

# Comparison of subjective self-assessment tests with objective imaging and endoscopic examination of the nasal cavity in patients with chronic rhinosinusitis qualified for ESS in accordance with EPOS 2012 guidelines (update to EPOS 2020)

Porównanie testów subiektywnej samooceny z obiektywnym badaniem obrazowym i endoskopowym jamy nosa u chorych z przewlekłym zapaleniem zatok zakwalifikowanych do zabiegu ESS zgodnie z wytycznymi EPOS 2012 (zaktualizowanymi z EPOS 2020)

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## Summary

**Objective.** Chronic rhinosinusitis (CRS) is a growing health problem in the world. Patients' complaints are not always reflected in objective tests, which may hinder the decision about surgical treatment. The aim of the study was to compare the results of objective tests assessing the severity of lesions i.e. endoscopy and CT, with the results of subjective tests.

**Methods.** The study comprised 130 patients with CRS aged  $46.9 \pm 14.5$  (range 19-82 years), admitted to the Department of Laryngology and Laryngological Oncology between July 1 and October 31, 2019 and qualified for ESS in accordance with EPOS 2012 guidelines (update to EPOS 2020). Subjective Sino-Nasal Outcomes Test (SNOT), Visual Analogue Scale (VAS), Brief Smell Identification Test (BSIT) and objective, endoscopic (Lund-Kenne-dy) and tomographic (Lund-Mackay), tests were performed in all the patients. The data on smoking, atopy, co-morbidities and previous operations were obtained.

**Results.** A significant correlation was found between the results of subjective tests and the extent of inflammatory lesions in the sinus CT and nasal endoscopy. Education, smoking, atopy, arterial hypertension, diabetes mellitus did not influence the subjective assessment results. Patients with diabetes mellitus had a significantly higher Lund-Mackay score. SNOT-22, SNOT-12 and VAS scores were significantly higher in female patients. Significant differences were found among subgroups of patients with different BSIT scores and both the Lund-Mackay score and the Lund-Kennedy score.

**Conclusion.** Subjective assessment of CRS-related complaints is a good indicator for making further therapeutic decisions.

**Keywords:** *sinusitis, SNOT-22, VAS, sinus surgery*

## Streszczenie

**Cel.** Przewlekłe zapalenie zatok (CRS) stanowi narastający problem zdrowotny na świecie. Skargi chorych na ściekanie wydzieliny, ograniczenie drożności nosa, zaburzenia węchu nie zawsze znajdują odzwierciedlenie w przeprowadzanych badaniach obiektywnych, co może utrudniać podjęcie decyzji o leczeniu operacyjnym. Celem badania było porównanie wyników badań obiektywnych oceniających nasilenie zmian w obrębie błony śluzowej nosa i zatok czyli endoskopii i badania TK z wynikami testów subiektywnych oraz próba znalezienia innych czynników wpływających na wyniki badań subiektywnych i obiektywnych.

**Materiał i metody.** Badaniem objęto 130 chorych z przewlekłym zapaleniem zatok w wieku  $46.9 \pm 14.5$ , przyjętych do Oddziału Laryngologii i Onkologii Laryngologicznej pomiędzy 1.07 a 31. 10.2019r zakwalifikowanych do zabiegu ESS zgodnie z wytycznymi EPOS 2012 (zaktualizowanymi z EPOS 2020). U wszystkich chorych wykonano badania subiektywne (SinoNasal Outcomes Test, Visual Analogue Scale, Brief Smell Identification Test) oraz obiektywne badanie endoskopowe (Lund-Kenne-dy) i tomograficzne (Lund-Mackay) oraz uzyskano dane dotyczące palenia, atopii, chorób współistniejących i poprzednich operacji.

**Wyniki.** Stwierdzono istotną korelację pomiędzy wynikami badań subiektywnych a rozległością zmian zapalnych widocznych w badaniu tomograficznym zatok i endoskopowym jamy nosa. Wykształcenie, nikotynizm, atopia, nadciśnienie tętnicze, cukrzyca nie miały wpływu na subiektywne wyniki ocen. Pacjenci z cukrzycą mieli znacząco wyższy stopień nasilenia zmian w skali Lund-Mackay. Wyniki SNOT-22, SNOT-12 i VAS były statystycznie wyższe u kobiet. Stwierdzono znaczące statystycznie różnice między podgrupami pacjentów z różną punktacją BSIT a skalą Lund-Mackay oraz Lund-Kennedy.

**Wnioski.** Subiektywna ocena dolegliwości związanych z CRS jest dobrym wskaźnikiem do podejmowania dalszych decyzji terapeutycznych.

**Słowa kluczowe:** *zapalenie zatok, SNOT-22, VAS, operacje zatok*

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## Introduction

Chronic rhinosinusitis (CRS) is one of the most widespread chronic diseases in the world, affecting 11% of Europe's population [1], and 12.5% of the US population [1, 2]. Despite applying maximal medical therapy, endoscopic sinus surgery (ESS) is becoming increasingly frequent [3,4,5]. Unfortunately, up to 40 % of patients, despite intensive conservative and surgical treatment, do not achieve clinically significant improvement [4,5], which may raise doubts as to the correct qualification for ESS. There are many tests for the clinical assessment of the severity of subjective and objective complaints in patients with CRS, which are intended to help in determining the optimal, individual treatment for each patient.

One category are questionnaires assessing sinonasal symptoms, including the visual analogue scale (VAS) [6], the Sinus Symptom Questionnaire (SSQ) [7] and the Nasal Obstruction Symptom Evaluation Scale [8]. Another category are tests assessing both sinonasal symptoms and general quality-of-life parameters. They include the SinoNasal Outcomes Test -22 (SNOT-22) [9], SNOT-20 [10] or its shortened version SNOT-12, Chronic Sinusitis Survey (CSS) [11], Rhinosinusitis Disability Index (RSDI) [10], Brief Symptom Inventory 18 (BSI-18) [12] and others.

In the case of the objective tests of the severity of inflammatory lesions, the Lund-Mackay score is used to assess the sinus computed tomography [13,14], whereas the Lund-Kennedy [15] or its short version (MLK) [16], Lund-Naclerio [14], Hadley scores and others are proposed for endoscopic assessment of the nasal cavity. The results of the tests are the basis for planning the extent of ESS and postoperative treatment, including analgesic treatment [17].

## Aims

The authors' aim was to investigate to what extent the complaints reported by patients may form the basis for making a decision about ESS. It was decided to compare the results of the objective extent of CRS with the subjective one provided by patients. Moreover it was examined what factors could influence the result of subjective assessment. The age of patients, education, multiple sinus surgery, comorbidities such as asthma, allergy, diabetes mellitus, arterial hypertension, and smoking were taken into account. It was assumed that finding factors that cause possible discrepancies between the results of subjective and objective tests would allow for better qualification for surgery and further treatment.

## Material and methods

The study included patients with CRS qualified for ESS in accordance with EPOS 2012 guidelines [18] updated with

EPOS 2020 [19], admitted to the Department of Laryngology and Laryngological Oncology between July 1 and October 31, 2019.

Patients under 18 years of age and those with allergic fungal rhinosinusitis, fungus ball, sinusitis of dental origin, cystic fibrosis, primary ciliary dyskinesia, immune deficiency, malignancy of the paranasal sinuses or history of alcohol, drug abuse or psychiatric illness were excluded, as were pregnant and lactating women.

The authors assessed the extent of inflammatory lesions in patients based on sinus computed tomography. The inflammatory lesions were assessed according to the Lund-Mackay score (the degree of opacification in the maxillary, anterior and posterior ethmoid, frontal, and sphenoid sinuses as well as the obstruction of the ostiomeatal complexes were evaluated (on both sides) on a 0-2 scale - a maximum of 24 points).

The presence of polyps (on a 0-3 scale), discharge, oedema, and crusting (0-2 points for each symptom on the right and left side of the nasal cavity) was assessed (Lund-Kennedy score) during nasal endoscopy.

To assess the patient's subjective well-being, the VAS, SNOT-22 and SNOT-12 scales (the first 12 points of the SNOT-22 scale for complaints closely related to sinusitis) were selected. VAS was evaluated by the patients, using points from 1 to 10, indicating how much the disease hindered their life, where 10 points meant unbearable discomfort and 1 lack of discomfort. A similar assessment of 22 symptoms was made on the basis of the SNOT-22 questionnaire, where points from 0 to 5 were used to assess each discomfort related to the disease (0 meant lack of discomfort). Olfactory testing was also performed. The BSIT (Brief Smell Identification Test) scale was applied, evaluating 3 scents on a scale from 0-5 (0 point – can smell and recognize 3 scents, 1 point- can smell and recognize 2 scents or only recognizes 3 scents, 2 points – can recognize 1 scent or smell 2 scents, 3-4 points – can smell 1-3 scents poorly, 5 points - cannot smell and recognize the scents).

Each patient admitted due to CRS had skin prick tests or serum-specific IgE antibody tests for inhaled allergens performed on an outpatient basis.

During the interview, patients were asked about previous sinus surgery, comorbidities such as asthma, allergy, diabetes mellitus, hypertension, as well as smoking and education.

The Ethics Committee was asked whether the treatment and research required special approval. In response, it was stated that the conducted observation and treatment did not require the consent of the Ethics Committee, because they did not differ from the applied standards of treatment of patients after ESS and all the applied procedures are also performed as standard in our Department.

**Statistical methods**

Results were expressed as means and standard deviations or absolute number and percentage. Parametric t-student test for unpaired data, Pearson correlation test to assess correlations, and non-parametric Kruskal-Wallis ANOVA test for comparisons among multiple groups were used. All analyses were performed with a software package (The STATISTICA 13). P values less than 0.05 were considered significant.

**Results**

130 patients aged  $46.9 \pm 14.5$  (range 19-82 years) were examined, including 63 (48.5%) women and 67 (51.5%) men. CRS sine nasal polyps (CRSsNP) was diagnosed in 63 (48.5%) patients, CRS with nasal polyps (CRSwNP) in 67 (51.5%). Clinical characteristics, including sex, age, presence of atopy, asthma, smoking, comorbidities such as arterial hypertension and diabetes mellitus, nasal polyps, previous endoscopic sinus surgery, level of education were recorded. Means ( $\pm$  standard deviations (SD)) for the SNOT-22 total score, SNOT-12 score, Lund-Mackay score, VAS score, Lund-Kennedy score and BSIT total score were calculated. The obtained data are presented in a tabular form for all CRS patients. (Table I).

Significant positive correlations were found between the SNOT-12 score and both the Lund-Mackay score ( $r = 0.306, p < 0.05$ ) (Fig.1) and the Lund-Kennedy score ( $r = 0.28, p < 0.05$ ) (Fig.2). A significant positive correlation was found between the SNOT-22 score and the Lund-Kennedy score ( $r = 0.2, p < 0.05$ ) (Fig. 3).

Tab. I Clinical characteristics of 130 patients with chronic rhinosinusitis

Parameter	Result
Sex	
Female	63 (48.5%)
Male	67 (51.5%)
Age (years)	$46.9 \pm 14.5$
Lund-Mackay score	$12.7 \pm 6.4$
SNOT-12	$27.4 \pm 10.2$
SNOT-22	$46.7 \pm 18.9$
VAS	$21.7 \pm 7.8$
BSIT	$1.9 \pm 2.04$
Lund-Kennedy score	$6.8 \pm 3.6$
Atopy (n, %)	44, 33%
Smoking (n, %)	33, 25%
Asthma (n, %)	36, 27%
Arterial hypertension (n, %)	29, 22%
Diabetes mellitus (n, %)	12, 9%
Education (hhh/.../primary)	55/72/3
Nasal polyps (n, %)	67, 51%
Previous sino-nasal surgery (n, %)	38, 29.2%

Significant positive correlations were found between the VAS score and both the Lund-Mackay score ( $r = 0.48, p < 0.05$ ) and the Lund-Kennedy score ( $r = 0.42, p < 0.005$ ).

Significant differences were found among subgroups of patients with different BSIT scores and both the Lund-Mackay score ( $p < 0.0001$ ) (Fig. 4) and the Lund-Kennedy score ( $p < 0.0001$ ) (Fig. 5)

The SNOT-22, SNOT-12 and VAS scores were significantly higher in female patients than in male patients (t-Student test,  $p < 0.002, 0.002$  and  $0.02$ , respectively). The SNOT-22 and BSIT scores positively correlated with age ( $r = 0.17, r = 0.2$ ; respectively,  $p < 0.05$ ). Both objective (the Lund-Mackay and Lund-Kennedy scores;  $p < 0.00005, 0.00005$ , respectively, t-Student test) and subjective (the SNOT-12, SNOT-22, VAS and BSIT) test scores were significantly higher in patients with asthma ( $p < 0.0005, 0.003, 0.0002, 0.000001$ , respectively, t-Student test).

Education, cigarette smoking, atopy, arterial hypertension did not influence either objective or subjective test results.

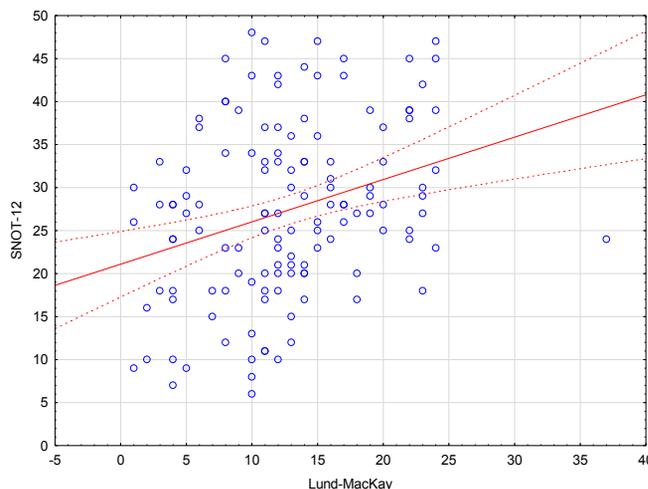


Fig. 1. Significant positive correlations between the SNOT-12 score and the Lund-Mackay score ( $r = 0.306, p < 0.05$ , Pearson correlation test).

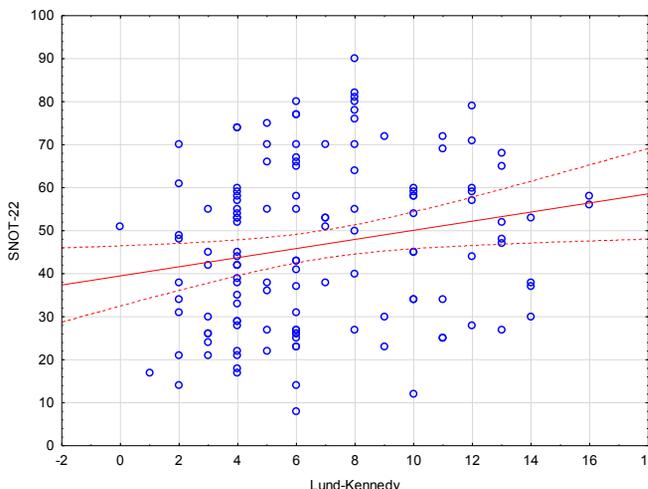


Fig. 2. Significant positive correlation between the SNOT-22 score and the Lund-Kennedy score ( $r = 0.2, p < 0.05$ , Pearson correlation test).

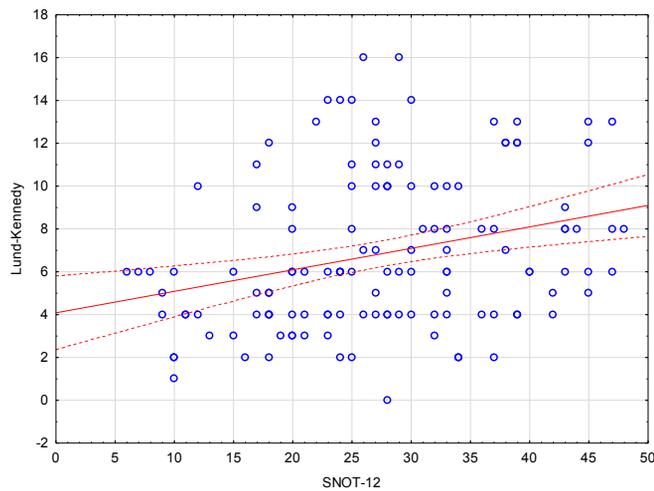


Fig. 3. Significant positive correlations between the SNOT-12 score and the Lund-Kennedy score ( $r=0.28$ ,  $p<0.05$ , Pearson correlation test).

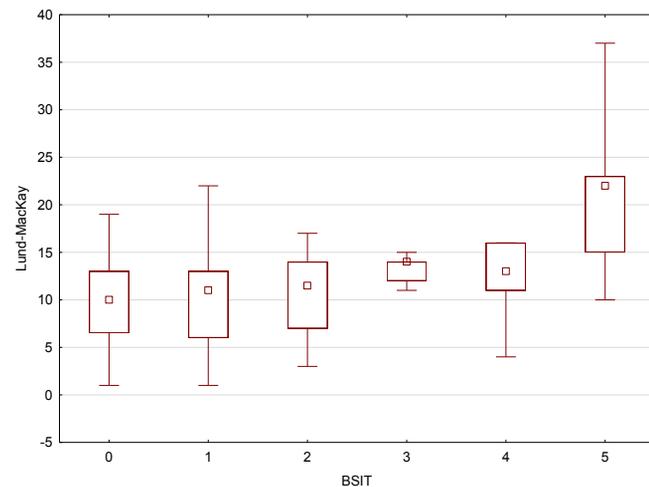


Fig. 4 The Lund-Mackay in patients with BSIT score from 0 to 5 points.  $P<0.0001$ , Kruskal-Wallis test.

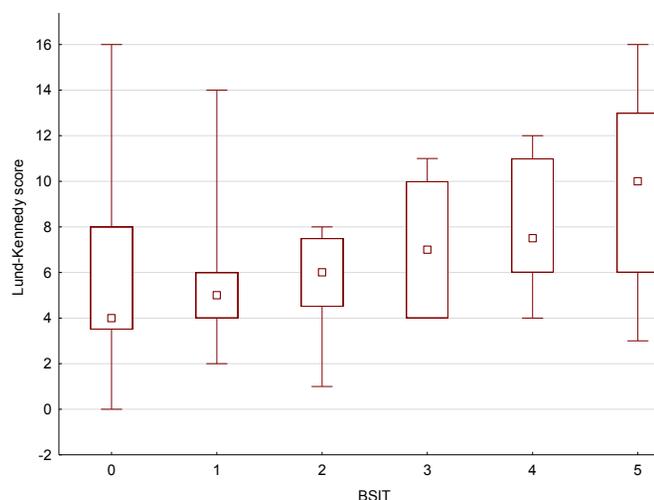


Fig. 5 The Lund-Kennedy score in patients with BSIT score from 0 to 5 points.  $P<0.0001$ , Kruskal-Wallis test.

Patients with diabetes mellitus had a significantly higher Lund-Mackay score ( $p=0.002$ , t-Student test).

The subgroup of patients who were previously operated because of CRS was older, had a higher Lund-Mackay score, higher VAS, BSIT and endoscopy values compared to the non-operated subgroup.

## Discussion

Many different tests are used in the literature to assess patients' subjective complaints. The study was based on the more commonly used VAS, SNOT-22, and BSIT tests, which are understood and accepted by patients. Unfortunately, weak correlations between the SNOT-22 total score and objective CRS parameters are frequently observed in the literature [20,21,22,23,24]. It may be due to the fact that most of the research has been done based on a non-European population [25], and cultural differences matter here. The aim of the study was not only to assess the correlation between subjective and objective tests, but also to evaluate the impact of comorbidities, education and sex of patients on the results of tests assessing the disease activity. There was a significant correlation between nasal and sinus complaints (SNOT-12, VAS, BSIT) and the extent of inflammatory lesions visible in sinus computed tomography and nasal endoscopy. Questions about sinuses and the overall effect of the disease on the patient's well-being (SNOT-22) significantly correlated with the result of the endoscopic examination. DeJaco [12] observed a significant and highly positive correlation between the "emotional symptoms" domain and BSI-18 total score. Significant correlations between the "nasal symptoms" and the "emotional symptoms" domains were observed with objective CRS parameters. He suggests that the resulting factorial structure with different item-domain assignments may thus be more suitable for European CRS patients [12].

The analysis of the influence of comorbidities has shown that the presence of asthma affects the values of the performed tests and the tomography and endoscopy results, which is probably due to the more severe course of CRS in patients with asthma. It is interesting to note that diabetic patients had higher Lund-Mackay scores. The study found no effect of atopy, hypertension and active smoking on the results. In the literature there are reports saying that smoking is one of the important factors affecting the occurrence of CRS and the severity of postoperative pain, but the effect of smoking on the results of the subjective assessment of the disease severity has not been studied [12, 23]. Similarly, the degree of education did not affect the results of the SNOT, VAS, and BSIT tests. The female gender correlated with higher SNOT-12, SNOT-22 and VAS values, suggesting a greater impact of the disease on the quality of women's lives.

The group that had previous surgery because of CRS had higher Lund-Mackay and Lund-Kennedy as well as VAS and BSIT scores, which is perfectly understandable because it results from longer duration of the disease and previous exacerbations.

The consistency between the reported subjective complaints of the patients and the actual extent of inflammation observed in the test results suggests that patients' complaints should be taken very seriously and the decision about surgical treatment should be made early enough.

High values of SNOT-12, -22, and VAS form the basis for qualifying for ESS and analgesic treatment after surgery especially in women, who are more affected by CRS-related complaints.

## Conclusions

1. Age, education, and comorbidities do not affect the subjective assessment of complaints reported by pa-

tients with CRS qualified for ESS in accordance with EPOS guidelines.

2. The complaints related to the nasal cavity and sinuses, reported by patients, may form the basis for qualification for surgical treatment, as they significantly correlate with objective tests of the severity of the inflammatory process.

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