%		
Total	40	100%	14	35%		

Table 8: Cough severity (symptoms) before and after FESS

	Cough				Chi Square	
	Before FESS		After FESS		X2	p value
	N	Percentage (%)	N	Percentage (%)		
Mild	8	33.33%	2	8.3%	1.94	0.67
Moderate	12	50%	4	16.6%		
Severe	4	16.66%	2	8.3%		
Total	24	100%	8	33.3%		

Table 9: Wheeze severity (symptoms) before and after FESS

	Wheeze				Chi Square	
	Before FESS		After FESS		X2	p value
	N	Percentage (%)	N	Percentage (%)		
Mild	6	20%	2	6.6%	1.88	0.54
Moderate	16	53.3%	4	13.3%		
Severe	8	26.6%	6	20%		
Total	30	100%	12	40%		

Table 10: Pre-Operative and Post-Operative Pulmonary function tests.

Pulmonary function test	Pre-operative	Post-operative	t value	p value
FVC	72 ± 3.78	82 ± 4.12	10.24	0.001
FEV1	70 ± 4.08	89 ± 4.56	16.85	0.001
FEF 25-75%	76 ± 2.92	88 ± 2.65	13.41	0.001

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[Table 7] shows that scoring results for dyspnoea before and after FESS. The score for mild, moderate and severe asthma were 30%, 50%, 20%; and improved postoperatively to 10%,10%,15% respectively.

Scoring results for cough shows that cough before and after FESS mild, moderate and severe were 33.3%,50%, 16.6% and improved postoperatively to 8.3%,16.6%,8.3% respectively.

[Table 9] shows that scoring results for wheezing before and after FESS. The score for mild, moderate and severe wheeze were 20%, 53.3%, 26.6%; and improved postoperatively to 6.6%, 13.3%, 20% respectively.

[Table 10] deplete the mean of spirometric parameters before and after FESS shows an improvement as follows: The FVC was improved from 72 ± 3.78 to 82 ± 4.12 , FEV1 from 70 ± 4.08 to 89 ± 4.56 and FEF 25-75% from 76 ± 2.92 to 88 ± 2.65 with statistical significance for all parameters $p < 0.001$.

DISCUSSION

COPD and asthma are the diseases of lower airway characterized by airway obstruction with remission and exacerbation. Researchers suggested that more than 80% pulmonary disease patients are accompanied by symptoms of chronic sinusitis.^[10] On the other hand, approximately 50% patients suffering with sinusitis shows symptoms of acute bronchial hyperresponsiveness.^[10]

Sinusitis has a self-reported incidence of 135 per 1,000 of the population per year and was the principle reason for almost 12 million physician office visits during 1995.^[11-14] Studies have shown that sinusitis significantly affects the quality of life measures along with pulmonary functions. Moreover, various pulmonary diseases have been found related with chronic sinusitis.^[12-14] Sinusitis is one of the main reasons for which an antibiotic is prescribed and for lost productivity in the work force.^[13,15]

Results of the present study showed that most of the patients suffering with sinusitis belonged to less than 40 years (62.5%). These results are in agreement with the findings of the previous study of Choudhry N et al,^[16] Winsted W et al and Ogunleye AO et al,^[17,18] as they recorded high frequency of sinusitis in less than 33 years, 34 years and 35 years respectively.

Present study showed that males (66.67%) were more commonly suffering from sinusitis in comparison of females (33.33%). These findings are consistent with the findings of the earlier studies of Kaliner MA et al and Osguthorpe JD et al^[11,12] as they recorded sinusitis was predominantly found in males compare to females. Similarly, Ogunleye AO et al,^[18] recorded that it was a ratio of 1.6 : 1 for males compare to females.

Various studies suggested that sinusitis and asthma coexist together. Moreover, sinusitis is linked pathologically with asthma.^[19]

Current study showed that there was significant improvement in symptoms of COPD after FESS. These findings are in agreement with the findings of the earlier study of Jones et al 20 as they recorded a significant improvement in COPD after FESS.

In addition, a significant improvement in asthma symptoms was recorded in this study which is consistent with the findings of previous studies of Senior BA et al,^[21] Dijima et al and Loehrl et al,^[22,23] as they recorded significant improvement in the symptoms of asthma after sinusitis operation. Moreover, Dijima et al and Loehrl et al,^[22,23] recorded significantly improvement of pulmonary functions as well as decreased in use of bronchodilators.

Further, along with asthma and COPD there was significant improvement in other pulmonary disorders like dyspnoea, cough and wheezing. These findings are consistent with the earlier studies of Dijima et al,^[22] Loehrl et al and Goldstein et al,^[23,24] as they observed significant improvement in dyspnoea, cough and wheezing after sinusitis operation.

The rationale for treating the nose in asthmatic patients follows the concept of "united airways" because nasal inflammation can influence the lower airway and intranasal corticosteroids can relieve symptoms of sinusitis and asthma.^[21] Dijima et al and Loehrl et al,^[22,23] evaluated 88 and 85 patients with chronic sinusitis and reported an improvement in subjective and objective symptoms of asthma, decreased use of bronchodilators and improved pulmonary function. In this study, the symptoms of asthma (dyspnoea, cough and wheeze) had a definite improvement after surgical intervention.

Results of the current study showed significant improvement in functions of lungs in both patients with and without nasal polyp. Similarly, Batra et al,^[15] observed a significant improvement in lung functions and decrease in oral corticosteroid use after FESS in patients with nasal polyp. Alike, Loehrl et al and Goldstein et al,^[23,24] recorded a significant improvement in lung functions of sinusitis patients after FESS.

In contrast to this But Uri et al,^[25] did not recorded any significant improvement in pulmonary functions in sinusitis patients with nasal polyp. Nonetheless, Ragab et al,^[26] reported subjective and objective improvement in lung functions; although, improvement was statistically insignificant.

The results of the present study showed that there was subjective as well objective improvement in lung functions as well as pulmonary diseases of sinusitis patients with and without nasal polyp after FESS.

Additionally, this study demonstrated the effect of improvement in upper airway on the lower airway

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irrespective to the pathology in patients with COPD or other pulmonary diseases. The effect FESS of on the lower airway has previously been demonstrated in patients with bronchial asthma and bronchial hyperreagibility.^[23,27]

CONCLUSION

Findings of the current study suggest that FESS is effective in improving pulmonary functions in patients suffering from pulmonary diseases as well as sinusitis with or without nasal polyp. Therefore, we strongly suggest that surgery for the sinusitis earlier in the course of the disease gives a far better outcome and could be beneficial for the pulmonary diseases.

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