Effect of endoscopic sinus surgery on asthmatic patients with chronic rhinosinusitis

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Abstract

Background There is a growing evidence that rhinosinusitis may be associated with asthma as different manifestations of the same disorder. Several reports suggest the effectiveness of endoscopic sinus surgery (ESS) in asthmatic patients with chronic rhinosinusitis (CRS). Whether ESS has a positive effect on the clinical course of asthma still remains controversial. The aim of this study was to investigate the outcomes of ESS on asthma in patients with coexistent CRS.

Materials and methods We performed a study to evaluate the effectiveness of ESS in 70 patients of CRS with associated asthma. The study compares changes in symptoms, medication and objective measures like pulmonary function in patients with persistent bronchial asthma and CRS before and after ESS.

Results Following ESS, there was an improvement in the mean asthma symptoms (wheeze, cough and shortness of breath) and asthma medication use. The number of emergency department visits and hospital admissions also showed a reduction postsurgery. Objective analysis with pulmonary function tests revealed an improvement in the predicted scores. Three patients with extensive polyposis showed poor improvement after surgery and needed revision.

Conclusions This study provides corroborative subjective and objective evidence that ESS is efficacious in the management of patients with CRS and asthma.

Keywords Asthma · Endoscopic sinus surgery · Chronic rhinosinusitis · Pulmonary function tests

Introduction

Asthma is a disease characterized by variable and reversible airway obstruction. Asthma and sinusitis both have been recognized in ancient literature. In the 1940s and 1950s, sinus surgery was performed by removal of purulent diseased tissue and excellent results were achieved for patients with asthma.

Clinically, physicians know that a sinus infection can contribute significantly to the frequency and severity of asthma attacks, but doubts still remain as to whether a causal relationship exists, or whether they are manifestations of the same underlying disease process in different parts of the respiratory tract. As many as 88% of asthmatic patients exhibit symptoms of rhinitis, and about 50% of rhinitis patients experience acute bronchial hyper-responsiveness [1]. A spectrum of upper airway diseases, such as acute upper respiratory tract infection, nasal polyposis, allergic rhinitis and paranasal sinusitis can lead to or worsen chronic inflammation of the lower airways [2, 3].

The rationale for treating the nose in asthmatic patients follows the concept of “united airways,” because nasal inflammation can influence the lower airways and intranasal corticosteroids can relieve symptoms of sinusitis and asthma [4]. Endoscopic sinus surgery (ESS) has been successfully used as a more physiological surgical approach to the treatment of medically refractory chronic rhinosinusitis (CRS). We evaluated improvement in asthma in adult patients with associated CRS after ESS.

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Materials and methods

Our study encompassed 70 adult patients with CRS with associated asthma who underwent ESS. The study compares changes in symptom scores with objective measures of pulmonary function in patients with persistent bronchial asthma and CRS before and after ESS.

Inclusion criteria of the study were (a) age above 18 years, (b) no prior paranasal sinus, nose or throat surgery, (c) patients with medically refractory CRS at the time of ESS and (d) no underlying immunodeficiencies, cystic fibrosis or neoplasia.

Physician evaluated patients every month before and after surgery for a period of 6 months for asthma. The physician's evaluation consisted of assessment of symptoms, physical examination, use of medication, spirometric pulmonary function tests (PFTs) and review of any emergency department visit or admissions for asthma. Postoperatively the ENT surgeon and physician routinely performed surveillance for recurrent disease, recurrent polyposis, CRS and asthma control.

The subjective assessment was carried out by evaluating three common symptoms of asthma – cough, shortness of breath and wheeze. Asthma symptoms were graded as (0: no symptoms; 1: mild symptoms causing little or no discomfort; 2: moderate symptoms that are interfering with daily activities or sleep; 3: severe symptoms that are intolerable). A change in symptom score before and after ESS was analyzed.

The patients were on medical treatment for asthma with β_2 -agonist, theophylline derivatives, mast cell stabilizers and steroids. Pre and postsurgical use of medication was evaluated. Objective lower airway evaluation was done by PFT which included forced expiratory volume in 1 second (FEV_1) (% predicted), forced vital capacity (FVC) (% predicted), FVC/FEV_1 (%) and peak expiratory flow rate (PEFR). PFTs were done at each pre and post-ESS visit using a spirometer (Model CVC Expirometer).

Statistical analysis was performed using SPSS (Ver10). Paired 't'-test was performed to compare pre and post-ESS variables. p value of <0.05 was considered significant.

Results

Our study consisted of 24 males and 46 females of the age group 19–57 years. The patients were diagnosed cases of asthma with medically resistant CRS on asthma medication of bronchodilators and steroids.

We evaluated three basic symptoms of asthma; shortness of breath, wheeze and dry cough in these patients 6 months before and after surgical intervention (ESS). On analysis of symptoms before ESS, 64 (91%) patients had symptoms of shortness of breath, 56 (80%) patients had wheeze and 52 (74%) patients had cough. The symptoms affecting the quality-of-life of the patients (moderate and severe symptoms) were seen in 32 (46%) patients with shortness of breath, 20 (29%) patients with wheeze and 32 (46%) patients with cough. After ESS there was a definite improvement in the number of symptomatic patients but it was not found to be statistically significant (Table 1).

β_2 -agonist 58 (83%), leucotriene inhibitors 48 (66%), theophylline 38 (54%) and inhaled steroids 36 (51%) were the most common asthma medication used by the patients. The number of patients using medication showed a reduction after surgery with oral theophylline, β_2 -agonists and inhaled steroids showing statistically significant reduction (Fig. 1). Emergency room visits for asthma exacerbations decreased in 10 (62.5%) of 16 patients. Admissions for acute attacks of asthma requiring intensive care also decreased in 6 (75%) of 8 patients (Fig. 2).

Objective assessment by PFT also demonstrated an improvement of scores after surgery. The FEV_1 improved from an average of 64% of the predicted value preoperatively to 86% after surgery. The average FVC increased from 68% to 74% and the peak flow rates showed improvement from 72% to 88% after ESS at the time of follow-up (Fig. 3).

Discussion

Scientists have long recognized that diseases coexist in the upper and lower airways. In the 2nd century, Galen noted the association between nasal symptoms and asthma, and

Table 1 Symptoms of asthma before and after ESS

Symptoms	Mild symptoms (a)		Moderate symptoms (b)		Severe symptoms (c)		Total symptomatic (a + b + c)	
	Pre-ESS	Post-ESS	Pre-ESS	Post-ESS	Pre-ESS	Post-ESS	Pre-ESS	Post-ESS
Shortness of breath	32 (45%)	24 (34%)	24 (34%)	14 (20%)	8 (12%)	4 (6%)	64 (91%)	42 (60%)
Wheeze	36 (51%)	22 (31%)	12 (17%)	10 (14%)	8 (12%)	6 (9%)	56 (80%)	38 (54%)
Dry cough	20 (28%)	10 (14%)	16 (23%)	12 (17%)	16 (23%)	10 (15%)	52 (74%)	32 (46%)

Fig. 1 Asthma medication before and after ESS

Fig. 2 Admission and casualty visit

Fig. 3 Spirometric analysis

advocated purging the nostrils of secretions in order to relieve the lower airways. After this historical observation various theories of pathogenesis have been described: (a) sinonasal bronchial reflex, i.e. a reflex bronchoconstriction by activation of a trigeminal afferent–vagal efferent neural arc [5], (b) tissue eosinophils contribute to inflammation

and injury of epithelium of the nose, sinuses and lungs [6], (c) silent dripping of infected material from the nose into the bronchial tree as a possible link between sinusitis and asthma, and (d) reduction in nitric oxide, which is a potent modulator of bronchial tone, a characteristic of CRS, may precipitate acute bronchial hyper-responsiveness [7].

As demonstrated in several studies in coexistent sinusitis and asthma, a proper treatment of diseased paranasal sinuses can significantly improve asthma symptoms. Dijima et al. and Loehrl et al. evaluated 88 and 85 patients with CRS and asthma and reported an improvement in subjective and objective symptoms of asthma, decreased use of bronchodilators and improvement of pulmonary functions [8, 9]. In our study the symptoms of asthma (cough, wheeze and shortness of breath) had a definite improvement after surgical intervention. The effect was comparatively lower in the patients who had severe symptoms as compared to mild and moderate symptoms. The patients with severe symptoms had extensive nasal polyposis preoperatively and developed recurrence for which they underwent revision surgery [10].

The medication use for asthma showed a significant reduction after surgery. In our patients the use of theophyllines, leucotriene inhibitors and inhaled glucocorticoids showed a reduction of 40%, 23% and 37%, respectively. Dunlop et al. evaluated 56 patients and demonstrated a reduction of 20% in steroid inhalers and 28% reduction in bronchodilator inhalers after ESS [11]. Ikeda et al. evaluated 21 patients with asthma and sinusitis, and found reduction in corticosteroid use in 7 patients after surgery [12].

The visits to the emergency room/casualty are a common occurrence in patients of asthma during disease exacerbations. These patients require intensive care during these attacks and these episodes are a marker of poor asthma control. Goldstein et al. in a retrospective case study has shown reduction of these episodes after ESS [13]. We also had a marked reduction in visits to the emergency room/casualty in our patients after surgery. Three patients who still had these exacerbations were found to be cases of extensive nasal polyposis preoperatively with recurrence. One patient among them was a case of Sampters triad (ASA triad) with extensive polyposis and had recurrent acute exacerbations of asthma requiring admission and intensive care.

Objective analysis of effect of surgery was done by PFTs. Multiple readings were tabulated for each patient before and after surgery and mean of the various spirometric parameters were calculated as % predicted for that patient for the height, age, weight and sex. An improvement was seen in the values of FEV₁, FVC and PEFR in the asthmatic patients after ESS. We had improved peak flow rates from 72% to 88% post-ESS. Studies evaluating the pulmonary function parameters have demonstrated improved peak flow rates from an average of 60% of the predicted value preoperatively to 86% [9, 13].

Conclusion

The rationale for treating the nose in asthmatic patients follows the concept of “united airways,” because nasal inflammation can influence the lower airways [14]. In our study we have both subjective and objective data to support that improvement of paranasal disease by ESS can play a significant role in the clinical improvement of asthma. We believe that proper medical and surgical management of CRS in the asthmatic patient can result in both improved sinonasal and asthmatic symptoms with fewer physician visits and decreased need for medication.

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