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The Effect of Functional Endoscopic Sinus Surgery on Pulmonary Improvement of Controlled Asthmatic Patients with Chronic Sinusitis

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ABSTRACT

The relationship between asthma and sinusitis has been proposed in many reports but the role of sinus surgery in their treatment is still controversial. Therefore, the effect of functional sinus surgery in patients with controlled asthma was evaluated.

Fifty six patients with a history of sinusitis in whom maximum medical treatment had failed and also those with a history of asthma who were in a stable condition at time of surgery and were candidates for endoscopic sinus surgery were selected. All those who underwent functional endoscopic sinus surgery were re-evaluated at last one year later for pulmonary and sinus status. The patients' characteristics were prospectively recorded during the study period from January 2007 to November 2009. Finally, the results of the assessments were analyzed. Among 56 studied patients, 35 (62.5%) were female and 21 (37.5%) male. Preoperative imaging, evaluated according to Lund Mac Kay score, had a mean score of 19.5±5. The average effect of FESS in asthma improvement was 69.6%. Asthma improvement had a significant relationship with the duration of asthma and sinusitis before surgery.

Functional endoscopic sinus surgery can effectively treat sinusitis in asthmatic patients. Earlier intervention in the course of pulmonary disease may warrant a better outcome.

Key words: Asthma; FESS; Sinusitis; Sinus Surgery; United Airways

INTRODUCTION

The concomitant presence and exacerbation of sinusitis and asthma are now a confirmed truth; therefore, the theory of unified airway is the basic element of medical data interpretation.[1-5]

Additionally, recent researches which have investigated the role of eosinophils in both diseases propose the tight interrelationship between two sites.[6, 8] However, the exact mechanisms of this association are not clear but the two common proposed hypotheses are sinonasal bronchial reflex and dripping of nasal secretion to the lung. Recent data supports the former one.[6,9]

Also, the effect of endoscopic sinus surgery on the treatment of chronic sinusitis and improvement of patients' asthma is still a controversial issue.[1,3,4,6,10-18] Interpretation of previous data is also a tough task because the exact severity of sinusitis and asthma are not so clear.[1,6,16,19-22] Moreover, the effects of patients' variables on predicting the outcome of the surgery and

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pulmonary status of the patients especially in those with a stable condition of asthma are debatable, too.[3,13,14,23-25]

One of the major sources of these contradictory results is different characteristics of subjects and also assessment methods.[7-10] Among different groups of patients, asthmatic ones with controlled symptoms of airway hyper-responsiveness and also cases with sinusitis resistant to medical treatment are a typical group; thus, we decided to evaluate the effects of functional endoscopic sinus surgery on the abovementioned patients.

PATIENTS AND METHODS

Study Subjects

Fifty six patients with a history of sinusitis, in whom maximum medical treatment (at least 4 weeks widespread antibiotic therapy added to nasal corticosteroid, guaifenesin , and nasal saline douches) had failed and also those with a history of asthma who were in a stable condition at the time of surgery and were candidates for endoscopic sinus surgery were selected. The study began in January 2007 and finished in November 2009.The patients were selected among those who were visited at the rhinology or pulmonary clinic of a tertiary referral center (Imam Khomeini hospital complex in Tehran). All patients were followed up for at least one year after surgery.

Inclusion Criteria

All patients who had asthma according to its accepted definition were included in this study. Asthma was diagnosed by clinical symptoms, medical history, physical findings and pulmonary function tests based on the guidelines of the American Thoracic Society. Asthma patients showed 20% reduction forced expiratory volume in the 1st second (FEV1) according to the basic norm, based on Methacholin provocation test data.[26] Also, patients were recruited who had the symptoms for at least one year and were treated for at least 6 months and were in stable pulmonary condition before the study.

Furthermore, during the follow up period all patients were treated with the same protocol, which was contain corticosteroid spray and beta 2 agonist spray. Moreover, diagnosis of the sinusitis was based on history, imaging, and endoscopic findings and selection of sinusitis patients was conducted after at least 6 weeks of the maximal medical treatment.

Exclusion Criteria

None of our patients suffered from systemic diseases such as diabetes or psychological problems. None of them was on medications which interfere with pulmonary function. Those with acute upper or lower respiratory tract infections within 2 weeks of evaluation were excluded from the study.

Moreover, pregnant patients, patients younger than 18 years, immunodeficient patients, cystic fibrosis cases, and cases with neoplasia or fungal rhino sinusitis were excluded from this study. Furthermore, four patients who did not participate in the follow-up period were excluded from the study, leaving a total number of 56 study subjects. The characteristics of the patients who did not return for follow-up did not affect the final outcomes and they also did not have more complications than others.

Ethical Approval

The protocol of this study was approved by the Institutional Review Board of the Tehran University of Medical Sciences. All aspects of the study were conducted according to the Declaration of Helsinki.

Variable Measurement

Smoking habits, history of any type of allergy and Aspirin sensitivity was evaluated in addition to demographic data.

Subjective Nasal Variable

Patients were asked about the symptoms associated with sinusitis such as coughs, headache, facial pain, facial fullness, nasal discharge, post nasal discharge, nasal obstruction, and hyposmia and were also asked to score them from 0 to 6 (0= lack of any symptoms, 1=mild, 2=mild to moderate, 3=moderate, 4=moderate to severe, 5= severe) pre and postoperatively (at least 12 months after surgery).

Therefore, the sum of the symptoms scores varied between 0 and 45. Moreover, using the visual analogue scale (0= no symptoms, 10= severe disease) patients were asked to report the severity of sinusitis pre and postoperatively. Sinusitis improvement was calculated by subtracting the preoperative score from the postoperative score.

Objective Nasal Variable

Nasal Endoscopy

For all patients, a complete nasal examination including nasal endoscopy was performed to determine the presence of polyp, crust, and discharge preoperatively and at least 12 months after surgery. In order to classify the extent of the polyposis, Stümberger classification was used (1= middle meatus polyp, 2=polyps have partially occupied the nasal space, 3= polyps have completely occupied the nasal space)

Radiography

All patients were undergone complete computerize tomography. The images were evaluated according to Lund-Mackay scoring before the time of surgery. All of images were assessed and reported with the same radiologist.

Subjective Pulmonary Variable

According to patients' symptoms and adding the pulmonary variable, asthma severity were categorized into 5 sections. (Section 0 = no symptom and 5= the severest symptoms). Preoperatively and postoperatively asked the patients to classify the severity of asthma into five groups (no symptoms, mild, moderate, high, sever symptoms)

Final Staging of the Pulmonary Status

According to GINA classification[27] with using spirometry, clinical presentation, and medical treatment, patients were categorized into five groups: Step 0= normal, Step 1= mild and intermittent (the symptoms ≤ 2 days in a week and 2 nights in a month) FEV1≥80%, variation in PEFR < 20% and no need for daily drug treatment. Step 2 = mild and continuous (the symptoms ≥2 days in a week, and 2 nights in a month, but less than one time in a day) FEV1≥80% , variation in PEFR = 20% to 30% and need for low-dose daily treatment with corticosteroid spray. Step 3 = moderate and continuous (all days symptoms and more than one night per week) 60%≤FEV1≤80% and variation in PEFR≥ 30% need for low-dose to moderate-dose corticosteroid spray and daily usage of β_2 agonist spray Step 4= severe and continuous (continuous daily and recurrent night symptoms) FEV1≤60% and variation in PEFR>30%, need for high-dose to moderate-dose corticosteroid spray and daily usage of β_2 agonist spray and probably oral intake of corticosteroid.

Objective Pulmonary Variable

Pulmonary function tests including FEV1 (% predicted), forced vital capacity/FEV1 (%) and $FEF_{25\%-75\%}$, were evaluated using the same spirometer preoperatively and at least 12 months after surgery.

Type of Treatment

Reducing the inflammation and mucosal swelling to easier surgery, oral prednisolone was used in all patients 3 days before surgery. The Messerklinger's method of endoscopic surgery was used as well as the same pre- and postoperative protocol including endoscopic debridement under supervision of one of the senior authors. All patients were treated with broad-spectrum antibiotics for two weeks after surgery. All patients continued to be treated with the same medical regimen for rhino sinusitis after surgery (inhaled nasal corticosteroid two times daily (Fluticasone propionate) and changing in dosage depending on endoscopic findings, and nasal saline douches three times daily) for at least six months. Moreover, the patient's pulmonary treatment was the same during the course of study. All of them utilized Fluticasone spray as the maintenance and Salmetrole spray as necessary.

Statistical Method

Various possible factors were statistically compared including the extent of the disease, age, sex, cigarette smoking, pathology of the disease, middle turbinate resection and other risk factors. Data was analyzed by Kruskai-Wallis, One-way, ANOVA, Mann-Whitney, and Spearman's correlation, Kendall's tau-b, Chi square and T-test using SPSS version 16. *P* values less than 0.05 were considered significant. Data were presented as the mean ± standard deviation.

RESULTS

Among 56 studied patients, 35 (62.5%) were female and 21 (37.5%) were male with a mean age of 36.6 ± 14.2 years (min=19, max=62). Age and sex did not have any significant relationships with other variables. Forty two (75%) patients had a history of allergy. The distribution of the types of sinusitis is summarized in table 1. The patients gave a VAS score to their subjective feelings about sinusitis and the preoperative and postoperative scores were 9 ±3.22 and 2.74±1.8, respectively.

Table 1. Distribution of different sinusitis pathologies

Sinusitis types	Frequency (%)
Chronic sinusitis	12(21.4%)
Nasal polyposis without Sampter	34(60.7%)
Sampter triad	10 (17.8%)

Therefore, sinusitis improvement was calculated to be about 63%.The preoperative VAS score showed a significant correlation with postoperative VAS score. (Correlation coefficient=1, *P*=0.00) but in the presence of nasal polyposis or Sampter triad, we could not find a significant relationship with preoperative VAS scores. The mean symptoms score was 17.5±11.35. The preoperative VAS score did not have a significant relationship with the sum of the preoperative symptoms scores. However, the correlation between the sum of the score and nasal discharge (Spearman's correlation coefficient=0.46, *P*=0.02) and nasal obstruction (Spearman's correlation coefficient=0.48, *P*=0.015) was significant.

The mean duration of sinusitis before surgery was 68.59±24.03 months and had a significant reverse relationship with subjective improvement of sinusitis in VAS (T test, *P*=0.022). Also, the duration of the coexistence of asthma and sinusitis was 55.1± 24.1 which had a significant reverse relationship with subjective improvement of sinusitis in VAS (T test, *P*=0.003). The mean duration of asthma was 76.6±16.7 months, but the relationship was not significant. (*P*=0.096) Smoking was positive in 7 (12.5%), but this history did not show a significant relationship with any variables except for preoperative severity of asthma (Man Whitney, *P*=0.046). The preoperative sinus CT scans were evaluated according to Lund-Mackay score and the results were 19.46±4.94 (min=8, max=24). We could not find any significant relationship between this score and none of the evaluated variables.

All patients underwent endoscopic sinus surgery and no one needed revision surgery during the follow-up period and the only complication was related to one of patient who had CSF leakage which was controlled by a middle turbinate flap.

Nasal endoscopy preoperatively and at least one year after surgery was conducted in all cases. Among all, 8 patients had secretion in nasal endoscopy out of which 50% showed complete improvement after surgery. The results of preoperative and postoperative nasal endoscopy regarding the status of polyposis is summarized in figure 1.

The status of pre and postoperative asthma is summarized in table 2. Preoperative and postoperative asthma severity had a significant relationship (Fisher exact test, *P*=0.001). Moreover, the correlation between these two variables was positive and significant. (Spearman's rho, correlation coefficient=0.730, *P*=0.00) The average effect of FESS in asthma improvement was 69.6%.

Additionally, the preoperative and postoperative pulmonary function test indices of the enrolled patients were evaluated but yielded no significant difference. The results are summarized in table 3. We could not find any significant differences among different types of the sinusitis (chronic sinusitis, nasal polyposis, and Sampter triads) in terms of preoperative sinusitis severity, symptoms score,

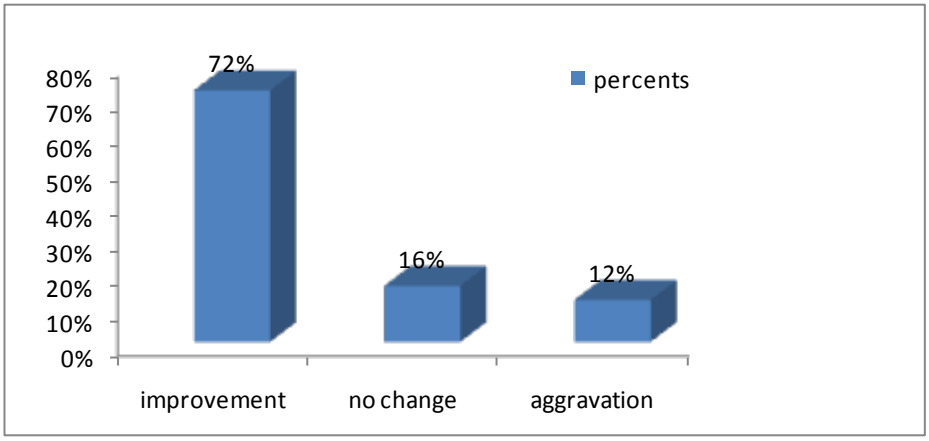

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Figure 1. Changes in preoperative and postoperative nasal endoscopy status of the patients

Lund Mc Kay score and asthma severity and also regarding the effect of FEES on asthma severity in postoperative evaluation (*P*=0.178).

Table 2. Pre and postoperative asthma severity

Asthma severity	Number of patients	
	Pre operation	Post operation
Step0	0(0%)	24(42.85%)
Step1	15(26.78%)	2(3.6%)
Step2	12(21.24%)	17(30.4%)
Step3	27(48.2%)	10(17.85%)
Step4	2(3.6%)	3(5.35%)

DISCUSSION

The companionship between asthma and sinusitis is confirmed in many studies,[1,4-7,9,11,23] but the effect of sinusitis treatment on pulmonary status, especially the outcome of controlled asthma after undergoing functional sinus surgery, is still controversial.[1,5,6,13,14,16,20,23] Also, in most of the previous studies, selected subjective and objective variables were limited and could not entirely evaluate the outcome of sinus surgery in selected patients.[12,16] Therefore, the effects of functional endoscopic sinus surgery on subjective improvement of controlled asthmatic patients with chronic sinusitis were evaluated. The overall asthma improvement in our series was about 70% and the effects were significantly significant. The differences between our results with some reports[13,14,16,23] were due to the methods of asthma assessment because pulmonary function tests in controlled asthma cannot be used as a proper method of surveillance over asthma changes. We used different methods which were more applicable according to the condition of these patients.

Table 3. Preoperative and postoperative pulmonary function test indices

Pulmonary Function variables	Pre operation	Post operation
FVC(L)	3.49±0.76	3.67±0.58
FEV_1(L)	2.65±0.34	2.78±0.33
$FEF_{25\%-75\%}$(L/S)	2.45±0.27	2.66±0.23

On the other hand, the outcome of surgery was another goal of this research on asthmatic patients; it is shown that complete improvement can be achieved in 50% of them and also 22% are endowed with some positive effects. Despite this effect, similar to other surveys, asthma condition should be regarded as a negative factor in FESS results.[28] Most of our patients suffered from severe sinusitis (Min Lund Mac-Kay score =19.46±4.94); Therefore, due to the lack of variation among our cases, we could not find any significant relationships between asthma severity and the outcome of sinus surgery; just the same, we could not use it as a prognostic factor in endoscopic sinus surgery.[6,12,15,28]

Also, alternative to imaging, we tried to use nasal endoscopy as a prognostic factor but we obtained the same results. Both aforementioned variables were used to evaluate the parallel involvement of the upper and lower airway which is expressed in many studies,[7] but it seems that nitric oxide or eosinophil count may be better variables.[4,5,7]

We could not find any significant differences between different sinus pathologies in their outcome which can be due to the small sample size of our study; however, it might warrant further researches to define diversity with other researches.[19,24,25]

Our results showed that the duration of the coexistence of asthma and sinusitis had a negative effect on the treatment outcome of both conditions which supports the theory of unified airway. In spite of our results regarding the effect of sinus surgery on improving sinusitis and asthma, a longer follow-up period may illustrate different results. Therefore, studies with longer follow-up periods should be done in future. Also, comparing the outcome of asthma in different sinusitis pathologies requires larger sample sizes to completely define the diversity of the variables.

CONCLUSION

The functional endoscopic sinus surgery can be an effective treatment of the sinusitis in asthmatic patients.

The earlier interaction in the course of pulmonary disease may predict better outcome.

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