

# Assessment of Quality of Life and the Risk of Obstructive Sleep Apnea in Individuals with Chronic Rhinosinusitis who are Candidate for Functional Endoscopic Sinus Surgery

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**Background:** Chronic rhinosinusitis is associated with changes in quality of life (QoL). The present study intended to evaluate the QoL and risk of obstructive sleep apnea in individuals with chronic rhinosinusitis who were candidate for functional endoscopic sinus surgery. To determine the Quality of Life and the risk of sleep apnea in cases with chronic Rhinosinusitis.

**Materials and Methods:** A total of 100 patients with drug-resistant chronic rhinosinusitis candidate for functional endoscopic sinus surgery referred to the ENT clinic of Masih Daneshvari Hospital, Tehran, Iran were recruited. SNOT-22 and STOP-BANG questionnaires were filled before the surgery.

**Results:** The mean SNOT-22 score was 40.44, with a standard deviation of 19.27 (ranged from 1 to 94). Also, according to the STOP-BANG questionnaire, 62% of participants were at increased risk of OSA. Based on the cut-off point of 30 for the SNOT-22 score (either larger or lower than 30), patients were categorized into two groups. Sixty-eight percent of participants were categorized in  $\geq 30$  SNOT-22 score. Age below 50, female gender, and those at high risk of OSA were associated with lower QoL.

**Conclusion:** Most patients with chronic rhinosinusitis had a low QoL and were mostly at increased risk of OSA. Being women younger than 50 years and the presence of OSA probably are associated with lower QoL in these patients.

**Key words:** Quality of life; endoscopic sinus surgery; rhinosinusitis; sleep apnea

## INTRODUCTION

Rhinosinusitis is characterized by inflammation in the nasal mucosa and paranasal sinuses. The term "chronic" refers to rhinosinusitis, where the paranasal sinus inflammation lasts for at least 12 consecutive weeks (1). According to the estimates, depending on the country, its prevalence ranges from 12 to 15% (2). Chronic rhinosinusitis (CRS) is a multifactorial disease whose definite pathophysiology mechanism has not yet been recognized. Factors that effectively contribute to CRS development can be categorized as either patient-related or

environmental factors (3). Allergy, genetic predisposition, disorders of mucociliary clearance, anatomical causes, and gastroesophageal reflux disease are considered as patient-related factors. Also, environmental factors include infectious-related factors such as viral and fungal infections, trauma, cigarette smoking, and environmental pollutants (3-5). A series of clinical criteria are developed for CRS diagnosis. However, to confirm the final diagnosis, clinical findings must be approved by an objective tool such as the CT scan or endoscopy (6). In addition to clinical symptoms, endoscopy findings, including polyp,

secretions, changed mucosal color, and edema presence in the middle meatus, are considered as objective criteria (7). Although various tools are available for the evaluation of negative effects of some diseases on normal life and the success rate of therapeutic interventions, those developed for evaluation of the quality of life (QoL) have crucial importance (8, 9). In recent years, several tools intended to investigate the QoL of patients with CRS have been introduced. For instance, a 22-item sino-nasal outcome test (SNOT-22) is a specific questionnaire intended to evaluate the QoL of patients with sino-nasal problems like CRS. Apart from the nose and sinuses, this tool contains items related to the ear, sleep, general health, and emotions (10). The SNOT contains at least 4 items on sleep. Hence, the current study intended to evaluate the risk of obstructive sleep apnea in CRS patients scheduled for sinus surgery and its association with SNOT-22 measures of QoL using the STOP questionnaire. This is an easy and sensitive tool to diagnose patients at high risk of OSA (11). While a few studies evaluated the QoL and sleep apnea risk in patients with CRS simultaneously, we decided to report the impact of CRS on QoL of patients and its association with the risk of OSA in patients referred to our referral center.

## MATERIALS AND METHODS

This is a descriptive, cross-sectional and analytical study designed to determine and compare the quality of life and apnea risk rate in patients with chronic sinusitis. Informed consent was obtained from all participants. In addition, the Ethics Committee of Shahid Beheshti University of Medical Sciences, Tehran, Iran, approved the current study.

### Patients

This study was performed in a university hospital in Tehran, Iran. Patients with CRS resistance to 1-month standard medical treatment who were candidate for endoscopic sinus surgery above 15 years old entered the study. Patients with a history of sinus surgery, cystic fibrosis, or ciliary dyskinesia were excluded. All patients filled the SONT and STOP questionnaires.

### Scoring method of SNOT questionnaire

We used the validated Persian version of SNOT-22 presented by Jalessi et al. (11). SNOT-22 questionnaire is scored on a six-point Likert scale, ranging from zero ("no problem") to five ("most severe problems"). The final score is equal to the sum of scores related to all items, which ranges from zero to 110. The higher the score, the more severe is the disease and its associated disability, which indicates more negative impacts on the QoL.

### Determination of risk rate of obstructive sleep apnea (OSA) by STOP questionnaire

The STOP questionnaire is designed by Chung et al. to screen patients for OSA before surgery (12). It contains both objective and subjective items (13). Its sensitivity for the identification of OSA ranges from 94 to 97%. The Persian version of this questionnaire is reported by 14. Sadeghniaat-Haghighi et al., who reported a sensitivity of 91% compared to the apnea index in polysomnography (14). The STOP-BANG questionnaire includes eight items on the history of loud snore, tiredness during the day, apnea, hypertension, body mass index (BMI), age, neck circumference, and gender.

### STOP-BANG questionnaire scoring

Each positive answer has a positive point. Its total score ranges from zero to 8. A score of three or higher (out of 8) indicate a high risk of OSA.

### Statistical analysis

Data analysis was administered using SPSS version 22 by Chi-square, Fisher, independent t-test, ANOVA, and univariate and multivariate logistic regression models.

## RESULTS

### Demographic characteristics

A total of 100 patients (67 males and 33 females) with CRS who were candidates for FESS were included in this study. The mean age of participants was  $39.5 \pm 13.8$  years. The youngest and oldest participants were 15 and 86 years old, respectively. The mean BMI was  $26.2 \pm 5.3$  and 33% of

them had a BMI higher than 30. Other information are provided in Table 1.

Table 1. Characteristics of patients with chronic rhinosinusitis in this study

Variable	SD /Mean	Volume (Percent)
Age	Less than 50 years old	80 (80%)
	More than 50 years old	20 (20%)
	Numerical Age	39.5 ± 13.8
Sex	Woman	33 (33%)
	Men	67 (67%)
Body Mass Index (BMI)	Less than 18.5	3 (3%)
	18.5 Up to 25	41 (41%)
	25 Up to 30	33 (33%)
	More than 30	23 (23%)
	Numerical Index	26.2 ± 5.3
Hypertension	Yes	11 (11%)
	No	89 (89%)

**Association between the quality of life score and chronic rhinosinusitis, calculated using SNOT-22 questionnaire**

The mean score of the SNOT-22 was 40.8 ± 19.3 (Table 2), which for 68% of patients was higher than 30. On the other hand, about, 40% of participants had a score between 30 and 50 (Figure 1).

**OSA Risk**

According to findings obtained from the STOP-BANG questionnaire, 62% of patients were at increased risk of OSA (at least 3) (Table 3). Also, the SNOT-22 score was examined by the separation of underlying variables that were not significantly different between the study groups (based on gender, age, BMI, and OSA) (Table 4). Hence, we performed logistic regression to consider the effect of different variables.

Since a SNOT-22 score of > 30 corresponds with a low level of QoL and the effect of FESS on the improvement of their QoL was higher (15), in the present study, the score of 30 was considered as a cut point for SNOT-22.

Table 2. Quality of life scores associated with chronic rhinosinusitis from the SNOT-22 questionnaire

Variable	SD /Mean	Median (Min-max)	Volume (Percent)
Questionnaire score (quantity)	40.8 ± 19.3	38 (1-94)	-
Questionnaire (quality)	Less than 30	-	32 (32%)
	More or equal to 30	-	68 (68%)

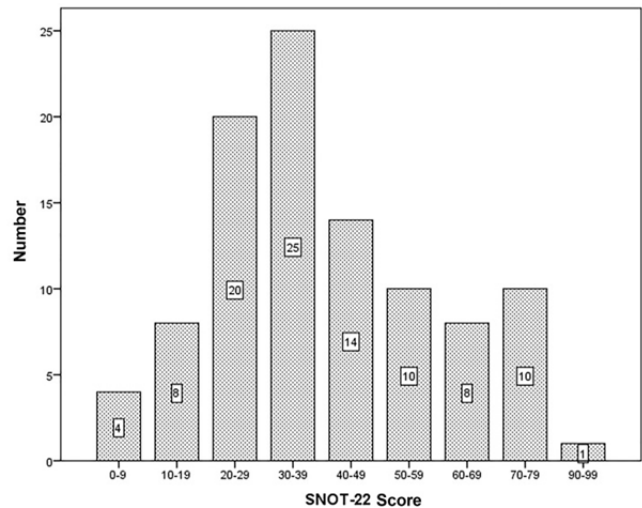


Figure 1. SNOT-22 score. Frequency of participants in ten categories of questionnaires scores

Table 3. The frequency of sleep apnea risk

Variable	SD /Mean	Volume (Percent)
STOP-BANG Questionnaire score	3.2 ± 1.7	
OSA	No	38 (38%)
	Yes	62 (62%)

Table 4. SNOT-22 score by gender, body mass index, age and status of the OSA

Variable	Mean(SD)	P-Value	
Age	Less than 50 years old	47 (19)	0.242
	More than 50 years old	41 (20)	
Sex	Woman	45 (19.6)	0.959
	Man	46 (19.5)	
Body Mass Index (BMI)	Less than 25	40.7 (21)	0.641
	Between 25 to 30	43 (18.1)	
	Over 30	38 (17.9)	
OSA	Yes	48 (19)	0.086
	No	41 (20)	

## Logistic regression

The interaction between the effects of independent variables such as age, sex, BMI, and OSA as well as CRS on patient's QoL was investigated by utilization of straightforward and multiple models of logistic regression. Based on the findings of the Hopkins study (14), a score of 30 was considered as the cut-off point. Then, based on the cut point, patients were divided into two groups of low QoL (score $\geq$ 30) and relatively optimum QoL (score $<$ 30). All variables were analyzed using a single-variable logistic model (Table 5). To investigate the effect of each variable in the presence of other variables (controlling for other variables), all of the following variables were entered into the multivariate logistic model: age, gender, BMI, and OSA. In the present study, multiple logistical model was utilized to model the included variables. It is worth noting that variables with a considerable effect on the QoL associated with rhinosinusitis included age, gender, and OSA.

Table 5. The effect of different independent variables on the quality of life score of patients with chronic rhinosinusitis in a simple and multiple regression models.

Independent Variable	Odd ratio (P-value: 95%)	P- Value	Adjusted ratio (P-value: 95%)	P- Value
Age (Age <50 to Age $\geq$ 50)	2.64 (0.97-7.2)	0.059	3.86 (1.25-11.9)	*0.019
Sex (Women/Men)	1.74 (0.68-4.5)	0.246	3.4 (1.01-11.8)	*0.048
Body Mass Index ( $<$ 25 to $\geq$ 25)	1.72 (0.74-4)	0.209	1.57 (0.59-4.2)	0.363
OSA Patients/ Healthy people	1.43 (0.61-3.4)	0.417	3.5 (0.98-12.7)	0.054

## Age

According to results obtained from the final model, the adjusted odds ratios, after controlling for other variables, were considered. A patient, younger than 50 years in comparison to a patient older than 50 years, has an odds ratio (OR) of 3.86% for a "lower level of QoL associated with CRS"(p=0.019).

## Gender

After eliminating the effect of other variables, women were 3.4 times more likely than men to have a low level of QoL associated with CRS. Also, the raw value ratio of the gender variable odds was 1.74 in the univariate model. Due to the significant difference with the adjusted value, it can be argued that the effect of gender is distorted by the effect of other variables (p=0.048).

## OSA

The adjusted OR of OSA for the QoL associated with CRS was 3.5, which was not statistically significant (p=0.054). As the obtained upper quartile of the confidence interval was large, the OR of this variable is probably due to the low number of subjects in the non-OSA group, which probably has led to the problem of data-sparse and low accuracy of the estimates.

## DISCUSSION

This study aimed to determine, firstly, the QoL associated with the health of people with CRS who were candidate for FESS, using the SNOT-22 questionnaire, and, secondly, to investigate the risk of OSA in these individuals using the STOP-BANG tool. According to the findings, these patients often suffer from low QoL and are mostly at increased risk of OSA. After removing the effect of confounding variables, the age below 50 and the female gender were significantly associated with lower QoL. The occurrence of OSA also had a positive association with lower QoL, although it was not statistically significant. In other words, CRS patients, both with a SNOT-22 score higher or lower than 30 (which indicates relative and low QoL, respectively), are at increased risk of OSA. It seems that CRS has a more severe negative impact on women younger than 50 years.

In Iran, a few studies have investigated the QoL associated with rhinosinusitis. In a recent prospective study, Aghdas et al. showed that the mean score of SNOT-22 was 59.38 $\pm$ 5.84 in CRS patients, which is higher than the value reported in the present study (16). This imbalance can be due to the higher prevalence of polyps in these

patients. In two other studies conducted in other countries by Steel and Hopkins, the mean score of the SNOT-22 is reported as 75.5 and 40.9, respectively (17, 18). All these studies reported low QoL in patients and also based on their findings, the score of QoL was improved remarkably after the surgery (19-21). Some studies reported an association between CRS and sleep and emotional problems. For instance, according to the findings of a large Swedish study, sleep problems were frequent among patients with rhinosinusitis and reported a relation between prevalence of sleep problems and severity of CRS (22). Brandsted et al. demonstrated that 25% of CRS patients have recently been treated for depression that is more than the average for depression in the general population (10-16%). According to their findings, CRS patients with depression had a lower score of health-related quality of life (HRQoL) and also lower QoL compared to CRS patients without depression (23). In addition to the higher rate of depression in the CRS population, high rates of anxiety disorders have been reported in these patients (24). It can be concluded that depression and anxiety are commonly associated with CRS and declined HRQoL in these patients. Although depression and CRS independently cause decreased HRQoL, healthcare professionals should be aware of the high rate of depression in these patients and the probable consequences of inappropriate case management. Future studies are needed to determine whether depression treatment simultaneously can improve HRQoL in patients with CRS or not. Persistent symptoms in association with CRS not only can disrupt vitality but also may affect other essential activities such as sleep and sexual activity. Benninger et al. (2010) demonstrated that patients with CRS suffer from significantly lower sleep quality and sexual activity (25). Fatigue and fibromyalgia are commonly associated with CRS, and it has recently been shown that both of them were improved following endoscopic sinus surgery (26). Other studies showed that CRS treatment has beneficial effects on these abnormalities and could improve HRQoL (27). For instance, a systematic

review and meta-analysis by Chester et al. confirmed the improvement of fatigue following endoscopic sinus surgery (28).

According to our results, a high percentage of patients with CRS are at increased risk of sleep apnea, which is in line with the findings of some previous studies. In a study on 534 participants,

Weintraub et al. investigated the association between CRS and OSA and reported a higher frequency of OSA in patients with CRS. They also mentioned CRS patients as a risk factor for OSA, regardless of age and BMI (29). Various studies reported different prevalence rates for OSA, which can be attributed to the characteristics of the study population. In the present study, the QoL of patients with OSA was slightly lower than those without OSA. Previously, the simultaneous effects of CRS and OSA on the QoL associated with rhinosinusitis have been studied. In a study on 405 patients with CRS, who were candidates for FESS, 15% of participants had concurrent OSA. Also, patients with rhinosinusitis and OSA have lower QoL than OSA patients without rhinosinusitis. However, there was a significant improvement in the QoL of both groups after sinus surgery (30). Craig also indicated lower QoL associated with sleep impairment in patients with rhinitis, rhinosinusitis, and nasal polyposis (31). Furthermore, Lachanas et al. have compared patients with CRS and patients with OSA concerning their QoL using the SNOT-20 questionnaire. According to their findings, the mean SNOT-20 score was high in both CRS and OSA groups but the pattern of symptoms distribution was different. In other words, OSA patients had higher scores for the wellness dimension, while CRS patients had a higher score for posterior sinonasal symptoms (32). Sleep problems in CRS patients can be attributed to several factors, including inflammation and nasal obstruction (22).

Considering the high frequency of probable OSA in patients with CRS (based on the STOP-BANG questionnaire), a series of questions about sleep quality and the consequences of sleep apnea should be answered. Many patients with CRS may not be aware of their sleep

problems. Hence, direct and specific questions related to OSA should be considered in pre- and post-operative consultations. It seems that patients at high risk of OSA have worse QoL.

In the present study, QoL and the risk of OS in CRS patients before FESS were investigated. Future studies should evaluate changes in QoL and risk of OSA following receiving different treatment modalities, particularly using polysomnography.

## CONCLUSION

This study demonstrated that most patients with chronic rhinosinusitis had a low quality of life, and most of them are at increased risk of OSA. Being younger than 50 years, gender female, and OSA are probably associated with lower quality of life. Considering the high probability of OSA in CRS patients, screening is recommended for timely diagnosis and treatment.

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