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RESEARCHARTICLE

THE EFFICACY OF FUNCTIONAL ENDOSCOPIC SINUS SURGERY IN RECURRENT AND REFRACTORY RHINOSINUSITIS PATIENTS IN TERMS OF SYMPTOMATIC BENEFIT – A PROSPECTIVE STUDY

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ABSTRACT

Introduction: The aim of the study was to evaluate the efficacy of functional endoscopic sinus surgery (FESS) in modifying patient's symptom profile and to also confirm that FESS is the modality of treatment in patients with refractory CRS.
Design: Prospective study.
Methodology: 50 patients with symptoms of CRS were included in the study and subjected to FESS. Patients were assessed for CRS symptoms preoperatively and postoperatively using grading symptoms.
Results: Leading symptom of CRS was nasal obstruction followed by headache, facial pressure and postnasal drip and other minor symptoms. After a postoperative follow up of 6 months there was improvement in the symptoms. All minor symptoms had 100% improvement. Nasal obstruction responded best, next followed by facial pain and headaches and PND (All symptoms P-value <0.001). An overall improvement of 86.66% was recorded.
Conclusion: The restriction of quality of life in patients with CRS is mainly caused by these symptoms, which can be improved in excellent fashion by FESS in majority of the patients.

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INTRODUCTION

With the increasing pollution in our ecosphere to various kinds of allergens, chronic rhinosinusitis (CRS) is fast evolving as a morbid state leading to much discomfort and absenteeism. CRS is one of the most frequent otorhinologic disease encountered in clinical practice. CRS is a very common aliment which negatively affects quality of patients. The epidemiological studies focussing on CRS in Indian population and the efficacy of various treatment options thereof are sparse in published literature. CRS significantly impacts quality of life measures with decrements in general health perception and is one of the main reason for which antibiotics are prescribed and for loss in the work force (Osgruthrope1999).

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Most patients are managed medically with long-term antibiotics, decongestants (topical or oral), corticosteroids (topical or systemic), mucolytic agent or by surgical intervention including OPD procedures like antral lavage to radical procedure which have been replaced by the conservative functional endoscopic sinus surgery (FESS) (Kennedy, 1985; Settlif, 1994).

MATERIALS AND METHODS

This study was carried out in one of the tertiary care hospital. A total of 50 cases of chronic rhino sinusitis refractory to medical treatment in the age group of 15 to 65 years were investigated and subjected to FESS. Detailed history and complete local and general physical examination was done. A uniform history was documented for each patient. All patients included in this study were recurrent and refractory to medical treatment for sinus

problem. All patients were examined with anterior and posteriorrhinoscopy. Patients presenting with any two of the following major symptoms and signs or one major and two minor symptoms and signs for duration of more than 2 weeks were selected.

Major symptoms and signs

a) Nasal obstruction.
b) Purulence in nasal cavity on examination
c) Purulent nasal discharge with post nasal drip
d) Hyposmia/anosmia
e) Nasal congestion/fullness
f) Facial pain / pressure

Minor symptoms and signs

a) Headache
b) Halitosis
c) Fatigue
d) Dental pain
e) Cough
f) Ear pain/pressure/ fullness

All the patients selected for the study were subjected to a standard protocol of investigations which included:

a) Radiographs of para nasal sinuses- an open mouth water's view, Caldwel-Luc view, lateral of view skull for investigating mucosal thickening > 5mm, opacification of one or more sinuses, An air fluid level.
a) NCCT scan of PNS were performed at 4 to 6 weeks from the initiation of medical treatment.3-mm coronal sections were taken for anatomic evaluation and the staging in chronic rhinosinusitis (CRS) was done on Lund-Mackay staging system, (1993)
b) Nasal endoscopy (NE):Lanza Kennedy criteria was used to grade nasal endoscopy findings looking at the presence of secretion, oedema and polyps. NE findings were considered positive when there was presence of either or combination of polyps, mucupus in the middle meatus or diseased mucosa. A diagnostic nasal endoscopy was performed pre-operatively on all patients under local anaesthesia, using 4mm -0 &-30 degree Hopkin rods.

Sugical procedure

All the patients were operated upon under general anaesthesia by the classical Messer linger technique. The patient was placed in supine with head in different positions depending on operating side. Nasal decongestion was obtained with packing the nasal cavity with cotton pledget soaking in 4% xylocaine with 1:10,000 adrenaline. After five minutes, the uncinate process, the roof of middle turibunate and ethmoid bulla were injected with 2% xylociane in 1:100,000 adrenaline under endoscopic visualisiation. The uncinate process was then incised with a sickle knife and removal with straight cup forcep, exposing the bulla. The extent of surgical resection from this point was variable based on intraoperative findings. The ethmoidal bulla and then anterior and posterior ethmoid cells were removed. Posterior ethmoid cells and sphenoid sinus were left unremoved in patients with limited disease. The lateral portion of bulla was used as a landmark for the lamina parpyracea. The fovea ethmoidalis was identified and followed posteriorly to the basal lamella. The natural ostium of maxillary sinus was identified in all patients with a 30°Hopkin rod and enlarged, using angled and back biting forceps to create an opening approximately 1.5×2 cms in size. The maxillary sinus was inspected using 70°telescope and disease was removed. The area of frontal recess was examined with 30°telescope and opened when there was frontal disease present. Concha bullosa of the middle turbinate was subjected to lateral laminectomy to deal with the disease and to enlarge the ostiometal complex. Following the surgery, an antibiotic was instilled in the operating field. At the end of surgery merocel packs was placed under the middle turbinate in the nasal cavity for 48 hrs. Patient were started saline nasal spray after removal of pack from nasal cavity which was continued until crusting ceased.

Follow up: All patients were kept under regular follow up for period of 3 to 6 months, postoperatively. At the intervals of 3 weeks, 6 weeks and 12 weeks they were subjected to meticulous examination including nasal endoscopy. Non-adherent crusts and secretions were removed using nasal endoscopes, various curved suction tips and alligator forceps. In the rest of the postoperative visits additional removal of crust and retained secretions was done until minimal crusting was present.

Patient's symptoms were recorded during each visit and improvement graded as :- (a) Complete relief – 90 to 100% betterment VAS score (0-3);(b) Partial relief – 50 to 90% betterment VAS score (4-7) and (c)Poor/no relief- <50% betterment, VAS score (>7) and their subjective improvement of symptom of chronic sinusitis was recorded on the basis of VAS score, so were the complications recorded if any occur intra / post operatively.

RESULTS

In the present study, maximum number of patients were falling in the age group of 15 – 25 years (52 %). The youngest patient being 16 years and the oldest was 62 years of age. (Table 1 and Fig. 1) In the study, males were more effected than females. Male to female ratio was 66: 34. (Table 2 and Fig. 2)

Table 1.Showing Age distribution of cases (patients)

Age of patients (years)	No. of patients	Percentage (%)
15 – 25	26	52
26 – 35	8	16
36 – 45	7	14
46 – 55	7	14
>55	2	4
Total	50	100
p-value	0.073	
Remarks	NotSignificant statistically	

Table 2. Sex distribution

Sex	No. of Patients	Percentage (%)
Male	33	66
Female	17	34
p-value	0.0013	
Remarks	Significant statistically	

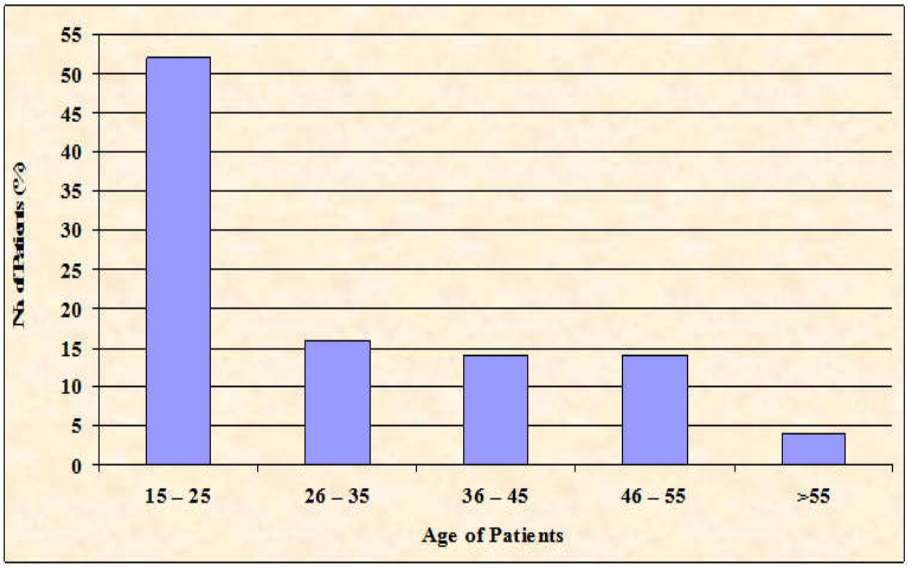

Fig. 1.Age distribution in patients undergone FESS

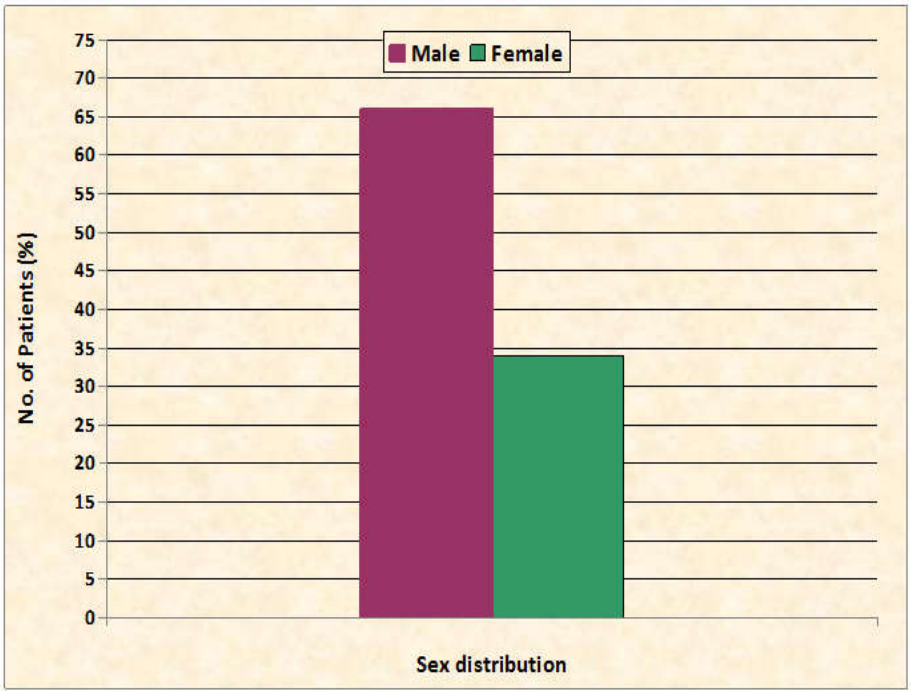

Fig. 2.Sex distribution in patients undergone FESS

Table 3. Chief Complaints

Chief complaints		No. of Patients	Percentage (%)
Nasal Obst.		44	88.00
Nasal discharge		14	28.00
PND		10	20.00
Anosmia & Hyposmia		5	10.00
Facial pain		2	4.00
Headache		32	64.00
Halitosis		13	26.00
Fatigue		9	18.00
URTI/cough/ sore throat		17	34.00
Epistaxis		5	10.00
Earache/ ear fullness		8	16.00
Miscellaneous	Foreign body sensation	1	2.00
	Dental pain	2	4.00
	Snoring	1	2.00
p-value		0.004	
Remarks		Statistically Significant	

The most common major symptoms were nasal obstruction (88%) followed by nasal discharge (28%), PND (20%) and alteration smell (10%) and the minor symptoms as headache (62.5%), URTI (34%), halitosis (26%), fatique (18%).Other associated symptoms include facial pain, epistaxis, earache and miscellaneous were seen in few patients (Table 3 and Fig. 3).

Anterior rhinoscopy revealed DNS in 32 (64%) patients, followed by hypertrophy of inferior turbinate in 25 (50%) patients, mucopurulent discharge in 25 (40%) patients, middle turbinate hypertrophy in 10 (20%) patients and ethmoid polyp in 5(10%) patients (Table 4 and Fig. 4)

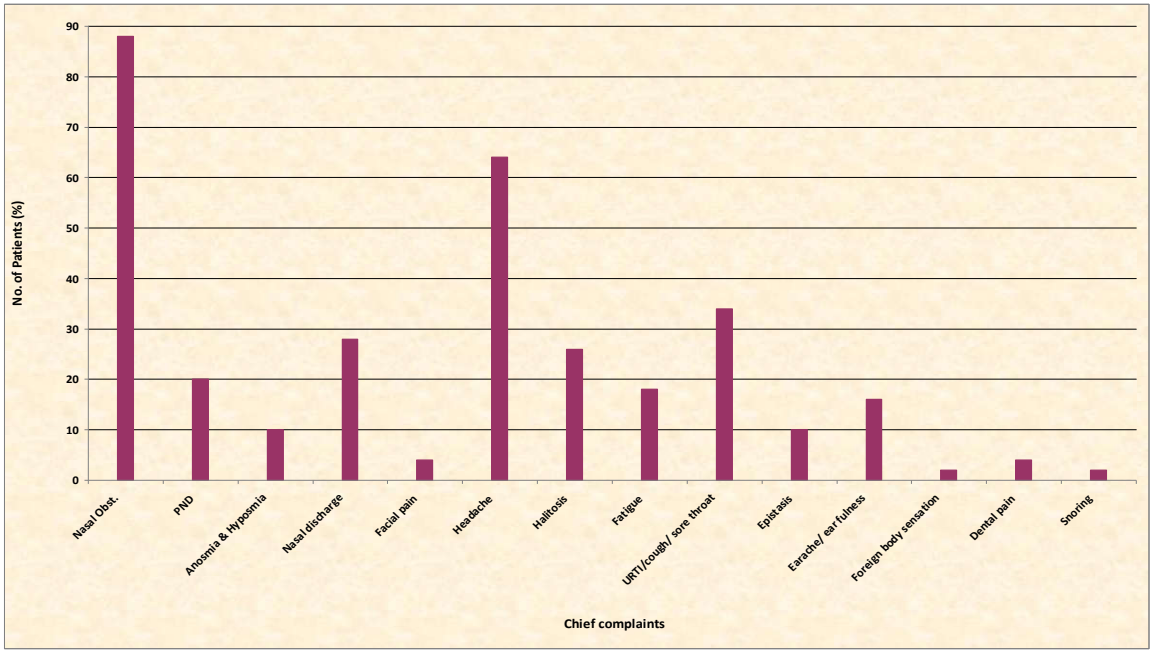

Fig. 3. Chief Complaints

Table 4. Preoperative findings in anterior Rhinoscopy (A/R)

Findings on anterior Rhinoscopy (A/R)	No. of patients	Percentage (%)
Deviated anterior nasal septum (DNS)	32	64
Inferior turbinate hypertrophy (ITH)	25	50
Middle turbinate hypertrophy (MTH)	10	20
Mucopurulent discharge	20	40
Nasal congestion	6	12
Ethmoidal polyps	5	10
p-value	0.015	
Remarks	Significant statistically	

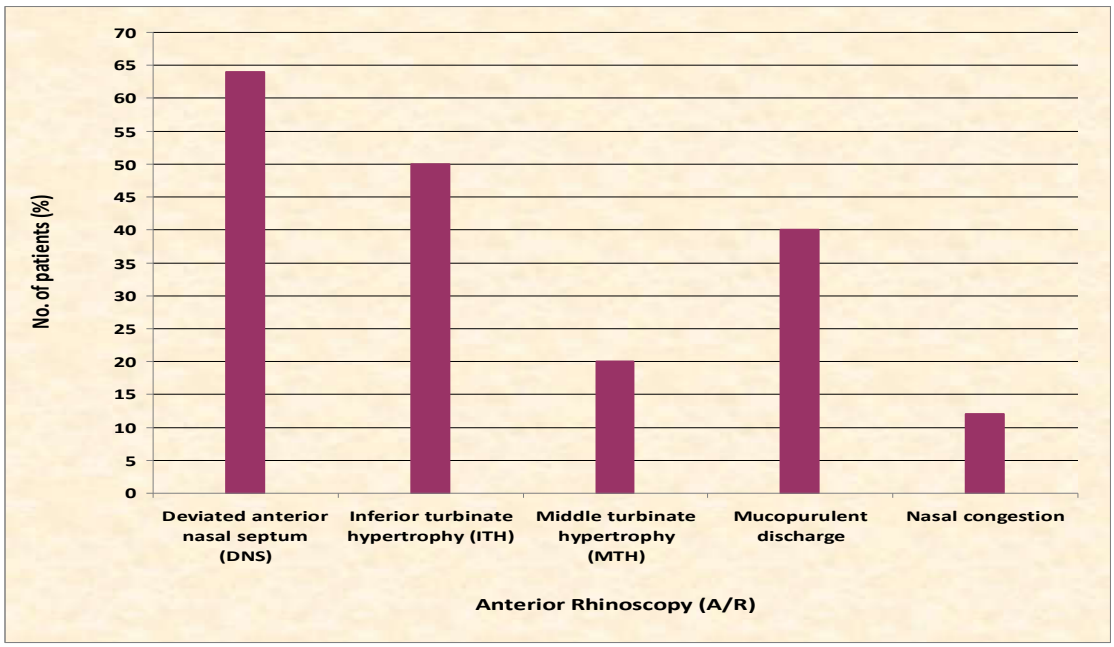

Fig.4. Preoperative findings in anterior Rhinoscopy (A/R)

Table 5.VAS Score

Complaints	VAS Score	
	Pre-operative	Post-operative
Nasal Obst.	7	2
Headache	6	1
PND	5	1
Halitosis	5	1
Facial pain	4	1
Fatigue	5	1
URTI/cough/ sore throat	4	1
Forgien body sensation	4	1
Anosmia/ hyposmia	5	1
Epistasis	5	1
Earache	3	1
Dental pain	6	1
p-value	0.00513	
Remarks	Statistically significant	

Fig. 5.Pre and Post-operative VAS score in patients undergone FESS

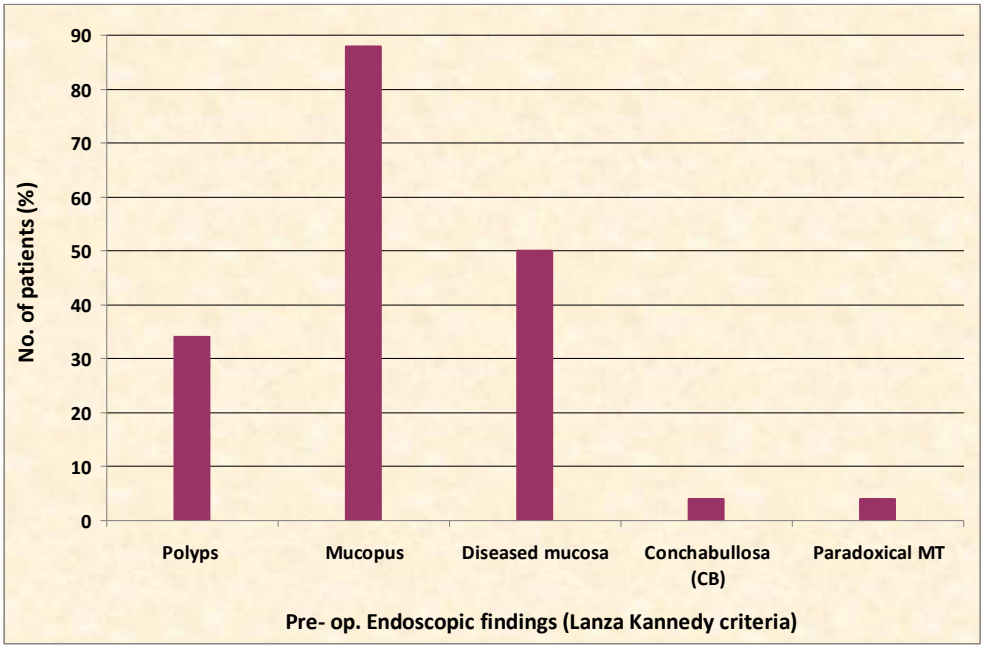

Fig. 6.Pre-op endoscopic findings in patients undergone FESS

In the present study, most frequent finding on pre operative endoscopy was mucopus 44 (88%) followed by diseased mucosa with polyps 25 (50%), polyps 17 (34%) and minor findings concha bullosa 2 (4%) and paradoxical MT 2(4%). (Table 6 and Fig. 6)

Table 6. Pre- op. Endoscopic findings (LanzaKannedy criteria)

Endoscopic findings	No. of Patients	Percentage (%)
Polyps	17	34.00
Mucopus	44	88.00
Diseased mucosa with polyps	25	50.00
Conchabullosa (C B)	2	4.00
Paradoxical MT	2	4.00
p-value	0.084	
Remarks	Not Significant statistically	

Table 7. Intra- operative findings

Intra op. findings	No. of patients	Percentage (%)
Polyps	16	32.00
Mucosal thickness	34	62.00
Lt. Osteomeatal complex Block (OMC).	37	74.00
Rt. Osteomeatal complex Block (OMC).	34	68.00
Concha bullosa (CB)	3	6
p-value	0.020	
Remarks	Significant statistically	

In the present study, the most frequent intraoperative finding during ESS include OMC block (68 % - 74%) of paients. The next frequent finding was mucosal thickening (62%) followed by polyps (32%) and C B (6%) patients. (Table 7 and Fig. 7)

A meticulous follow-up was done in the present study to evaluate the results with regard to relief of symptoms and response to treatment based on visual analogous scale (VAS) and results were graded as: Complete relief (VAS 1-3), Partial relief (VAS 4-7) Poor/no relief (VAS > 7).

In the present study complete relief (VAS 1-3) was noted in 47 (94%) patients; 2 (4%) patients had only partial relief (VAS 4-7) from their symptoms whereas 1 (2%) patient claimed to have no relief (VAS >7). We noticed the pre-operative visual analogue score (VAS) 7 for nasal obstruction was reduced to a post-operative score of 2. VAS of other complaints were even reduced upto 1. (Table 5 and Fig. 5)

In the present study, the majority of patients 27 (54%) were discharged within 3 days and 5 (10%) were at 7th post-operative day. (Table 8 and Fig. 8)

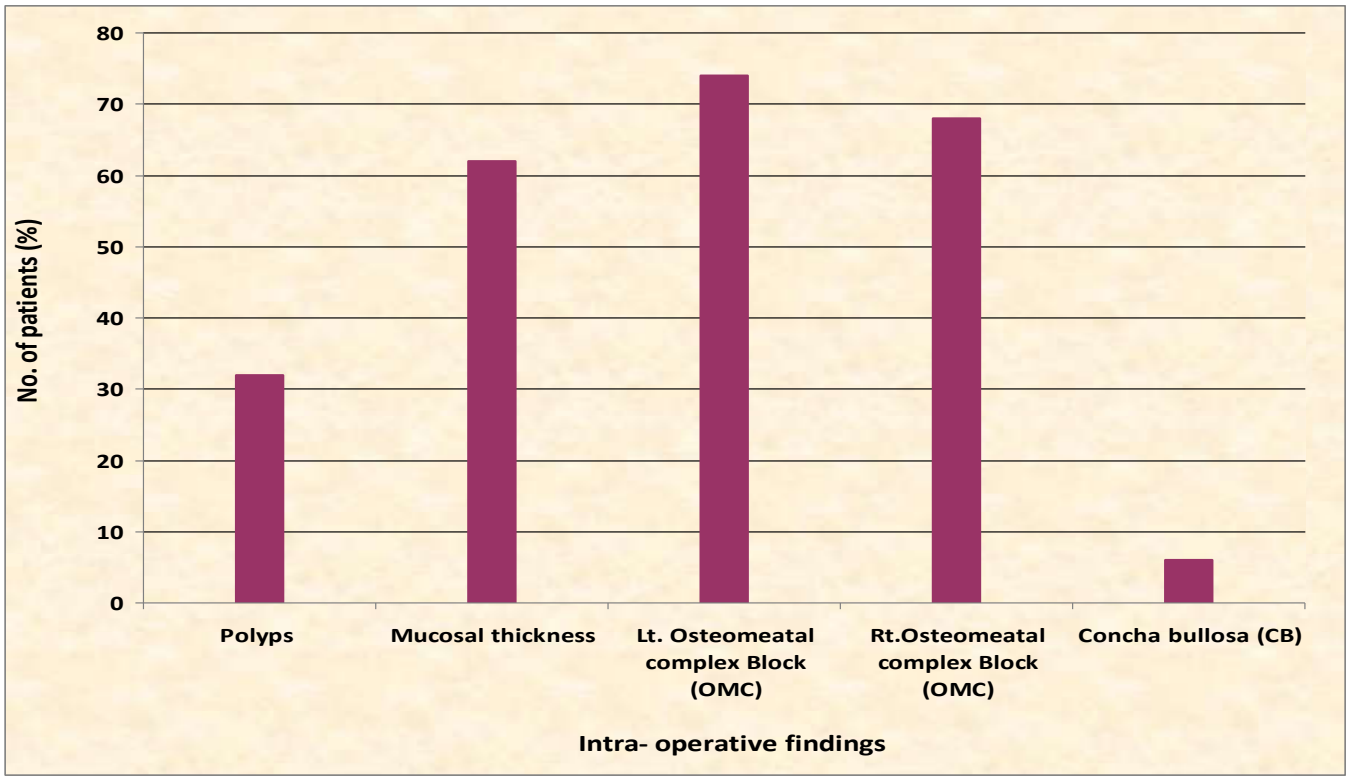

Fig. 7. Intra-operative findings in patients undergone FESS

Table 7. Intra- operative findings

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Concha bullosa (CB)	3	6
p-value	0.020	
Remarks	Significant statistically	

Table 8. Hospital stay

Hospital stay (days)	No. of Patients
1 - 3	27 (54%)
4 - 6	18 (36%)
≥ 7	5 (10%)
p-value	0.0001
Remarks	Significant statistically

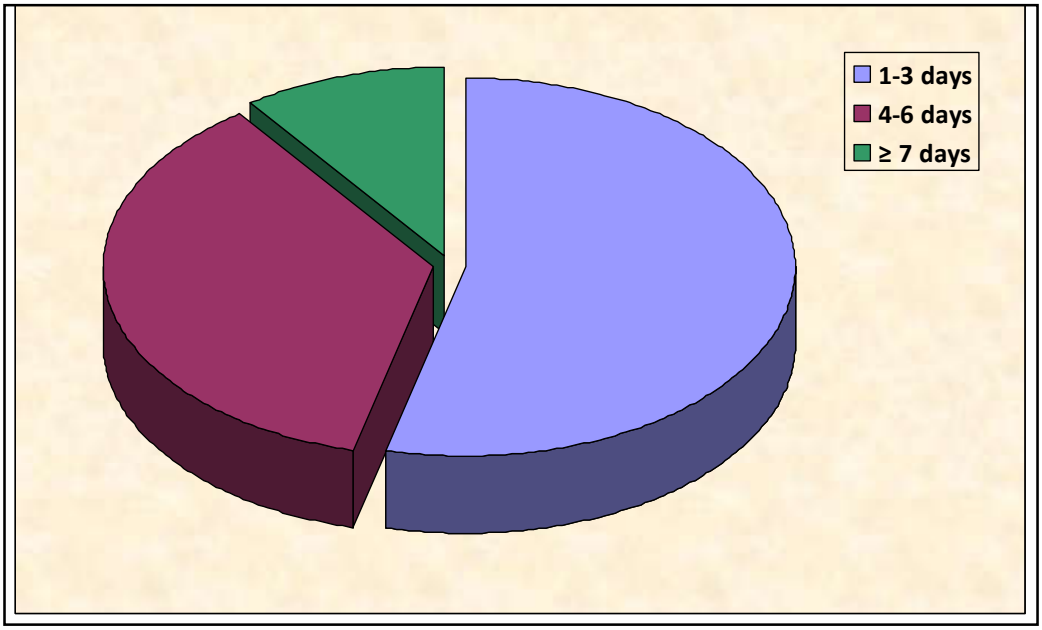

Fig 8. Duration of Hospital Stay in days

Table 9 Author	Nasal obstruction	Nasal discharge	PND	Altered smell	Halitosis	Headache	DNS
Lush and Muntz (1990) (n=31)		100%					
Levine (1990) (n= 250)			51.2%				
Venketachalam and Bhat (2000) (n= 210)	87.14%	70%					
Chang (2004) (n=101)	96.03%	94.05%					
Gandotra*et al*. (2000) (n=69)			28.9%				4.9%
Ranjankumar*et al*. (2010) (n=200)	89.5%						
Bajaj y *et al*. (2007) (n=266)	81.5%			83.1%			
Present study (n=50)	**88%**	**28%**	**20%**	**10%**	**13%**	**64%**	**64%**

Table 10 Author	No.of patients	Complete relief.
Kennedy (1992)	120	85%
Gross *et al*. (1989)	57	92%
Schaefer *et al*. (1989)	100	83%
Hoffman *et al*. (1989)	30	90%
Rice (1989)	100	83%
Levine (1990)	250	80.2%
Lusk and Muntz (1990)	168	71%-80%
Nayak*et al*.(1991)	78	60.25%
Chamber*set al*. (1997)	182	45%
Senior *et al*. (1998)	72	92.4%
Gandotra*et al*. (2000)	69	84%
Jakobsen and Svendstrup (2000)	237	45%
Venkatchalam and Bhat (2000)	210	70%
Chang *et al* (2004)	101	86%
Present study	**50**	**94%**

DISCUSSION

The sinuses are lined by ciliated epithelium under which is lamina propria which contain mucus and serosanguinous glands the secretion of which form a two layered mucous blanket(Lucas and Douglas,1934).

Each sinus has its own pattern of movement for the mucous blanket ending at the natural ostium (Stammberger,1990). Messerklinger (1978) identified ventilator defects in the middle meatus, anterior and middle ethmoid. The area of the anterior end of the middle turbinate and meatus bears the brunt of high velocity inspiratory airflow which after passing through the

constricted area of nasal valve, has to change direction of flow (Proctor, 1982) and leading to particulate impaction. Wolsdorf *et al*. (1969), demonstrated that inhaled tagged water aerosol was primarily deposited in this area. It was evident that even severe mucosal disease in the maxillary and frontal sinuses usually underwent resolution when normal ventilation and mucociliary clearance was restored and ethmoid disease eradicated (Wigand, 1978, 1981; Buiter, 1982)

Osteomeatal complex is an area where frontal, maxillary and anterior ethmoid drain. The small area is key for proper functioning of the sinuses. The obstruction of mucociliary clearance in this area, leads to tissue hypoxia and retention of secretion followed by bacterial proliferation. In response to this there is inflammation of the lining epithelium which becomes metaplastic and ciliary dysfunction ensues, perpetuating the condition. Various local factors such as nasal polyp, adenoid vegetation, dental infection and sinonasaltumors can predispose to sinusitis. A wide variety of systemic factors may also contribute to the pathogenesis of CRS including allergy, cystic fibrosis, primary ciliary dyskinesia and immune deficiency (Naclerio 2001). The cycle of worsening inflammation and obstruction leads to irreversible changes in sinus mucosa which will require surgical debridement.

The goal is achieved primarily by the endoscopic removal of the disease from key areas of anterior ethmoid and middle meatus it re-establish the ventilation, mucociliary clearance and normal functioning of sinuses. The principles involved in the management of recurrent or chronic sinusitis are first to attempt to identify and treat the underlying cause and second, if possible, to restore functional integrity of the inflamed mucosal lining. Medical therapy is first modality of treatment for patient with CRS. The detailed treatment regimen for CRS was documented by EPOS2007. The recommended treatment depends on variety of sprays, nasal douching, nasal decongestants and long-term treatment with antibiotics. A short course of oral steroids to be given initially before this treatment in patients with nasal polyposis presenting with severe symptoms (VAS score between 7 and 10). It is also recommended that a CT scan of the sinuses is performed if symptom persists for more than three months prior to surgery (Fokkens; EPOS 2007). Use of saline irrigation for CRS concluded that there is an evidence that this treatment relieves symptoms, helps as an adjunct to treatment and is better tolerated by majority of patients. (Harvey 2007).

Conventional surgeries used to treat sinusitis includes antral lavage, external, internal (Kennedy, 1998) and transantralethmoidectomy, external frontal sinus surgery and the Caldwell Luc procedure. The Caldwell Luc operation became main stay of the maxillary sinus until the introduction of endoscopic sinus surgery in the 1970s, which has revolutionised the treatment of sinonasal disease. FESS has become an increasingly popular treatment for chronic sinus disease. Advanced technology like small fiberoptic endoscope and CTscan has allowed a more accurate and direct study of sinus disease that was impossible previously. FESS was originally coined by Kennedy in (1985) to distinguish 'sinus surgery with endoscope' from the Caldwell-Luc. In 1978, Messerklinger introduced the concept of FESS based on endoscopic observation and demonstration of anatomy and pathology in the middle meatus area and sinus mucociliary clearance in normal and diseased mucosa.

Key to this surgical intervention i.e. FESS is diagnostic nasal endoscopy which allows the ENT surgeon to see subtle changes not readily identified on anterior rhinoscopy, objective evaluation of medical treatment and post operative care. The major advantage of this surgery is the use of endoscopes improves visualization, enables greater preservation of normal structures and reduces the necessity for wider exposure and provides a safe and effective treatment of chronic and recurrent sinusitis. However, the surgery is technically demanding, since the key is the accurate diagnosis and removal of the underlying causes of sinus disease. The ability to diagnose these problems and to correct them with FESS has opened new possibilities in the field.

The concept of FESS is the removal of tissue obstructing the OMC and the facilitation of drainage while conserving the normal non-obstructing anatomy and mucus membrane. The rigid fiberoptic nasal telescope provide superb intra-operative visualization of the OMC, allowing the surgery to be focussed precisely on the key areas. The image can be projected onto a television monitor through a small camera attached to the eyepiece of the endoscope.

Nasal obstruction (88 %) was the most frequent presenting symptom followed by headache (64%). Table 9 comparing our results with worldwide literature reveals that no single sign or symptom in isolation is pathognomic of chronic sinusitis, though nasal obstruction, headache, purulent rhinorrhoea and post nasal drip occur more frequently than the others. Since the diagnosis of chronic rhinosinusitis is based on major and minor subjective symptom criteria and objective signs of disease as per European Academy of Allergology and Clinical Immunology (EAACI – 2005), determining the success or failure of treatment regimen for chronic sinusitis should naturally be based on an evaluation of subjective symptomatic relief. There was dramatic improvement in terms of symptomatic relief based on VAS which was reduced to even 1.

Symptoms relieved were nasal obstruction (88%), PND (20%), nasal discharge (28%), anosmia (10%) and headache (64%). These results compare favourably with the results of other results of other workers as shown below in table 10. Statistically complete relief was achieved in 94% patients, partial in 4% patients and 2% patient had no relief from sinonasal symptoms as was measured on VAS scale concluding that FESS is an efficient treatment modality in CRS. Similarly the hospital stay was reduced to as low as 3 days.

Summary and Conclusion

In conclusion, the present study, though a small series with a short follow-up as compared to those reported in literature, has shown encouraging results of endoscopic sinus surgery in the management of chronic rhinosinusitis (CRS). The preoperative most common symptoms like nasal obstruction, nasal discharge, PND were completely relieved in patients undergoing FESS.

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