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Original Research Article

A study on olfactory improvement assessed with butanol threshold test in chronic rhinosinusitis patients after fess at a tertiary care centre in Malabar region

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ABSTRACT

Background: Chronic Rhinsinusitis is a hetreogenous disorder with a broad range of etiologic factors involving mucosa of nasal cavity and paranasal sinuses. Olfactory dysfunction has been reported in approximately 60-80% of patients who suffer from CRS.
Methods: Hospital based prospective observational study in the department of ENT, KMCT medical college, Mukkam done in Patients diagnosed with CRS who require FESS having anosmia or hyposmia as an additional symptom. Calculated sample size was 87. Butanol threshold test was done in patients before undergoing FESS and at 1st week,6th week and 24 weeks following FESS and improvement noted. Independent sample t test and ANOVA were used to test statistical significance
Results: Out of 87 subjects, 36% belonged to age group of 36-45 years 15-25 years was the least involved group and majority of patients had nasal obstruction (83.9%) or nasal discharge (81.6%). 69% of patients experienced facial pain and 79.3% had post nasal discharge. Pre operative BTT showed a mean value of 4.89.BTT at 1st week post op showed a mean value of 3.63. At 6 weeks post op BTT value showed significant difference from pre op value with a mean of 2.05 and at 24 weeks post op the mean BTT was 1.70
Conclusions: Summarising the results from our study we affirm that FESS improves olfactory function substantially in CRS patients especially in patients with polyps.

Keywords: Chronic rhinosinusitis, Olfactory dysfunction, Functional endoscopic sinus surgery, Butanol threshold test

INTRODUCTION

Chronic rhinsinusitis is a hetreogenous disorder with a broad range of etiologic factors involving mucosa of nasal cavity and paranasal sinuses and is a very common entity an ENT specialist encounters. Though the exact epidemiology is not available it is estimated to effect almost 12-15% of human population at some pointy of life and effects all age groups and is a major burden to society in terms of productiveness and economic effect. The European position paper on rhinosinusitis and nasal polyps has now defined rhinosinusitis as a diagnosis made on clinical grounds based on the presence of characteristic symptom, combined with objective evidence of nose and paranasal sinuses.[1] Rhinosinusitis is further defined as acute or chronic with a time span of 12 weeks as standard. At the present time CRS is largely subcategorise into chronic rhinosinusitis with nasal polyposis (CRSwNPs) and rhinosinusitis without polyps (CRSsNPs).[1] The most international guidelines have supported the EPOS

definition confirming the need for objective evidence to confirm the symptom profile.[2] The primary symptom profile of CRSwNPs and CRSsNPs include nasal congestion, nasal discharge(anterior or posterior) and nasal obstruction and the additional symptoms include facial pain or pressure and olfactory dysfunction(hyposmia or anosmia).[3]

Diagnostic criteria for chronic rhinosinusitis

Symptoms should be correlated by either endoscopic and/or radiologic findings.[3] Primary symptoms (requires atleast one to be present, but if both present sufficient for diagnosis) include Nasal blockage, Congestion and Nasal discharge and additional symptoms include Facial pain/pressure and Olfactory dysfunction (Hyposmia/ Anosmia) with supportive endoscopic findings of Nasal polyps· Mucopurulent discharge and Oedema/mucosal obstruction in middle meatus and respective mucosal changes in CT. The endoscopic findings are graded based on modified Lund and Kennedy scoring system.[4] Score is based on presence of polyps, discharge, edema or crusting in middle meatus. CT-Computed tomography of paranasal sinuses scored with Lund Mackay scoring and is based on absent/partial/complete opacification of each sinuses and osteo meatal complex and scored accordingly.

Such patients are managed mainly by correcting the underlying cause as there are a large number of endocrine, anatomical as well as physiological etiologies for the same. The prevalence of CRSwNP is around 7% in patients with asthma, compared to 4% of the generalpopulation,[5] and increases to 30-60% in patients with aspirin exacerbated respiratory disease (AERD).[6] Surgical management is considered for patients who have failed to respond to maximal medical treatment and for those with complications. Functional endoscopic sinus surgery aims to improve sinus ventilation and drainage as well as removing polyps. A combined treatment strategy involving both medical and surgical management is recommended for long-term control because of the chronic and recurrent nature of the disease, with treatment aiming to eliminate nasal polyps and rhinitis symptoms, re-establish nasal breathing and olfaction.[7]

The prevalence of chronic rhinosinusitis (CRS) estimated in epidemiologic studies is 5% to 12%[8]. In Indian population rhinosinusitis is a common disease affecting large number of populations annually but statistically not much data is available. Approximately 83% patients are managed conservatively whereas around 17% need surgical intervention.[9] Olfactory dysfunction has been reported in approximately 60-80% of patients who suffer from CRS. The etiology of CRS-associated smell loss is multi factorial and occurs by a combination of localized inflammation of the olfactory mucosa and mechanical obstruction of the olfactory cleft from either mucosal edema or structural abnormalities.[10]

This study is to assess the improvement in olfactory dysfunction following surgical management of both CRSwNPs and CRSsNPs.

METHODS

Study design, location and duration

Current hospital based prospective observational study was conducted at the department of ENT, KMCT medical college, Mukkam, Kozhikode. The study was completed within a period of 2 years from January 2021 to December 2022.

Study population

Patients with clinical diagnosis of Chronic rhinosinusitis, after confirming the diagnosis with diagnostic nasal endoscopy and computed tomography of paranasal sinuses, patients with refractory rhinosinusitis who require surgical correction (Functional endoscopic sinus surgery) who have anosmia or hyposmia as an additional symptom are selected after detailed history and clinical examination.

Sample size

From data obtained from previous studies 68% of subjects were shown to have improved in olfactory function. From this data and an allowable error of 10%, sample size was calculated using the formula:

$$N = 4pq/dxd; 68\ x\ 32\ x4\ /10\ x\ 10 = 87.$$

P value from previous studies is found to be less than 0.005. As the study requires comparison of same group at two different points of time paired t test is used for this study.

Inclusion criteria

Patients with symptoms of chronic rhinosinusitis (Major symptoms+anosmia or hyposmia as additional symptoms for more than 12 weeks, confirmed with CT of paranasal sinuses and Age group of 15-55 years were included.

Exclusion criteria

Symptoms of rhinosinusitis with less than 12 weeks duration, Age <15 years and >55 years, history of previous nasal surgeries, history of major facial trauma, evidence of systemic diseases like cystic fibrosis, Parkinsons disease, Alzheimers disease and evidence of benign or malignant tumours of sinonasal mucosa were excluded.

Methods

After obtaining approval from institute regulatory committee and ethics committee the study is proposed to be done in Department of ENT, KMCT medical college, Mukkam, Kozhikode. Selection of study population is

done based on inclusion and exclusion criteria. Step 1: Patients attending OPD with symptoms of rhinosinusitis are noted and cases with refractory symptoms even after medical management who require surgical correction are selected. Step 2: Diagnosis confirmed with diagnostic nasal endoscopy and computed tomography of paranasal sinuses and assessed for need of Functional endoscopic sinus surgery. Step 3: Consent obtained from the selected patients. Step 4: Pre operatively, a Butanol threshold test is done for all the selected cases. Patient is asked to smell cotton ball soaked in Butanol solution. The lowest concentration of 1-butanol is given first, increasing the concentration threefold with subsequent bottles. The bottles are graded from 1 to 10 in increasing order of concentration of butanol. The concentration at which the patient is able to perceive the odour is noted. Step 5: Patient undergoes functional endoscopic sinus surgery Step 6: Butanol threshold test is repeated at 1 weeks and 6 weeks post operatively. Step 7: Subjective improvement in olfaction in patients are noted after 6 months of surgery. Step 8: Data obtained is analysed with paired t test and further analysis done.

Statistical analysis

Data was analysed and graphs are depicted using suitable statistical softwares. Continuous variables are summarized as mean and standard deviation. Categorical variable summarized in terms of frequency with percentage and paired t test was used for analysis.

RESULTS

Age group

Out of 87 subjects, maximum number around 36% belonged to age group of 36-45 years and 15-25 years was the least involved group.

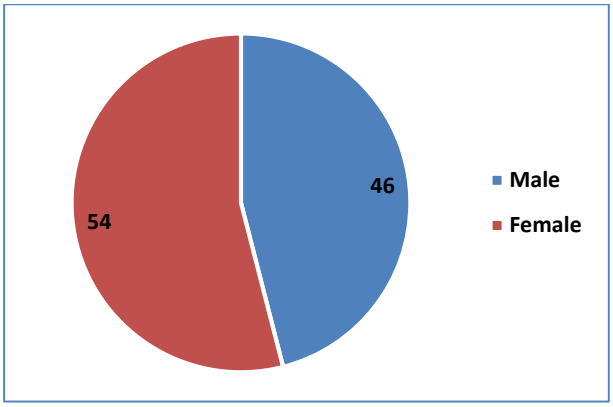

Figure 1: Sex distribution.

Presenting symptoms

In our study we considered all major symptoms (nasal obstruction, nasal discharge and nasal congestion) and minor symptoms (facial pain and olfactory dysfunction, we observed that majority of patients had either nasal obstruction (83.9%) or nasal discharge (81.6%). 69% of patients experienced facial pain and 79.3% had post nasal discharge.

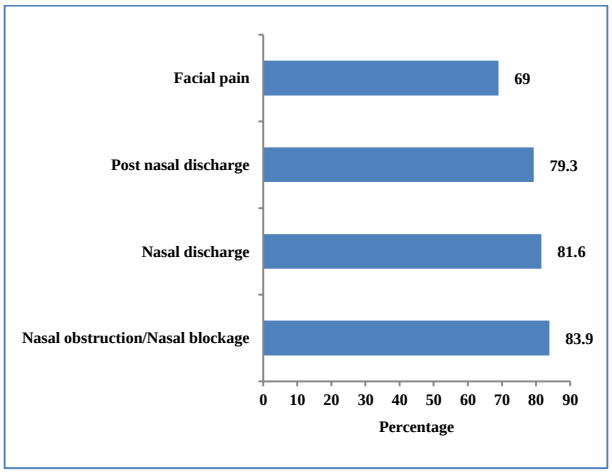

Figure 2: Symptom profile of patients.

Examination finding of inferior turbinate

Among 87 subjects,45 patients (51.7%) had normal inferior turbinate on both sides, 22 subjects (25.3%) had polypoidal right inferior turbinate,14 (16.1%) patients had polypoidal left inferior turbinate. B/L Polypoidal IT was noted in only 6 subjects (6.9%).

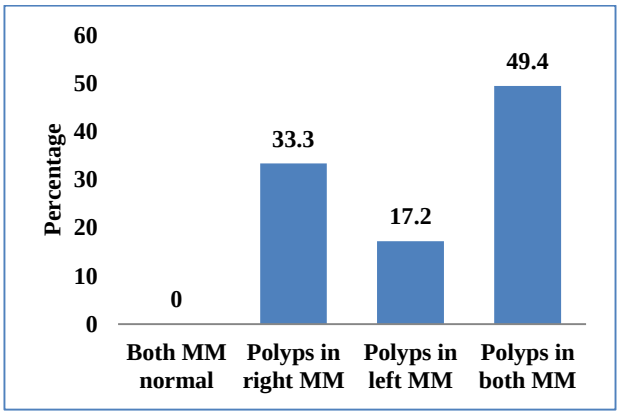

Figure 3: Middle meatus findings.

Examination finding of middle turbinate

Among the 87 subjects only 1% had a normal middle turbinate. Rest 86 patients had Polypoidal middle turbinate with 30 (34.5) having a Polypoidal right middle turbinate , 24 (27.6%) having Polypoidal left middle turbinate and 34 subjects (36.8%) having bilateral Polypoidal middle turbinate.

Examination finding of middle meatus

Almost all of the patients had polyps in middle meatus with 29 patients having polyps in right MM,15 having

polyps in left MM and 43 patients having polyps in bilateral middle meatus.

Table 1: CT PNS with Lund Mackay scoring frequency.

Computed tomography of paranasal sinuses scored with Lund Mackay scoring	
Mean±SD	15.08±3.73
Median (IQR)	16 (12-18)

Computed tomography of paranasal sinuses

We obtained CT PNS of all subjects in the study and scored them with Lund and Mackay scoring system.

Diagnostic nasal endoscopy

DNE was routinely done for all patients who underwent FESS and scoring was given based on Lund and Kennedy scoring system. We obtained a mean score of 11.1 for the group with a standard deviation of 3.55 and median score was 10.

Table 2: DNE scoring frequency.

Diagnostic nasal endoscopy scored with Lund Kennedy scoring	
Mean±SD	11.10±3.55
Median (IQR)	10 (8-14)

Table 3: Butanol Threshold test values.

Parameters	
Butanol threshold testpreoperatively	
Mean±SD	4.89±1.55
Median (IQR)	5 (4-6)
Butanol threshold test 1 week postoperatively	
Mean±SD	3.63±1.65
Median (IQR)	3 (2-4)
Butanol threshold test 6 weeks postoperatively	
Mean±SD	2.05±1.21
Median (IQR)	2 (1-3)
Butanol threshold test 24 weeks postoperatively	
Mean±SD	1.70±0.96
Median (IQR)	1 (1-2)

Butanol threshold score

Pre operative butanol threshold showed a mean value of 4.89 and median of 5.BTT at 1st week post op showed a mean value of 3.63 and median value of 3.At 6 weeks post op BTT value showed significant difference from pre op value with a mean of 2.05 and at 24 weeks post op the mean BTT was 1.70.Thus in our study we noticed a statistically significant improvement in olfaction in terms of BTT values.

DISCUSSION

Demography

In our study on olfactory improvement in chronic rhinosinusitis patients, which is a hospital based prospective cross-sectional study 87 subjects (47 females and 40 males were included). We noticed that majority of subjects belonged to age group of 35-45 years. The demographic distribution is comparable to a similar study by Babak Saedi et al which also showed a female preponderance and mean age affected being 35 years.[11]

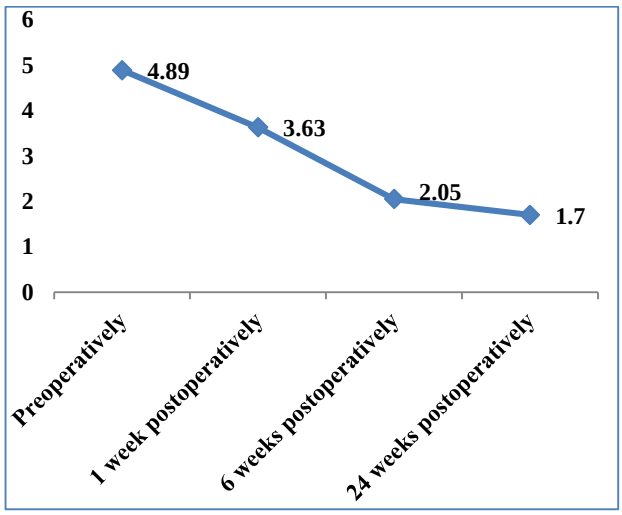

Figure 4: Butanol threshold improvement chart.

Table 4: Correlation between change in BTT score from preoperative period to 24 weeks postoperative period and CT PNS and DNE.

Variable	Change in BTT score	
	Correlation coefficient	**P value**
CT PNS	0.628	<0.001
DNE	0.632	<0.001

Symptom profile

In our study we noticed that most of the patients had experience nasal discharge (71 of 87) or nasal obstruction (73 of 87) and 60 of them experienced facial pain. Post nasal discharge was reported by 69 patients. According to our study nasal discharge or obstruction is the most common symptom and facial pain the least common one. According to study by Hirsch et al the most common symptom was post nasal drip and least common symptom was nasal discharge.[12]

In another study by Garg et al which studied 94 patients the symptom profile was similar to our study with almost 100% of subjects reporting nasal discharge and the most presenting symptom followed by facial pain and post nasal discharge.[13] The results of this study is comparable with our study in terms of symptom profile. This may be due to

similar geographic and environmental factors of subjects in both the studies.

Lund Mackay scoring

Among 87 subjects who participated in the study, the mean Lund Mackay score was 15.08 and median score was 16 which is less when compared to subjects in a study by Cartlano et al in which the mean Lund Mackay score was 17.6.[14] Another study by Aljfout correlating Lund Mackay scores and delay in surgery they observed mean values of 17.96, 18.8 and 17.3 in the three groups in which in their study was conducted which also shows a slight increase from the mean score of our study.[15] In another large population study of about 1840 patients by Hopkins et al the mean score by Lund Mackay system obtained was 11.[16] Our study with limited population showed a mean of 15.96 which is 4 scores higher than this study.

Olfactory improvement following fess

There is substantial evidence that olfactory function improves after FESS in CRS patients. In a study by Litvack et al in 2009, they demonstrated that olfactory improvement was reported in patients with anosmia but not in patients with hyposmia. In another study by Pade et al with a study population of 206 they reported olfactory improvement in 23% of patients, 68% received no change and 9% had decline in olfactory function following FESS.[17,18] Litvack et al and Pade et al also suggested polyps as one of the important factors responsible for olfactory dysfunction. In a study by Rudmik et al, they suggest that patients with anosmia and nasal polyposis had greater chance of olfactory improvement following FESS. In a study of 97 patients by Saedi et al he noticed olfactory improvement in almost 77% of patients.[11] In a study by Perry, data was collected from 178 patients and they reported subjective improvement in olfaction almost all of the patients. The average olfactory dysfunction score was 4.9 pre op which improved to 0.9 at 1 year following surgery. In our study we noticed olfactory improvement in around 92% of subjects. The statistically relevant change was noted in patients with polyps in Middle meatus. The mean BTT score pre op was 4.89 which improved to 3.67 one week after FESS and had a drastic improvement when assessed at 24 weeks post op with a mean score of 1.7. Analysing the factors related with improvement in BTT score, patients with polyps in middle meatus and a higher Lund Kennedy and Lund Mackay score indirectly indicating severity of disease, had statistically significant improvement.

Limitations

Limited follow up period of 24 weeks and recurrence of polyps and olfactory decline in recurrence couldn't be followed up. Study was performed with a limited study population and hence there is narrow frame for generalizabilty of results

CONCLUSION

We had studied 87 Chronic rhinosinusitis patients who underwent FESS. 92% (80) patients had olfactory improvement in terms of BTT score of which few had marginal improvement. Only 8% patients didnt show significant improvement in BTT score at 24 weeks post op. Most of the studies showed that improvement in Olfaction was evident in CRS patients with polyps than in CRS patient without polyposis. Since almost all of our patients belonged to CRSwNP we noticed significant olfactory improvement post FESS. Summarising the results from our study we affirm that FESS improves olfactory function substantially in CRS patients.

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Conflict of interest: None declared
Ethical approval: The study was approved by the Institutional Ethics Committee

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