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ORIGINAL ARTICLE

Treatment Outcome Post Endoscopic Sinus Surgery(ESS) in Patients with Chronic Rhinosinusitis (CRS)

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Abstract
Chronic rhinosinusitis (CRS) is one of the most prevalent conditions in medicine causing a considerable amount of healthcare expenditure. This study was performed to clinically diagnose chronic rhinosinusitis with or without polyps and to measure the intensity of patients' symptoms and treatment outcomes. This was a prospective cohort study, which included 70 patients diagnosed with CRS according to the EPOS-2012 and were given SNOT-22 questionnaire preoperatively, which was repeated on 1st, 4^{th,} and 12th weeks post-op to determine the treatment outcome. Patients were divided into three groups according to their predominant histopathological features and the treatment outcomes were assessed based on SNOT-22 scoring system. According to our study, ESS effectively raised the quality of life for CRS patients, and one week after surgery, there was a significant improvement in total symptoms (from 49.01 ± 14.83 to 21.91 ± 8.88). it was noted that there was a decrease in SNOT-22 scores at various intervals from baseline to week 12. The four subscales of the SNOT-22 test (rhinological symptoms, ear and facial symptoms, sleep function, and psychological difficulties) showed significant improvements in quality of life across all groups, and this relationship extended beyond the relationship with rhinological symptoms. These improvements were statistically significant after three months of post operative medical therapy. SNOT-22 is determined to be reliable and convenient to use. After ESS, all of the symptoms in our study showed a drop in SNOT-22 scores from week 1 to week 12, indicating an improvement in overall symptoms. Therefore, it can be used to monitor the success of surgical intervention in addition to medicinal therapy.

Keywords Chronic rhinosinusitis (CRS) · Sino-nasal outcome test-22 (SNOT-22) · Endoscopic sinus surgery (ESS)

Background

The clinical disease known as chronic rhinosinusitis (CRS) is characterized by a persistent inflammatory response of the paranasal sinuses and nasal mucosa. Chronic rhinosinusitis with (CRSwNP) and without nasal polyps (CRSsNP), in all of its forms, is one of the most prevalent conditions in medicine. When severe complications arise, a variety of clinicians, including primary care and emergency room physicians, allergists, otorhinolaryngologists, intensivists, and neurosurgeons, may be consulted. Due to the direct costs of doctor visits and medication as well as indirect factors like decreased productivity and low quality of life scores—which are found to be even lower than those of patients with congestive heart failure, angina, chronic obstructive pulmonary disease, and low back pain—CRS results in a considerable amount of healthcare expenditure [1].

The National Institute of Allergy and Infectious Diseases (NlAlD) estimates that 134 million Indians have chronic sinusitis, more than twice as many as the country's diabetic population. This condition has a significant negative influence on people's personal and financial lives. In addition to the massive financial cost of CRS, numerous studies have shown that the condition significantly impairs patient quality of life and reduces overall productivity [2, 3].

Numerous outcome measure questionnaires that are used to evaluate patients with acute and chronic rhinosinusitis and rhinitis have been identified in recent reviews. These questionnaires are evaluated for their, validity, reliability, responsiveness, and convenience of use [4, 5].

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Additionally, many criteria have been applied in order to diagnose CRS and quantify the severity and impact of symptoms. The Sino-Nasal Outcome Test-22 (SNOT-22) is a useful tool for assessing symptom intensity and treatment response. It incorporates all of the primary symptoms listed in the European Position Paper on Rhinosinusitis and Polyps-2012 (EPOS-2012) diagnostic criteria for CRS, making it readily adaptable [6]. Furthermore, because it encourages the patient to pay attention to the disease's most prevalent signs and symptoms as well as its severity, it makes it possible to methodically gather important details for the patient's medical history and educate them. In addition to measuring the efficacy of surgery and treatment, SNOT-22 may be able to find the key factor that determines the maximal response to treatment [7].

Four distinct constructs within the SNOT were found to have evidence in the study conducted by Browne et al. [8]. Among them were rhinologic symptoms, which include runny nose, sneezing, thick nasal discharge, postnasal discharge, and the urge to blow one's nose. Ear fullness, lightheadedness, ear pain, and pressure or pain in the face came next. Sleep function ranked third (difficulty getting asleep, nighttime awakenings, and poor quality sleep). The fourth discussed psychological problems such as exhaustion, decreased focus, productivity, and restlessness, as well as depression and shame. In our study, we assessed each symptom's score separately and compared them across all time points and the three groups.

A combination of corticosteroids, antibiotics, and decongestants is the mainstay of multidrug therapy for rhinosinusitis treatment. It is advised to undergo Endoscopic Sinus Surgery (ESS) to treat symptoms when medication therapy is ineffective. In 85% of patients, ESS improves quality of life while also lowering short- and long-term symptoms [6].

This study uses the SNOT-22, a standardized questionnaire that can be used to clinically diagnose chronic rhinosinusitis with or without polyps, to measure the intensity of patients' symptoms and treatment outcomes.

Aims and Objective

To decide the management and study the outcome of treatment post Endoscopic Sinus Surgery according to the histopathological diagnosis in patients with CRS.

Materials and Methods

This was a prospective cohort study, which included 70 patients and was conducted during a span of two years.

Sample size of 70 patients was taken with assumption of 12% prevalence rate of chronic rhinosinusitis, with 80% power and 0.05 level of significance, using Open Epi Version 3.03.

Inclusion Criteria - Patients with CRS with or without nasal polyps as per EPOS-2012.

Exclusion Criteria - Patients with acute symptoms (< 12 weeks), granulomatous diseases, immunocompromised patients, invasive fungal sinusitis, suspicion of malignancy, previous h/o endoscopic sinus surgery, ciliary dysfunction and in whom oral steroids were absolutely contraindicated.

Methodology

Patients diagnosed with CRS according to the EPOS-2012 were given preoperatively SNOT-22 questionnaire which was repeated 1st, 4th and 12th weeks post-op to determine the treatment outcome. Patients underwent pre-operative Diagnostic Nasal Endoscopy and CT scan of nose and Para Nasal Sinuses. Treatment was offered as ESS.

Biopsy from the sinonasal mucosa taken intra-operatively, underwent histopathological processing. Patients were divided into three groups according to their predominant histopathological features:

Group 1. Mucosal Eosinophilia without Fungal Hyphae.

Group 2. Fungal Hyphae (allergic non-invasive fungal sinusitis).

Group 3. Glandular Hyperplasia of submucosal seromucous glands.

Written informed consent was taken once histopathology report was ready and patients were included in the study as per inclusion and exclusion criteria.

Following was done for all the post-op patients irrespective of the outcome:-.

1. Tab Amoxycillin (500 mg) + Clavulanic Acid (125 mg) BD for one week.
2. Antihistaminics (Levocetrizine 5 mg OD) for 1week post op.
3. Saline nasal douching.
4. Follow up with DNE after 1st, 4th and 12th weeks.
5. SNOT-22 scoring after 1st, 4th and 12th weeks to correlate the treatment outcome.

Depending on the histopathological diagnosis postoperative treatment was planned.

1. **Group 1**:-.

a. Topical intra nasal steroid spray.

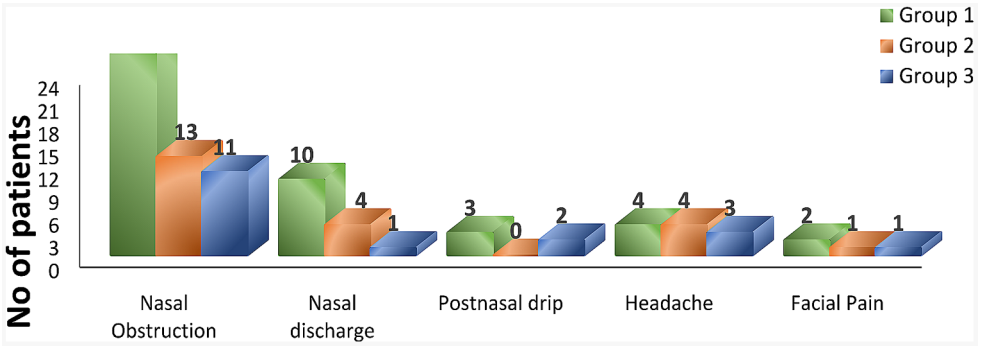

Fig. 1 Symptoms

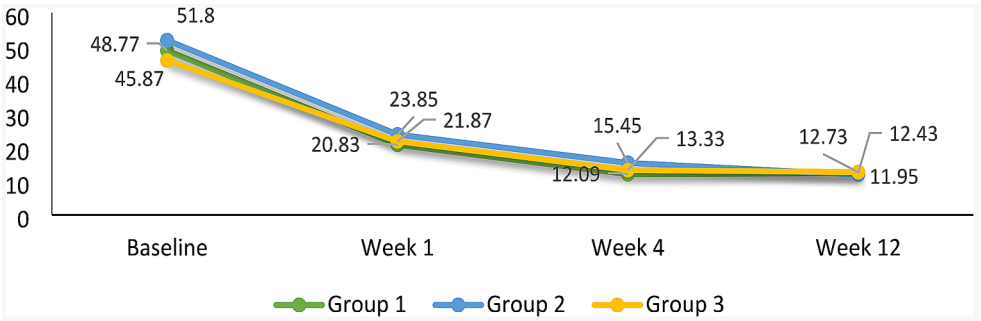

Fig. 2 Total SNOT scores at various intervals in each group

b. Short course of oral steroid [Prednisolone 0.5- 1 mg/kg body weight tapering dose over a period of 3 weeks].

2. **Group 2**:-.

a. Topical intra nasal steroid spray.
b. Short course of oral steroid [Prednisolone 0.5- 1 mg/kg body weight tapering dose over a period of 3 weeks].

3. **Group 3**:-

Macrolides [Azithromycin (AZM) given for 3 days at 500 mg during the first week, followed by 500 mg per week for the next 11 weeks.].

Statistical Analysis

Data was entered into M.S Excel sheet. All demographic variables were analyzed using descriptive analysis. Significance was accessed by using chi square or fisher exact test and t-test. P value < 0.05 was consider as significant. All statistical analyses were performed using Statistical Package for Social Sciences (SPSS), version 21.0. Armonk, NY: IBM corp.

Results

The purpose of this prospective study was to assess treatment outcomes after ESS and make decisions concerning management.

Following careful consideration of their informed consent, 70 individuals were added to the study. The mean age of the group, was 40 years (range 10–70 years), with somewhat more men 38 (54.3%), than women (32, 45.7%).

Thirty-five patients (50%) belonged to Group 1, twenty patients (28.6%) to Group 2, and fifteen patients (21.4%) to Group 3. In all three groups, the post-ESS therapy management and results were compared. None of the assessed studies made this kind of comparison.

The most frequent presenting symptom was nasal obstruction (78.57%), which was followed by nasal discharge (21.42%) and headache (15.71%). Additional symptoms were hyposmia/anosmia, post-nasal drip, and pressure and soreness in the face. (Fig. 1).

The overall mean preoperative SNOT-22 score at base line was 49.01 ± 14.83 and the mean baseline SNOT-22 scores in each group were 48.77 ± 15.61, 51.80 ± 15.59, 45.87 ± 11.86 (p 0.474) respectively (Fig. 2).

Patients in groups 1 and 2 of our trial received prednisolone at a tapering dose as part of a brief oral steroid regimen. After ESS, these patients' SNOT-22 scores significantly decreased, and at the three follow-up visits after surgery, the patients' symptoms had decreased. [Group 1 - week 1 (20.83 ± 9.87), week 4 (12.09 ± 7.18) week 12

Table 1 SNOT-22 Score

Total SNOT score	Total ($n=70$)	Group 1 ($n=35$)	Group 2 ($n=20$)	Group 3 ($n=15$)	p-value
Baseline	49.01 ± 14.83	48.77 ± 15.61	51.80 ± 15.59	45.87 ± 11.86	0.474
Post-op Week 1	21.91 ± 8.88	20.83 ± 9.87	23.85 ± 8.67	21.87 ± 6.45	0.486
Post-op Week 4	13.31 ± 6.78	12.09 ± 7.18	15.45 ± 6.99	13.33 ± 4.98	0.092
Post-op Week 12	12.36 ± 9.91	12.43 ± 10.81	11.95 ± 7.03	12.73 ± 11.53	0.990

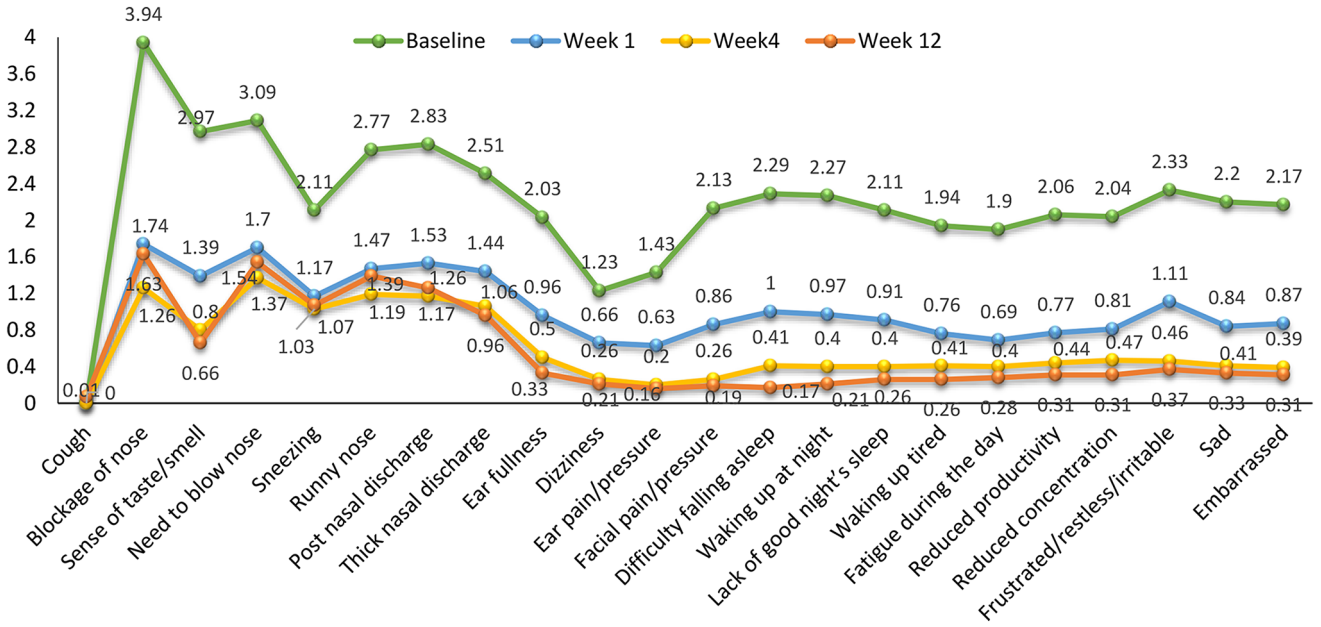

Fig. 3 Improvement in SNOT-22 scores at various intervals

(12.43 ± 10.81); Group 2 - week 1 (21.87 ± 6.45), week 4 (15.45 ± 6.99) week 12 (11.95 ± 7.03)].

In Group 3, following ESS, there was decrease in SNOT-22 score in all the symptoms from week 1 (21.87 ± 6.45) to week 12 (12.73 ± 11.53), suggesting improvement in overall symptoms. (Table 1)

The overall mean preoperative SNOT-22 score was 49.01 ± 14.83 and post-op 1st, 4th and 12th week was 21.91 ± 8.88, 13.31 ± 6.78, 12.36 ± 9.91 respectively. These figures show a significant reduction in SNOT-22 scores from baseline to post-op week 1 SNOT-22 scores (49.01 ± 14.83 to 21.91 ± 8.88). (Fig. 3)

According to our study, ESS effectively raised the quality of life for CRS patients, and one week after surgery, there was a significant improvement in total symptoms (from 49.01 ± 14.83 to 21.91 ± 8.88). (Table 2).

On comparison of baseline SNOT-22 scores at various intervals. There was a decrease in SNOT-22 scores at various intervals from baseline to week 12.

Discussion

In our study, based on histopathology which comprised mucosal eosinophilia without fungal hyphae, fungal hyphae (allergic non-invasive fungal sinusitis) and glandular hyperplasia of submucosal seromucous glands.

The most prevalent presenting symptom in our study (78.57%) was nasal obstruction (unilateral or bilateral), which was followed by mucopurulent or mucoidal nasal discharge (21.42%) and headache (15.71%). In addition to hypo- and anosmia, other symptoms included post-nasal drip, facial pain, and pressure. Similar findings were observed in research conducted by Srivastava M. et al. [9] where nasal obstruction (89%) and nasal discharge (81%) were the most prevalent symptoms. In this study, the following symptoms were recorded in decreasing order of frequency: post-nasal drip (42%), headache (34%), and sneezing (36%).

The mean duration of symptoms in our study was 3 ± 3.64years (1 month to 20 years) while in a study done by Lakshmi Vaid et al. [10] the mean duration of symptoms at the time of presentation was 2½ years with a range of 10 months to 5 years.

Table 2 Improvement in total SNOT-22 score and its measures at various intervals

Symptoms	Baseline	Post-op Week 1	Post-op Week 4	Post-op Week 12
	Mean ± S.D	Mean ± S.D	Mean ± S.D	Mean ± S.D
Cough	0.01 ± 0.12	0	0	0.07 ± 0.26
Blockage/congestion of nose	3.94 ± 1.26	1.74 ± 0.91*	1.26 ± 0.85*#	1.63 ± 1.01*+
Sense of taste/smell	2.97 ± 1.54	1.39 ± 1.01*	0.80 ± 0.83*#	0.66 ± 0.87*#
Need to blow nose	3.09 ± 1.29	1.70 ± 0.79*	1.37 ± 0.78*#	1.54 ± 0.88*
Sneezing	2.11 ± 1.22	1.17 ± 0.72*	1.03 ± 0.61*	1.07 ± 0.69*
Runny nose	2.77 ± 1.32	1.47 ± 0.812*	1.19 ± 0.55*#	1.39 ± 0.80*
Post nasal discharge	2.83 ± 1.32	1.53 ± 0.76*	1.17 ± 0.64*#	1.26 ± 0.86*
Thick nasal discharge	2.51 ± 1.31	1.44 ± 0.86*	1.06 ± 0.68*#	0.96 ± 0.69*#
Ear fullness	2.03 ± 1.11	0.96 ± 0.77*	0.50 ± 0.56*#	0.33 ± 0.61*#
Dizziness	1.23 ± 1.18	0.66 ± 0.70*	0.26 ± 0.47*#	0.21 ± 0.48*#
Ear pain/pressure	1.43 ± 1.08	0.63 ± 0.71*	0.20 ± 0.40*#	0.16 ± 0.40*#
Facial pain/pressure	2.13 ± 1.47	0.86 ± 0.82*	0.26 ± 0.47*#	0.19 ± 0.46*#
Difficulty falling asleep	2.29 ± 1.45	1.0 ± 0.95*	0.41 ± 0.60*#	0.17 ± 0.51*#+
Waking up at night	2.27 ± 1.30	0.97 ± 0.93*	0.40 ± 0.58*#	0.21 ± 0.54*#
Lack of good night's sleep	2.11 ± 1.39	0.91 ± 0.79*	0.40 ± 0.55*#	0.26 ± 0.56*#
Waking up tired	1.94 ± 1.25	0.76 ± 0.71*	0.41 ± 0.53*#	0.26 ± 0.56*#
Fatigue during the day	1.90 ± 1.28	0.69 ± 0.67*	0.40 ± 0.55*#	0.28 ± 0.57*#
Reduced productivity	2.06 ± 1.19	0.77 ± 0.69*	0.44 ± 0.56*#	0.31 ± 0.63*#
Reduced concentration	2.04 ± 1.19	0.81 ± 0.67*	0.47 ± 0.58*#	0.31 ± 0.63*#
Frustrated/restless/irritable	2.33 ± 1.25	1.11 ± 0.93*	0.46 ± 0.56*#	0.37 ± 0.73*#
Sad	2.20 ± 1.25	0.84 ± 0.77*	0.41 ± 0.58*#	0.33 ± 0.72*#
Embarrassed	2.17 ± 1.20	0.87 ± 0.76*	0.39 ± 0.55*#	0.31 ± 0.67*#
Total SNOT	49.01 ± 14.83	21.91 ± 8.88*	13.31 ± 6.78*#	12.36 ± 9.91*#

*p value < 0.05 as compared to Baseline

#p value < 0.05 as compared to Week 1

+p value < 0.05 as compared to Week 4

Preoperatively SNOT-22 questionnaire was filled and was repeated 1st, 4th and 12th weeks post-op to determine the treatment outcome.

The overall mean preoperative SNOT-22 score at base line was 49.01 ± 14.83 and the mean baseline SNOT-22 scores in each group were 48.77 ± 15.61, 51.80 ± 15.59, 45.87 ± 11.86 (p 0.474) respectively and the preoperative SNOT-22 score in our study (49.01 ± 14.83) was comparable to the preoperative SNOT-22 score in a study by Henrik Lind [11] *(43.6* ± 18.5).

According to our study, ESS effectively raised the quality of life for CRS patients, and one week after surgery, there was a significant improvement in total symptoms (from 49.01 ± 14.83 to 21.91 ± 8.88). The four subscales of the SNOT-22 test (rhinological symptoms, ear and facial symptoms, sleep function, and psychological difficulties) showed significant improvements in quality of life across all groups, and this relationship extended beyond the relationship with rhinological symptoms.

Although the improvement in SNOT-22 scores after ESS are rather encouragingly good, The group with polyps will have to undergo a much longer follow-up than 12 weeks to understand the real benefit/ detriment of surgery.

According to a study by Kennedy et al. [12] patients who had the highest symptom ratings also showed the greatest degree of symptom reduction, demonstrating the importance of the overall SNOT-22 score. Additionally, our results were in line with earlier research that had noted that individuals with more severe conditions had improved more than others.

Wright and Agrawal [13] conducted a randomized, double-blind, placebo-controlled study that evaluated the effect of perioperative systemic steroids on ESS clinical outcomes. The study population was comprised of patients with CRS and nasal polyposis. The steroid protocol used in this study started patients on prednisone (30 mg) 5 days before surgery and continued for 9 days postoperatively, without a taper. Although systemic steroids failed to improve postoperative symptoms, there was a significant postoperative endoscopic improvement compared to the placebo group, which was most evident at the 2-week postoperative time point.

In our study patients in group 3 were given Macrolides [Azithromycin (AZM) given for 3 days at 500 mg during the first week, followed by 500 mg per week for the next 11 weeks.]. The total treatment was given for 12 weeks.

In Group 3, following ESS, there was decrease in SNOT-22 score in all the symptoms from week 1 (21.87 ± 6.45) to week 12 (12.73 ± 11.53), suggesting improvement in overall symptoms.

Hashiba et al. [14] reported that response rates of chronic rhinosinusitis patients were 5% at 2 weeks and at 71% at 12 weeks of macrolide treatment.

Similarly, Cervin et al. [15] showed that patients who had a response after 12 weeks of treatment showed continued improvement in symptom scores, after 12 months of macrolide. They previously stated that only a subgroup of patients with CRS respond to macrolide therapy. To date, no one has managed to pinpoint the characteristics of a subgroup with a higher likelihood of AZM responsiveness. In our study we tried to evaluate the symptom score following azithromycin therapy in patients with glandular hyperplasia of submucosal seromucous glands. To date, only a few studies have examined the long-term efficacy of macrolides, and, more specifically, azithromycin, in persistent post-ESS CRS patients.

In a study by Amin Amali et al. [16] the improvement in SNOT-22 scores after treatment and the percentage change was statistically significant after 3 months of azithromycin therapy.

Videler et al. [17] and Wallwork et al. [18] run RCT trials, using roxithromycin and AZM, respectively. Although both studies showed an overall positive response rate to macrolide treatment compared with placebo, only the roxithromycin study attained statistical significance.

In accordance with these reports, and based on our own experience, there have been patients showing favorable outcomes after surgery for CRS with no postoperative antibiotic treatment.

The overall mean preoperative SNOT-22 score was 49.01 ± 14.83 and post-op 1st, 4th and 12th week was 21.91 ± 8.88, 13.31 ± 6.78, 12.36 ± 9.91 respectively. These figures show a significant reduction in SNOT-22 scores from baseline to post-op week 1 SNOT-22 scores (49.01 ± 14.83 to 21.91 ± 8.88). The reduction in SNOT-22 score after ESS was statistically significant in all the groups. Similar results were seen in the studies done byRudmik et al. [19] and Hopkins et al. [20, 21]. At 12 weeks follow-up there were reductions in mean score for all 22 parameters that constitute the SNOT-22 score with statistically significant decreases in each of the four subscales (psychological problems, sleep function, ear and facial symptoms, and rhinological symptoms) across all groups. Similar findings were made by Browne et al. [8] in their study.

The SNOT-22 is a standardised questionnaire that can be used to assess the degree of a patient's symptoms and the effectiveness of their treatment. It can also be used to diagnose CRS in a clinical setting, as well as to assess the effectiveness of post-ESS treatment and subsequent medicinal therapy.

Conclusion

One of the most prevalent rhinological conditions seen globally, chronic rhinosinusitis has a higher likelihood of causing morbidity. According to the current study, headache and nasal obstruction are the two most typical CRS symptoms. SNOT-22 is determined to be reliable and convenient to use. After ESS, all of the symptoms in our study showed a drop in SNOT-22 scores from week 1 to week 12, indicating an improvement in overall symptoms. Therefore, it can be used to monitor the success of surgical intervention in addition to medicinal therapy.

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Author Contribution SK collected, analyzed, and interpreted the patient data. NK, SPS and AV performed the research on all available studies and was a major contributor to writing the manuscript. RY and ASN helped in applying statistics to the collected data. All authors read and approved the final manuscript."

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Data Availability The datasets analyzed during this study are available from the corresponding author on reasonable request.

Declarations

Ethics Approval and Consent to Participate This study was approved by Institutional Ethics Committee, MLN Medical College, Prayagraj.

Consent for Publication Not Applicable.

Consent to Participate Written informed consent was taken from each patient included in the study.

Competing Interests The authors declare that they have no competing interests.

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