

# Impact of depression on the outcomes of endoscopic sinus surgery

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**Abstract.** Objective: To prospectively measure the prevalence and impact of depression on the quality of life in patients with chronic rhinosinusitis with nasal polyps, and its effects of endoscopic sinus surgery outcomes. Material and Method: A total of 106 patients with chronic rhinosinusitis and nasal polyps, scheduled for endoscopic sinus surgery, were prospectively enrolled. Demographic data, associated comorbidities, computed tomography Lund-Mackay scores, endoscopy scores, pre and post-operative disease specific (SNOT-22) and depression questionnaires (HPQ-9) were noted for all patients. Differences in outcome scores were measured using two-way ANOVA test. Results: The incidence of depression was 19.7%, defined by HPQ-9 scores. The only statistically significant association shown by the univariate analysis was between the presence of depression and a higher value of SNOT-22 scores. The improvement of QoL scores at 6 months was similar between groups and regardless of the presence of depression. PHQ-9 scores improved after endoscopic sinus surgery. Patients with the highest values of PHQ did not show improvement of SNOT-22 postoperatively. Conclusion: Improvement of disease-specific scores is similar regardless of depression being associated or not, however the initial and six-months SNOT scores are significantly worse in depressed patients. There is a complex relation between CRS and emotional well-being, leading us to advocate preoperative screening for depression through a simple, fast and accurate questionnaire.

**Key Words:** chronic rhinosinusitis, nasal polyps, depression, endoscopic sinus surgery.

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## Introduction

According to the European Position Paper 2020 (EPOS2020) (Fokkens et al 2020), chronic rhinosinusitis (CRS) stands for the inflammation of the nose and paranasal sinuses, manifesting through nasal obstruction, nasal discharge, reduction or loss of smell and facial pain or pressure. The patient must present at least two symptoms for a minimum duration of 12 weeks. CRS is classified according to the presence (CRSwNP) or absence of nasal polyps (CRSsNP) and represents an important healthcare issue worldwide. The pathophysiology of CRS is not completely elucidated, however recent research has identified certain genetic and epigenetic variations in the host immune system that permit alterations of sinonasal mucosa, generating its loss of symbiosis, and leading to chronic inflammation or even tissue remodeling. One of the most frequently diagnosed pathologies in rhinology, CRS poses a significant quality of life burden for patients and important costs for the healthcare system (Fokkens et al 2012). In a notable paper, Gliklich and Metson (1995) first quantified the impact of CRS on global quality of life, proving this pathology to have a higher impact than congestive heart failure, angina pectoris and chronic obstructive pulmonary disease. On the other hand, depression is common among patients with CRS, and is frequently underdiagnosed. A systematic review upon depression in CRS reported that up to 40% (Schlosser et al 2016) of patients associated these two comorbidities, while the prevalence in the general population is between 5.4% and 8.9% (Litvack et al 2011). However, most studies evaluating

depression in CRS do not differentiate according to the presence or absence of nasal polyps. Erskine et al. (2017) demonstrated worse scores on mental-health questionnaires in patients with CRSsNP, compared to CRSwNP. Recently, the connection between CRS and depression has gained a lot of interest due to conflicting reports in literature regarding the role depression plays in post-operative health gains; certain authors have shown similar gains in both depressed and non-depressed patients, while others have demonstrated that patients with depression score lower on disease-specific post-operative questionnaires. (Litvack et al 2011, Brandsted & Sindwani 2007, Mace et al 2008, Smith et al 2005, Davis et al 2005, Ospina et al 2019)

The aim of this study is to prospectively quantify the prevalence of depression in patients with CRSwNP and to measure the impact of depression on these patients' quality of life. Furthermore, to our knowledge, this is the first study to include only patients with CRS with nasal polyps.

## Methods

### Study population and data collection

This study was approved by our Institutional Ethics Committee (590 from the 10th of December 2019).

Adult patients (>18 years) with a diagnosis of chronic rhinosinusitis with nasal polyps, as defined by European Position Paper 2012 (Fokkens et al 2012), who failed medical treatment and were scheduled for endoscopic sinus surgery (ESS), were prospectively included. Standard medical history and physical

Table 1. Comparison of initial SNOT values and evaluated values at 6 months

Parameters	Initial	6 months	P value
Snot value	46 (31; 62)	9 (4; 21)	<0.001

Table 2. Analysis of initial and 6-months SNOT-22 values in correlation with demographic data and presence of depression and comorbidities, using two-way ANOVA test

Variables	Initial SNOT-22	6-months SNOT-22	p-value
<b>Gender</b>	male	40 (28.25, 58)	0.45
	female	54 (34, 64)	
<b>Age</b>	<= 50 years	43.5 (29.25, 69)	0.72
	> 50 years	49 (32, 61)	
<b>Depression</b>	present (HPQ-9 > 10 points)	57.5 (48.75, 77.25)	0.7
	absent (HPQ-9 < 10 points)	41 (27, 60)	
<b>Concomitant asthma</b>	present	56.5 (32.25, 69.25)	0.34
	absent	43 (29, 57)	
<b>Aspirin intolerance</b>	present	64 (43, 75)	0.2
	absent	43 (29, 58)	
<b>&gt;= 4 previous surgeries</b>	present	31 (27, 56.5)	0.5
	absent	47.5 (32, 62.5)	

examination was recorded for each patient. Demographic data, presence of concomitant asthma, aspirin intolerance, history of depression and previous treatments for CRS were noted. Computed tomography Lund-Mackay (score range 0-24) and endoscopy scores (score range 1-3/nosril) were documented in all cases. All patients were asked to complete Patient Health Questionnaire-9 and Sino-nasal Outcome Test-22 preoperatively. All patients underwent standard functional endoscopic sinus surgery, with complete removal of nasal polyps and opening of all sinuses. Six months following surgery, patients completed the two questionnaires, during the follow-up consultation.

### Survey instruments

Patient Health Questionnaire (PHQ-9) is a 9-item validated analysis used to diagnose and measure the degree of depression, with a score range between 0 and 27. A score of 9 points or less is considered minimal or mild depression (Kroenke et al 2001). PHQ-9 has demonstrated its consistency and reliability as a screening tool in multiple clinical studies (Spitzer et al 1999, Levis et al 2019).

Sino-nasal Outcome Test-22 is a rhinology-specific patient-reported outcome measure tool developed for patients with CRS. This questionnaire includes 22 items evaluating CRS symptoms, and it contains five subdomains, three sinus-specific symptom domains (rhinologic, extrarhinologic and facial/ear), and two general health-related quality of life domains (psychological and sleep dysfunction). A maximum score of 5 can be attributed to each item and a low total score is associated with better sino-nasal quality of life (Hopkins et al 2015). Improvement after endoscopic sinus surgery is considered significant if the patients scores at least 9 points less after surgery on the SNOT-22 score (Hopkins et al 2015).

### Analysis

Of the entire population of patients with CRSwNP, we included only patients with a minimum 6-months follow-up. Patients were then stratified into two subgroups according to the preoperative score of over or less than 10 points on the PHQ-9 questionnaire, into depressed and respectively non-depressed patients. A Univariate analysis was performed to evaluate the relation between SNOT-22 scores and various parameters (demographic data, QoL scores, presence of depression, asthma, aspirin intolerance and more than four previous surgeries), using two-way ANOVA.

### Results

Out of 106 patients with CRSwNP surgically treated in our service between December 2019 and March 2021, a total of 71 patients were eligible for the present study. The study population included 29 women and 42 men, mean age was 50.2 years [range 18-80]. A score of 10 or more on the preoperative PHQ-9 questionnaire was found in 14 patients (19.7%), out of whom one patient was diagnosed by a psychiatrist with depression, but refused the prescribed treatment. Disease severity was similar between depressed and non-depressed patients, with comparable Lund-Mackay and endoscopy scores.

The median value of the initial SNOT was significantly higher than the evaluated value at 6 months ( $p=0.001$ ), as seen in table 1. Univariate analysis revealed no statistically significant association between the evolution of SNOT values and gender, age, presence of depression, concomitant asthma, associated aspirin intolerance or a history of previous surgeries for CRSwNP (Table 2). There was a higher value of HPQ-9 scores in patients with aspirin intolerance, but due to the small number of patients it did not reach statistical significance. Initial and 6 months

SNOT scores were significantly higher in depressed patients. However, the improvement in both depressed and non-depressed patients was similar.

## Discussions

In this prospective clinical study, almost 20% of patients were diagnosed with depression, according to the PHQ-9 questionnaire. This finding is in accordance with data reported in literature, and supports a lower incidence of depression in patients with CRSwNP compared to patients who do not present nasal polyps (Erskine et al 2017). We find this observation interesting, since patients with nasal polyposis present a more severe manifestation of the same disease, however the emotional impact of CRS is higher for patients without nasal polyps. A possible explanation provided in literature for this particular finding is that patients with CRSwNP have a hope for 'cure' through surgical removal of the polyps (Erskine et al 2009). Moreover, Hopkins et al (2009) demonstrated that objective measurements of disease severity (CT scan scores, peak nasal inspiratory flow rates) do not always parallel with patients' reported symptom scores. Another explanation could come from the influence emotional distress has on these patients' quality of life.

An interesting correlation between nasal symptoms and anxiety was provided by Erskine et al. (Erskine et al 2017), who proposed an autonomic nervous system dysfunction (ANS) to be involved in the pathogenesis of CRS. The hypothesis began from the involvement of ANS in regulation of the complex nasal nerve supply during postural change, and the possibility that ANS dysfunction could influence rhinologic symptoms such as nasal congestion and rhinorrhea. Additionally, Trueba and Ritz (2013) established a connection between stress and asthma exacerbations. There is proof that stress hormones, through T-Helper cells, can promote inflammation and induce asthma exacerbations. According to the United Airway Disease concept (Togias 2003), any pathological process involving the upper airway, is most likely to affect the lower airway, and vice-versa. Extrapolating this proven theory, stress and anxiety could also be involved in CRS pathogenesis and clinical evolution.

Patients with depression reported significantly higher disease-specific scores at baseline. Most patients presented similar improvement of SNOT-22 scores at six months, irrespective of associating depression, but the preoperative and postoperative values in quality of life were markedly higher for patients with depression. An interesting finding was that three patients with the highest preoperative PHQ-9 scores (14 and 15), presented worse SNOT-22 scores postoperatively. One of these three patients disclosed being diagnosed with depression by a psychiatrist, but refused treatment. Even though it is not possible to draw a conclusion due to the small number of patients, it would be interesting to investigate the possibility that patients with more severe depression behave differently from patients with mild depression. Thus, a study with a more precise stratification of different depression degrees could highlight interesting results. On this matter, we agree with Gill et al. (2021) over the recommendation of providing complete care for the CRS patient, meaning that emotional health concerns should also be addressed by the ENT specialist. Screening for comorbid major depressive disorder before surgery could help counsel the

patient regarding expected postoperative results and also aid the surgeon in understanding why some patients do not present the expected postoperative improvement. Furthermore, detecting patients with depression who would benefit from psychiatric treatment, could lead to better results following ESS.

There has been significant controversy in literature over the impact of depression on endoscopic sinus surgery results in patients with CRS. In a prospective study on 76 patients, with results similar to the present paper, Litvack et al. (2011) found worse baseline disease-specific scores in depressed patients, but improvement after ESS was comparable to non-depressed patients. Lower QOL scores and worse reported rhinologic symptoms were also reported in patients with elevated psychiatric distress by Davis et al. (2005). However, one year after surgery, amelioration was similar to non-depressed patients. On the contrary, records of 320 patients with CRS were retrospectively reviewed by Brandsted and Sindwani, who noticed a significant postoperative improvement of disease-specific and QOL scores in non-depressed patients, but not in depressed patients. Similarly, Ospina et al. (2019), analyzed 142 patients and reported a worse preoperative burden for depressed patients, with significantly smaller gains attributable to ESS. In addition, Steele et al. (2015) found anxiety to occur more frequently in CRS patients and was associated with worse preoperative symptoms and reduced QOL improvement following ESS.

We found intriguing the fact that SNOT scores were not worse in patients with associated comorbidities. Aspirin intolerance, asthma and a history of previous surgeries have an impact on any patient, and would have led us to logically assume worse QoL scores and a higher emotional impact of their pathologies. In a similar study by Schlosser et al. (2016), found revision surgery to be associated with baseline depression ( $P < .001$ ). On the other hand, we found a higher prevalence of depression in patients with aspirin intolerance, but due to the small patient population it is not statistically significant. Nonetheless, it is an issue deserving further investigation.

A thought-provoking finding of the present research consisted in the improvement of depression severity, evaluated through PHQ-9, after sinus surgery. Apparently, CRS also influences emotional well-being, not just the other way around. This discovery was also noticed by Litvack et al. (2011) and Schlosser et al. (2016), and we agree that it is worth further analysis, since there appears to be a more complex and not yet completely discovered interplay between depression and CRS.

Our study has some limitations. First of all, PHQ-9 questionnaire is a recognized tool for screening depression, however it does not take the place of a specialized psychiatric consult. Moreover, it does not allow to differentiate between depression and anxiety. Second, our study contained a heterogenous population with respect to associated comorbidities, and a higher number of patients would be necessary to obtain statistically significant results for each associated comorbidity. Future clinical studies on this matter could provide additional evidence over the impact of depression on chronic rhinosinusitis patients. On the other hand, the main strength of this study is the prospective collection of data, which includes detailed records of patients. Furthermore, this is the first study on this matter, which only includes a subpopulation of patients, CRSwNP.

## Conclusion

Depression does not have an impact on the degree of postoperative improvement in patients with nasal polyposis, however patients with more severe depression seem not to follow this rule. Further studies with a more precise stratification and a higher number of patients would be of interest. On the other hand, we consider available data to be sufficient in order to recommend screening of depression in patients suffering from this pathology.

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