

ORIGINAL ARTICLE

Impact of Functional Endoscopic Sinus Surgery on Patients with Chronic Rhinosinusitis: A Prospective, Cohort Study among Indian Patients

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ABSTRACT

Aim: To study subjective and objective outcomes following functional endoscopic sinus surgery (FESS) in patients with chronic rhinosinusitis (CRS).

Materials and methods: We prospectively followed up 140 CRS patients after FESS for 6 months to 2 years. Demographic data was collected. Using the Lund–Kennedy endoscopic score (LKES) and the sinonasal outcome test (SNOT-22) score, we assessed the postoperative outcome.

Results: Patients with CRS with polyps (CRSwNP) were more likely to be asthmatic ($p = 0.01$) and have allergic rhinitis ($p = 0.02$). CRSwNP patients had higher LKES than those without polyps (CRSsNP) ($p = 0.001$). Postoperative improvement in LKES was significantly greater in CRSwNP patients ($p < 0.001$). Preoperative SNOT-22 scores were high in both groups, and postoperative scores showed significant improvement ($p < 0.001$). Patients who had revision surgery had a similar baseline and postoperative LKES and SNOT-22 scores to those who underwent primary surgery.

Conclusion: FESS improves both endoscopic and quality of life outcomes for patients with CRS with and without polyps.

Clinical significance: Our study highlights the improvement both in the overall quality of life and in each of the subdomains in patients with CRS after FESS especially in the Indian population. It is important to correlate the objective and subjective outcomes with standardized instruments postoperatively. This will help in monitoring the disease and aid in postoperative management

Keywords: Chronic rhinosinusitis, Endoscopic sinus surgery, Outcomes, Quality of life.

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INTRODUCTION

Chronic rhinosinusitis (CRS) is a common health problem with an estimated prevalence of 10.9% in Europe,¹ 4.5–12% in the United States² and 6.8% in Asia.³ The diagnosis of CRS is based on well-defined criteria⁴ which include a combination of specific symptoms and signs, confirmed with endoscopic and radiological findings. Two broad phenotypes exist, *viz.*, chronic rhinosinusitis with polyps (CRSwNP) and chronic rhinosinusitis without nasal polyps (CRSsNP). The treatment of CRS involves an initial course of maximal medical therapy followed by FESS in patients refractory to medical treatment. In India, the management of patients with sinonasal polyposis has improved considerably following the introduction of FESS over the last few decades.

Most authors have shown that FESS is an effective means of treating recalcitrant CRS.⁵⁻⁷ FESS has also been shown to be more cost-effective than a continuation of medical therapy.⁸ Some authors have shown variable benefit from FESS for CRS, however.⁹ One systematic review¹⁰ that analyzed randomized, controlled trials comparing medical treatment with FESS found no significant benefit of FESS over medical therapy.

Assessment of outcome following FESS includes both endoscopic and quality of life (QOL) assessment. The Lund–Kennedy endoscopic score (LKES)¹¹ is one that is easy to use and popular. QOL can be assessed by various tools specific for sinonasal diseases like chronic sinusitis survey (CSS),¹² respiratory symptom disability index (RSDI),¹³ respiratory symptom index (RSI)¹⁴ and sinonasal outcome test (SNOT-22).¹⁵ Of these, the SNOT-22 is one of the most widely used tools for measuring the QOL in patients with CRS.^{4,16} The test consists of 22 questions which can be divided into four subdomains (nasal, extranasal, sleep and psychological). This questionnaire is easily administered and reflects the severity of all the major symptoms associated with CRS.¹⁷

Despite the popularity of FESS worldwide, there are very few studies from the Indian subcontinent that have studied the effect of FESS on patients with CRS using specific QOL instruments and endoscopic assess-

ment. We, therefore, aimed to prospectively evaluate a cohort of Indian patients with CRS undergoing FESS to note the impact of the surgery on endoscopic and QOL parameters.

MATERIALS AND METHODS

All patients diagnosed with CRS with or without nasal polyps, (based on the EPOS 2012 guidelines) who were refractory to medical treatment and posted electively for FESS were included in the study. The study was conducted in the Department of ENT, Christian Medical College, Vellore, Tamil Nadu, India over a four year period from January 2012 to December 2015. Basic demographic data were recorded. Information regarding prior surgery was noted. The cohort was divided into two groups, the first being those with CRSwNP and the second being those with CRSsNP.

Exclusion Criteria

Patients less than 18 years, those with a diagnosis of invasive fungal sinusitis and sinonasal malignancies were excluded from the study.

Preoperative Assessment

All patients enrolled in the study underwent a complete history and ENT examination. Rigid nasal endoscopy was performed and the extent of the disease recorded. The LKES was recorded and calculated for each patient. The SNOT-22 questionnaire was administered to measure QOL and scores for each domain as well as for all domains calculated for each patient. Non-contrast enhanced CT scans of patients were studied to note the extent of disease. The Lund–Mackay CT score¹⁸ which is a well-described radiological measure of involvement of the various paranasal sinuses by disease was also calculated for each patient. The presence of comorbidities like allergy, bronchial asthma, diabetes mellitus, and hypertension was recorded.

Surgery

All patients underwent FESS based on the standard Messerklinger technique. The extent of surgery was tailored to the extent of disease.

Postoperative Assessment

Patients were reviewed postoperatively on multiple visits throughout 3 months to 2 years. At the first of these visits, the postoperative SNOT-22 questionnaire was completed. At the same visit, rigid nasal endoscopy was performed and the LKES recorded.

Outcome Measures

The primary outcome measure was an improvement in SNOT-22 and LKES scores at the first postoperative visit after surgery. The pre- and postoperative scores were compared between the two groups. The secondary outcomes assessed were changes in individual domains of the SNOT-22 questionnaire as well association between LKES and SNOT-22 scores both pre- and postoperatively.

Statistical Analysis

The analysis was performed using statistical package for the social sciences (SPSS) statistical software (version 16.0; SPSS Inc., Chicago, IL). LKES and SNOT-22 scores were treated as continuous variables. Mean, standard deviation and confidence intervals for preoperative and postoperative scores were calculated for both groups of patients. Chi-square test of proportions was used to test for significant differences in baseline demographic variables. Unpaired t-tests were used to test for improvement in mean LKES and SNOT-22 scores between the preoperative and follow-up examinations.

Institutional Review Board Approval

This study was approved by the Institutional Review Board and Ethics Committee, Christian Medical College, Vellore, Tamil Nadu, India.

RESULTS

Demographic Variables

A total of 140 patients with CRS were included in the study. There were 83 patients (59.3%) with CRSwNP and 56 patients (40.7%) with CRSsNP.

There was a 2:1 male preponderance in the study population and CRSwNP was significantly more common among males. CRSwNP patients were relatively older than CRSsNP patients, although the difference was not statistically significant. Allergic rhinitis ($p=0.02$), bronchial asthma ($p=0.01$) and hypertension ($p=0.02$) were comorbidities which were seen with significantly greater frequency in those with CRSwNP.

The overall mean duration of symptoms was 41.9 months (range 3–240 months). There was no significant difference in symptom duration between the two groups. A total of 119 patients (85%) had primary FESS. Although most (77.3%) of the revision cases were patients with CRSwNP, there was no significant difference in the number of revision cases between the two groups ($p=0.12$).

The mean Lund–Mackay scores were significantly greater in the CRSwNP group ($p<0.001$) as most patients had stage 3 nasal polyposis.

LKES RESULTS

Patients with CRSwNP had significantly higher preoperative LKES score compared to those with CRSsNP ($p = 0.001$) (Table 1). Although both groups showed significant postoperative improvement in the LKES scores, there was a significantly greater degree of improvement in LKES scores in the CRSwNP group ($p = 0.003$) (Table 2).

SNOT-22 score

Most patients had a preoperative score between 40 and 60 points. More than 50% of the patients had a postoperative score of less than 7. Given the fact that a score of 7 or less is considered normal,¹⁹ it is implied that these patients went on to have a normal score after surgery. An overall statistically significant benefit was noted postoperatively for all patients compared to preoperative values for SNOT-22 scores ($p < 0.001$). Both groups of patients also individually showed improvement in postoperative SNOT-22 scores ($p < 0.001$) (Table 3). However, the mean change in postoperative SNOT-22 scores between the two groups was not significant ($p = 0.41$).

SNOT-22 Subdomain Analysis

The SNOT-22 questionnaire scoring was sub-analyzed dividing the questions into four domains which were relevant to this study: nasal, extranasal, sleep and psychosocial symptoms. The extranasal domain included the extranasal rhinologic as well as facial/aural symptoms.

Both the groups showed a predominance of nasal symptoms when compared to the other domains as shown in Tables 1 and 2. There was no significant difference between CRSwNP and CRSsNP groups with respect to the affected domains both pre- or post-operatively. Post-operatively there was a statistically significant reduction in all four domains in both groups of patients ($p < 0.001$) (Table 2).

Type of Symptoms

The most common symptoms in the group with CRSwNP were blocked nose, loss of smell or taste and sneezing whereas the group with CRSsNP had predominant symptoms of a blocked nose, thick nasal discharge and needed to blow the nose.

Primary Versus Revision Surgery

There were 16 patients in the CRSwNP group and five patients in the CRSsNP group who required revision surgery. None of these patients had been operated previously at our center during the study period. The difference in frequency of revision surgery in both groups was not significant ($p = 0.09$). Analysis of the SNOT-22 and LKES scores between the two groups of primary and revision surgery showed similar baseline values for SNOT-22 for both CRSwNP and CRSsNP patients as well as a significant improvement in both LKES and SNOT-22 scores for both the groups postoperatively ($p < 0.001$).

Table 1: Preoperative LKES and SNOT-22 scores in study population

Parameters studied	Mean preoperative scores (SD) (range)			p value
	All patients	CRSwNP	CRSsNP	
LKES	8.42 (3.14) (2–14)	9.75 (2.71) (2–14)	6.45 (2.89) (2–14)	0.0001
SNOT-22 scores	47.77 (20.80) (7–101)	49.63 (22.11) (7–101)	45.16 (18.22) (9–100)	NS
Nasal domain	17.92 (7.75) (0–30)	18.25 (7.95) (3–30)	17.46 (7.57) (0–30)	NS
Extranasal domain	4.47 (3.77) (0–15)	4.77 (3.84) (0–14)	4.04 (3.71) (0–15)	NS
Sleep domain	9.40 (7.27) (0–25)	10.76 (7.6) (0–25)	7.44 (6.15) (0–21)	NS
Psychosocial domain	8.50 (6.68) (0–25)	8.80 (6.65) (0–25)	8.07 (6.86) (0–24)	NS

NS, not significant

Table 2: Postoperative LKES and SNOT-22 scores in study population

Parameters studied	Mean preoperative scores (SD) (range)			p-value
	All patients	CRSwNP	CRSsNP	
LKES	2.9 (3.02) (0–13)	3.53 (3.16) (0–13)	1.98 (2.55) (0–12)	0.003
SNOT-22 scores	9.65 (9.74) (0–48)	10.39 (10.70)	8.57 (7.92) (0–33)	NS
Nasal domain	6.64 (5.88) (0–30)	7.18(6.16) (0–29)	5.86 (5.30) (0–30)	NS
Extranasal domain	0.79 (1.47) (0–9)	0.79 (1.25) (0–4)	0.79 (1.73)(0–9)	NS
Sleep domain	1.23 (2.36) (0–12)	1.41(2.56) (0–12)	0.96 (1.97) (0–10)	NS
Psychosocial domain	1.12 (2.60) (0–15)	1.24 (2.78) (0–15)	0.95 (2.28) (0–12)	NS

NS, not significant

Table 3: Comparison of mean pre- and postoperative LKES and SNOT-22 scores in study population

Groups	Mean LKES preop	Mean LKES postop	p value	Mean SNOT-22 scores preop	Mean SNOT-22 scores postop	p value
CRSwNP patients (n = 83)	9.75	3.53	<0.001	49.63	10.39	<0.001
CRSsNP patients (n = 57)	6.45	1.98	<0.001	45.16	8.57	<0.001
Total patients (n = 140)	8.42	2.9	<0.001	47.77	9.65	<0.001

DISCUSSION

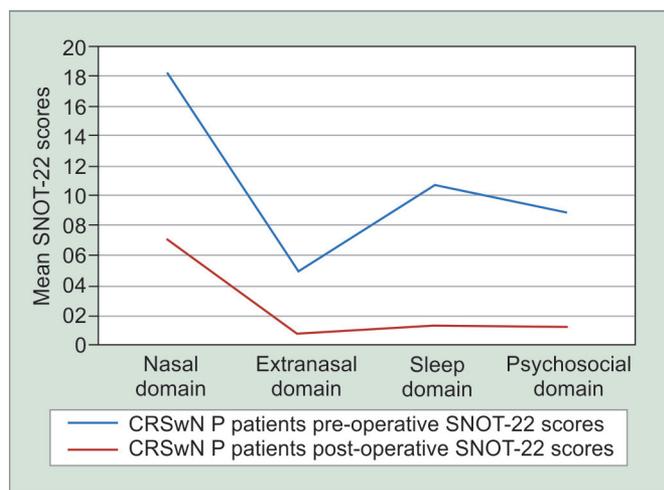
The results of our study show that FESS is beneficial to both patients with CRSwNP and CRSsNP. This was evident both by endoscopic assessment by LKES as well as by QOL assessment by SNOT-22 scores. Similar results have been described by other authors.^{5,6,20,21} The indication for FESS is usually failed medical therapy. However, the exact duration and type of failed therapy are not well defined, and recommendations vary across countries and even centers. Our patients were often subject to several courses of antibiotics, steroid sprays and drops over a period ranging from months to years. Most patients in our series had stage 3 polyposis with high Lund Mackay scores when they came in for surgery. The relief obtained from improved airway was reflected in improved LKES and SNOT-22 scores. There was also relief in all domains of the SNOT-22 questionnaire, and an almost equal relief was obtained even in CRSsNP cases where LKES scores are significantly different from CRSwNP cases. There is improved mucosal healing and sinus ventilation in all cases which lead to improved outcomes.

The demography of our study cohort showed that both phenotypes of CRS were more common in the middle-aged group with a male predominance. Interestingly, this predominance was more pronounced in the CRSwNP group. Similar results have been reported by other authors.^{22,23} In our study, while there was a trend for CRSsNP patients to be younger than those without, this was not found to be statistically significant. The strong association between sinonasal allergy and bronchial

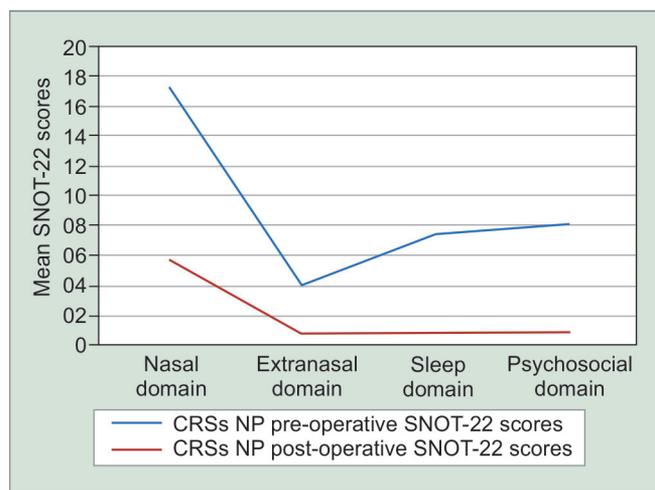
asthma with CRSwNP has been described before.^{24,25} The results of our study also corroborate this. However, some authors have found no association between atopy and presence of CRSwNP.²⁶ Geographical variation may be a cause for this.

The SNOT-22 is a validated tool to evaluate the quality of life in patients with CRS. and measure outcomes following medical or surgical treatment.¹⁵ The average preoperative SNOT-22 scores in the present study were in the range of 40–60 points which was similar to other studies.^{22,27} Postoperatively FESS had a positive impact on the reduction of the overall SNOT-22 scores in both groups of patients as shown in our study. More than 50% of the patients had a postoperative score of seven or less indicating that their scores became normal after surgery. Significant improvements in SNOT-22 scores in CRS patients with or without polyposis have been demonstrated in the literature.²⁷ Even after long-term follow up significant improvement in scores has been noted.²⁸ While our follow-up was variable and ranged from 3 months to 2 years, it can be assumed that most patients benefited from the surgery even in the long term as none presented for revision surgery in the study period.

Our study showed that FESS produced a significant reduction in all four domains of the SNOT-22 scores in both the groups with the greatest being in the psychosocial and sleep domain (Graphs 1 and 2). This reduction is indirectly related to the reduction in the nasal symptoms. Persistence of psychosocial and sleep-related symptoms



Graph 1: Distribution of pre- and postoperative SNOT-22 scores in patients with CRSwNP



Graph 2: Distribution of pre- and postoperative SNOT-22 scores in patients with CRSsNP

after surgery could be multifactorial and could include the chronic nature of the disease, undiagnosed underlying psychological and sleep disorders, anxiety and depressive states. High preoperative psychosocial and sleep domain scores might warrant adequate patient counseling and referral to psychiatric and sleep specialists to diagnose any underlying disorders.²⁹

Our analysis of patients who underwent revision surgery showed that although the number of patients with CRSwNP who underwent revision surgery was greater (20.5%) than those with CRSsNP (8.8%), there was no significant difference in the frequency of revision surgery between the two groups ($p = 0.09$). The baseline QOL scores were also similar in both primary and revision surgery groups. One of the important findings in those patients undergoing revision surgery for CRSsNP in our series was that many of them appeared to have had incomplete primary surgery elsewhere. In these patients, some of the affected sinuses were left untouched despite the presence of disease seen on the preoperative CT scans. The indication for revision surgery or persistence of symptoms was more because of incomplete surgery than the severity of the disease. This was the case in both CRSwNP and CRSsNP patients. Some studies³⁰ have shown that both primary and revision surgery have equal impact on the improvement in QOL in CRS patients while others have shown that more patients who undergo primary FESS have QOL benefit than those who undergo revision FESS.³¹ The authors suggest that those undergoing revision surgery may have a more severe form of disease necessitating multiple surgeries and, hence, a lesser degree of improvement.

One of the shortcomings of our study was lack of standardization of prior medical therapy because most patients had inadequate documentation of the same. Despite all this, patients who underwent surgery appeared to benefit significantly from the surgical intervention.

CONCLUSION

Patients with CRS need to be evaluated based on strict guidelines to ensure uniformity in diagnosis and treatment. Improper diagnosis can lead to unwarranted endoscopic sinus surgeries and often no change in the presenting symptoms. Our study showed that FESS is effective in improving the overall QOL and also in each of its subdomains in both groups of patients. Postoperative follow-up with both endoscopy and SNOT-22 scores helps in monitoring both symptomatic improvement and disease activity in patients with CRS.

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