

Article

# Assessment of the Correlation of Clinical And Functional Indicators and Cognitive Tests in Patients with Chronic Rhinosinusitis with Polyps.

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**Abstract: Relevance:** the versatility of the clinical picture of chronic rhinosinusitis with polyps is not limited to nasal obstruction and impaired sense of smell, this disease has a complex complex effect on the central regulatory mechanisms of the patient, manifested by impaired cognitive and mnestic functions of the brain. **Objective:** to evaluate the correlation of indicators characterizing the functional state of the nasal cavity in patients with chronic rhinosinusitis with polyps and cognitive tests in the pre- and postoperative period. **Materials and methods:** testing was performed in 45 patients with chronic rhinosinusitis with polyps with a long history of the disease (M= 117 months). The age of the study group was from 22 to 65 years (M=48.964 years), without concomitant chronic pathology. The scope of clinical testing included testing of synonasal symptoms of SNOT-22, the Lund-Kennedy scale and active anterior rhinomanometry (ml/sec). Changes in X-ray examinations (CT ONP) were assessed on the Lund-MacKay scale. Cognitive abilities were tested on the basis of the MoCA test in points with subsequent interpretation by a psychiatrist. The evaluation of the indicators was carried out before the surgical treatment of chronic rhinosinusitis with polyps, after 1 and 6 months. **Results:** The results were obtained to reduce the indicators of sinonasal symptoms on the SNOT-22 scale from M=31.42 before surgery and up to 4.04 points after 6 months; the Lund-Kennedy scale from M=7.87 to M=0.38 points; the Lund-Mackey scale from M=15.49 to M =0.47 points at the final stage. The indicators of active anterior rhinomanometry tended to increase from M=399.04 ml/sec before surgery and M=856.60 ml/sec after six months. Testing of neurocognitive disorders according to MoHS in patients preoperatively demonstrated average values of 21.49 points, which indicated the presence of mild disorders. Further testing made it possible to obtain indicators of 25.38 points after 1 month, which were fixed with a clear positive trend during the study after 6 months. **Conclusion.** An interdisciplinary approach to the assessment of clinical manifestations in patients with chronic rhinosinusitis with polyps, based on the inclusion of testing of neurocognitive disorders in the study, allows for a more complete assessment of the impact of the pathological process on the patient's body. The inclusion of the MOS test in the complex of pre- and postoperative studies allows us to form an individualized approach to the implementation of therapeutic and rehabilitation measures in this category of patients.

**Keywords:** polypous rhinosinusitis, chronic rhinosinusitis with polyps, sinonasal symptoms, neurocognitive tests.

### Introduction

Chronic rhinosinusitis with nasal polyps (CRSsNP) is a well-studied and complex problem of otorhinolaryngology, which still has a huge number of white spots and still remains an important area in ENT diseases that requires further study [1,2,3]. This is due, on the one hand, to an increase in the number of patients, and, on the other, to the active development of modern treatment and rehabilitation measures based on the latest data in the field of immunology and pathohistochemistry.

The main clinical symptoms of CRSsNP depend on the prevalence of the process and are characterized by nasal breathing disorders, hypo/anosmia, and headache [4]. However, the generally accepted clinical manifestations of chronic productive process in the paranasal sinuses, which in the case of periodic exacerbations is accompanied by purulent-inflammatory manifestations, do not reflect the entire symptom complex of the disease, since they do not take into account the quality of life and other systemic effects on the patient's body as a whole [4,5,6,7].

The diversity of the clinical picture of CRSsNP, depending on the localization and pathomorphology, also includes cognitive and mnestic disorders observed by patients [8,9,10]. In turn, neurologists and psychiatrists have recently been widely discussing the deterioration of cognitive functions against the background of the inflammatory process in the nasal cavity and paranasal sinuses [11, 12, 13]. Surgical treatment to remove nasal obstruction in rhinosinusitis undoubtedly improves the quality of life of patients and allows them to cope with depression [14], improves memory and attention [15], and, in general, significantly affects cognitive abilities [16]. A set of data on the complexity of the complex impact of chronic productive inflammation in the paranasal sinuses formed the basis of the study [17].

**Objective:** to assess the correlation of indicators characterizing the functional state of the nasal cavity in patients with chronic rhinosinusitis with nasal polyps and cognitive tests in the pre- and postoperative period.

### Patients and research methods.

The study included 45 patients with CRSsNP who were treated at the Krasnodar Regional Health Center No. 3 in the period from May 2022 to February 2023. The group of tested patients with CRSsNP was represented by individuals aged from 22 to 65 years ( $M=48.96$  years,  $\sigma = 13.137$ ), without concomitant chronic pathology (exclusion criteria-diseases of the cardiovascular system, bronchial asthma, etc.). The duration of the disease in patients was at least one year ( $M=117$  months, from 12 months to 396 months,  $\sigma = 117.816$ ). The study included 28 men (62.2%) and 17 women (37.8%). In accordance with the indications, the patients underwent endoscopic polypsinusotomy in the required volume [18].

The scope of clinical testing included тестирование SNOT-22 sinonasal symptom scale testing, Lund-Mackey scale, and active anterior rhinomanometry (ml / sec). Changes in X-ray examinations (CT of paranasal sinuses) were evaluated on the Lund-MacKay scale. Cognitive abilities were tested on the basis of the MoCA test – the Montreal Cognitive Scale – an international screening method for studying cognitive functions that evaluates attention and

concentration, executive functions, memory, speech, opto-spatial activity, conceptual thinking, counting and orientation. The test result was evaluated in points with subsequent interpretation by a psychiatrist (from 30 to 26 points – normal, less than 26 points-mild cognitive impairment) [19]. Patients previously received informed voluntary consent and explained all the stages and methods of the study.

Evaluation of clinical tests in parallel with the results of tests of cognitive disorders was carried out by at the patient's admission to the hospital, 1 month and six months after surgery, X-ray tests-in the preoperative period and after 6 months.

Statistical processing of the obtained data was performed using the Microsoft Excel MSO application software packages (16.0.12026.20312), Statistica 12.5.192.7 (StatSoft, Inc., USA). In order to check the digital data for normality depending on the sample size, chi-square criteria were used. For the normal distribution of data, parametric methods were used: the arithmetic mean (M) was used as descriptive statistics. For statistical analysis, correlation and regression analysis (Pearson coefficient) was used.

### Research results

Analysis of sinonasal manifestations of CRSsNP according to the SNOT-22 questionnaire filled in by patients and the Lund-Kennedy scale, based on a point assessment of qualitative indicators, namely, the nasal polyposis process, at the initial stage of the study (before surgery) showed the severity of clinical manifestations in all patients (Table 1).

1 month after the operation, the SNOT-22 questionnaire showed a significant decrease in the values-from M=31.42 points to M=10.04 points, and after 6 months-M=4.04 points. On the Lund-Kennedy scale, a similar trend was observed: before the operation, the average values were M=7.87 points, then after 1 month-M=1.49 points, and at the final stage after 6 months-M=0.38 points.

Indicators of active anterior rhinomanometry showed positive dynamics with M=399.04 ml / sec before surgery, the maximum increase in the first estimated postoperative period was M=778.89 ml / sec. The further trend had the same trend in direction, but at a lower rate with the achievement of up to M=856.60 ml / sec, which can be estimated as close to the norm.

According to the Lund-MacKay scale, the average values in the studied group of patients with CRSsNP were M=15.49 points. Since the X-ray control was carried out after 6 months, the indicators of the final stage were M=0.47 points, which indicated a bright positive dynamic.

Testing of cognitive impairment in patients before surgery showed average values of M=21.49 points, which indicated the presence of mild disorders. Further testing allowed us to get the indicators M=25.38 points and M=26.93 points after 1 month (the norm is more than 26 points), which were fixed after 6 months.

Table 1. Characteristics of functional and clinical parameters and cognitive testing in patients with chronic rhinosinusitis with nasal polyps in the pre- and postoperative period.

Clinical and functional parameters	Mean (M)	Minimum (min)	Maximum (max)	Standard deviation ( $\sigma$ )
Pre-surgery				
Rhinomanometry (ml/sec)	399.04	21.0	627.0	150,174
Lund-Mackey (points)	15.49	5,000	23,000	5,142
Lund-Kennedy (points)	7.87	4,000	10,000	1,646
MoCA test (points)	21.49	17,000	28,000	2,139
SNOT-22 (points)	31.42	12,000	59,000	9,258
1 month after surgery				
Rhinomanometry (ml / sec)	778.89	162,000	1249,000	224,500
Lund-Kennedy (points)	1.49	0.000	4,000	1,180
MoCA test (points)	25.38	22,000	28,000	1,353
SNOT-22 (points)	10.04	2,000	20,000	5,130
5,130 6 months after surgery				
Rhinomanometry (ml/sec <sup>856</sup> )	856,60	.60 314,000	1329,000	221,128
Lund-Mackey (points)	0.47	0.000	2,000	0.815
Lund-Kennedy (points)	0.38	0.000	2,000	0.535
MoCA test (points)	26.93	24,000	30,000	1,304
SNOT-22 (points)	4,04	0,000	15,000	3,411

An additional statistical analysis, with the determination of correlations, allowed us to determine the main parameters that characterize the results of the study in patients with chronic rhinosinusitis with nasal polyps (Table 2).

Table 2. Correlations of clinical and functional parameters in patients with chronic rhinosinusitis with nasal polyps in combination with testing of neurocognitive disorders in pre- and postoperative periods

Study stages														
Clinical and functional parameters and test results	Before surgery					After 1 month from surgery				After 6 months from surgery				
	Rhinometry	Lund-Mackey	Lund-Kennedy	MoCA Rhinometry	SNOT-22	Rhinometry	Lund-Kennedy	MoCA	SNOT-22	Rhinometry	SNOT-22	Lund-Kennedy	MoCA	SNOT-22
Rhinomanometry Test	1	-.411**	-.086	-.332*	.158	.624**	-.289*	.132	.148	.693**	-.315*	-.403**	.035	-.044
Lund-Mackey	-.411**	1	.620**	.444**	.250*	.413**	.297*	-.455**	.053	-.309*	.601*	.444**	.005	-.003
Lund-Kennedy	-.086	.620**	1	-.433**	-.008	.000 <sup>387**</sup>	-.201	-.137	-.027	.251*	.291*	.261*	-.379**	
MoCA test	.332*	-.444**	-.433**	1	-.163	-.097	-.196	.696**	-.095	.106	-.043	-.304*	.428**	-.006
SNOT-22	.158	.250*	-.008	-.163	1	.188	.001	-.541**	.442*	.142	.226	.054	-.482**	.280*

\*\* . The correlation is significant at 0.01 (1-sides).  
 \* . The correlation is significant at the level of 0.05 (1-sides).

According to the obtained results of statistical analysis (tab. 2) it can be observed that active anterior rhinomanometry, as a method for assessing nasal obstruction, showed significant correlations with the Lund-Mackay scale data at the initial stage of the study, and average correlations after 6 months, active anterior rhinomanometry scores were negative preoperatively. After 6 months, a significant correlation was determined. For MoCA test, active anterior rhinomanometry showed a moderate correlation only preoperatively, and no correlation was found at other stages. no correlations were obtained for the SNOT-22 scale. In the postoperative period, for active anterior rhinomanometry, there were significant correlations in the dynamics of changes after 1 month and six months ( $p < 0.01$ ).

To assess clinical manifestations based on endoscopic examination (Lund-Kennedy scale), a significant correlation was observed with the data of the Lund-Mackay scale and the MoCA test at the first stage of the study and with SNOT-22 testing after 6 months, but in the opposite direction. A less pronounced correlation, where  $p < 0.05$ , was found for the Lund-Mackay scale and the MoCA test at the final stage of the study. Internal correlations in the Lund-Kennedy scale assessment were assessed as significant and quite naturally reflected the picture of the postoperative period in patients with CRSsNP.

Results of testing the SNOT-22 questionnaire on the clinical manifestations of nasal obstruction in patients with CRSsNP revealed a significant correlation only with the MCA test. At the initial stage of the study, this correlation was average, but then it can be assessed as significant in severity (after 1 month and six months).

The Lund-Mack a y score of radiological changes performed before surgery showed a pronounced one-way correlation at the initial stage, and with all indicators except for the SNOT-22 test, where it was of average significance.

The MoCA test in the study at the initial stage revealed a positive correlation with the data of the SNOT-22 questionnaire, which later acquired the opposite direction. For the indicators of active anterior rhinomanometry, Lund-Mackay and Lund-Kennedy scales, a correlation was recorded only at the first stage of the study. It is noteworthy that there is a significant correlation according to the MoCA test itself in the postoperative period ( $p < 0.01$ ).

#### Discussion of the research results

The improvement of general well-being in patients with CRSsNP after surgical treatment aimed at normalizing or improving nasal breathing is due not only to the elimination of nasal obstruction. The influence of nasal breathing on a whole complex of important systems in the human body is determined physiologically.

The conducted study of a complex of clinical and radiological tests characterizing patients with chronic rhinosinusitis with nasal polyps demonstrated quite natural stages of postoperative recovery. At the initial stage of the study, preoperatively, the tests that characterize nasal obstruction (SNOT-22 and active anterior rhinomanometry) were quite significant, which ultimately, in combination with clinical and radiological indicators, served as the basis for the operation.

The regularity of the fact that in the postoperative period the data of the Lund-Mackay (computed tomography data) and Lund-Kennedy (endoscopic assessment of the nasal cavity) scales tended to decrease in the score is quite explicable by the observation period. It is interesting to analyse the correlation of these indicators with the data of the SNOT-22 patient

questionnaire. Only complete recovery of the nasal mucosa after 6 months with the elimination of postoperative oedema was evaluated positively by patients when filling out the questionnaire. For the Lund-Mackey scale, the combination of the pathological process in the SNP with the results of the survey took place only at the initial stage of the study. In the future, no regularities were found for these indicators.

The analysis of the questionnaire survey of patients with CRSsNP on the severity of neurocognitive disorders (MoCA test) is of maximum interest both at the initial stage of the study, and during follow-up in the early and late postoperative period in combination with clinical and functional indicators. Given that cognitive functions include such important components as perception, attention, memory, thinking, praxis and gnosis [20], and are involved in the formation of the second signal system, the importance of their study seems quite relevant.

Studies aimed at diagnosing neurocognitive disorders in the preoperative period in patients with CRSsNP were combined with the severity of nasal obstruction (SNOT-22 questionnaires, active anterior rhinomanometry and Lund-Kennedy scale). This allows us to expand our understanding of the effect of nasal disorders on the activity of the central nervous system. Preoperative testing of neurocognitive disorders by MoCA in patients showed average values of 21.49 points, which indicated the presence of mild variants of disorders. Further testing allowed us to get indicators of 25.38 points after 1 month, which were fixed during the study after 6 months.

### Conclusion

For patients with chronic rhinosinusitis with polyps, an integrated approach is important, based not only on the severity of nasal obstruction, but also including data from endoscopic examination of the nasal cavity, radiation diagnostics of pathological changes in the paranasal sinuses. In addition, the brightness of the patient's general perception of the existing disease has a certain value.

An interdisciplinary approach to the assessment of clinical manifestations in patients with chronic rhinosinusitis with polyps, based on the inclusion of neurocognitive disorders in the complex of clinical and functional indicators of testing, allows us to more fully assess the impact of the pathological process on the patient's body. It is possible that such a detailed analysis of the symptom complex of clinical manifestations in this disease will allow us to more fully determine the need for surgical intervention in order to eliminate nasal obstruction.

The inclusion of the MoCA test in the complex of pre- and post-operative studies makes it possible to form an individualized approach to the implementation of therapeutic and rehabilitation measures in this category of patients.

### Application of artificial intelligence (remove unnecessary):

The article is written without the use of artificial intelligence technologies.

**Conflicts of Interest:** The authors declare no conflict of interest.

**Informed Consent Statement:** Informed consent was obtained from all subjects involved in the study.

### Contribution of authors:

The concept of the article – Elizbarian I.S., Lazareva L.A.

The concept and design of the study – Elizbarian I.S., Lazareva L.A.

Writing the text – Elizbarian I.S., Lazareva L.A.

Collection and processing of the material – Elizbarian I.S.  
 Literature review – Elizbarian I.S., Lazareva L.A.  
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 Approval of the final version of the article – Elizbarian I.S., Lazareva L.A.

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