



Correlations between symptoms, nasal endoscopy and computed tomography findings in patients with chronic rhinosinusitis without nasal polyps

Korelacije između simptoma, nalaza endoskopije nosa i kompjuterizovane tomografije kod bolesnika sa hroničnim rinosinuzitisom bez nosne polipoze

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Abstract

Background/Aim. Chronic rhinosinusitis (CRS) is one of the most common chronic conditions that is diagnosed on the basis of the condition symptoms, nasal endoscopy and computed tomography (CT) of the nose and paranasal sinuses. There are two forms of CRS: CRS with nasal polyps (CRSwNP) and CRS without nasal polyps (CRSsNP). The aim of this paper was to determine if there is a correlation between the symptoms, nasal endoscopy and CT in patients with CRSsNP. **Methods.** The study included 110 patients with CRSsNP. The intensity of the symptoms assessed on the visual analogue scale (VAS) and the condition of nasal mucosa and the presence of nasal secretion was estimated by endoscopic examination of the nose while CT was used to determine the Lund-Mackay (LM) score values. Pearson's coefficient of correlation was used for statistic data processing. **Results.** The severity of the disease as a whole ($r = 0.509$) and nasal discharge ($r = 0.562$) moderately correlated with CT. Nasal congestion ($r = 0.354$) and the reduction of loss of smell ($r = 0.324$) mildly correlated with CT, while facial pain/pressure ($r = 0.218$) had a very weak correlation

with CT. The severity of the disease as a whole ($r = 0.717$) and nasal discharge ($r = 0.821$) strongly correlated with nasal endoscopy. Nasal congestion ($r = 0.525$) had a moderate correlation with nasal endoscopy while facial pain/pressure ($r = 0.345$) and the reduction of the loss of smell ($r = 0.394$) had a mild correlation with nasal endoscopy. A moderate correlation was found between nasal endoscopy and CT ($r = 0.630$). **Conclusion.** The severity of the disease as a whole and nasal discharge have more significant correlations both with nasal endoscopy and CT in relation to the correlations between other symptoms and nasal endoscopy, as well as CT. More significant correlations between the symptoms and nasal endoscopy in relation to the correlations between the symptoms and CT and the existence of a moderate correlation between nasal endoscopy and CT, enable a lesser use of CT diagnostics and only in precisely defined situations.

Key words:

chronic disease; endoscopy; rhinitis; severity of illness disease; signs and symptoms; sinusitis; tomography, x-ray computed.

Apstrakt

Uvod/ Cilj. Hronični rinosinuzitis (HRS) je jedno od najčešćih hroničnih oboljenja koje se dijagnostikuje na osnovu simptoma bolesti, endoskopije nosa i kompjuterizovane tomografije (KT) nosa i paranazalnih sinusa. Postoje dve forme rinosinuzitisa: HRS sa polipozom nosa (HRSsPN) i HRS bez polipoze nosa (HRSbPN). Cilj rada je bio da se utvrdi da li postoje korelacije između simptoma, nalaza endoskopije nosa i KT kod bolesnika sa HRSbPN. **Metode.** Istraživanjem je obuhvaćeno 110 bolesnika sa HRSbPN. In-

tenzitet tegoba je bio procenjen na vizuelnoj analognoj skali (VAS); endoskopskim pregledom nosa procenjeno je stanje nosne sluznice i prisustvo sekreta u nosu, a korišćenjem KT nosa i paranazalnih sinusa utvrđene su vrednosti Lund-Mackay skora. Za statističku obradu podataka korišćen je Pirsonov koeficijent korelacije. **Rezultati.** Težina bolesti u celosti ($r = 0,509$) i sekrecija iz nosa ($r = 0,562$) umereno su korelirale sa vrednostima KT skora. Zapušenost nosa ($r = 0,354$) i osećaj oslabljenog ili izgubljenog mirisa ($r = 0,324$) blago su korelirali sa vrednostima KT skora, dok je korelacija između osećaja bola/pritiska u licu ($r = 0,218$) i KT skora

bila vrlo slaba. Težina bolesti u celosti ($r = 0,717$) i sekrecija iz nosa ($r = 0,821$) snažno su korelirale sa nalazima endoskopije nosa. Zapušenost nosa ($r = 0,525$) je imala umerenu korelaciju sa nalazom endoskopa nosa, dok su osećaj bola/pritisaka u licu ($r = 0,345$) i osećaj oslabljenog ili izgubljenog mirisa ($r = 0,394$) blago korelirali sa nalazom endoskopijom nosa. Korelacija između nalaza endoskopije nosa i KT bila je umerena ($r = 0,630$). **Zaključak.** Težina bolesti u celosti i sekrecija iz nosa, u odnosu na druge tegobe, značajnije koreliraju, kako sa nalazom endoskopije nosa tako i sa KT skorom. Značajnije korelacije između simptoma i

nalaza endoskopije nosa u odnosu na korelacije između simptoma i KT skora, uz postojanje umerene korelacije između nalaza endoskopije nosa i KT skora, omogućavaju da se KT nosa i paranazalnih sinusa koristi samo u jasno definisanim situacijama.

Ključne reči:

hronična bolest; endoskopija; rinitis; bolest, indeks težine; znaci i simptomi; sinuzitis; tomografija, kompjuterizovana, rendgenska.

Introduction

Chronic rhinosinusitis (CRS) is a very common chronic condition taking the second place on the list of all chronic conditions in the USA¹. It impairs the quality of life to a great extent and it has been proven that this condition has a bigger impact on patients' social interaction in comparison to heart disease, angina or back pain². CRS has a great impact on patients' health as well as the health and economic system of one country. The costs for curing this condition, both directly and indirectly in the USA, place the condition among the first ten conditions with the biggest annual costs³. Almost 85% of CRS patients is aged between 18 and 65, which is the prime time of the working life⁴.

The diagnosis of CRS at the tertiary health level is made on the basis of the symptoms, and it is confirmed by nasal endoscopy and/or computed tomography (CT) of the nose and the paranasal sinuses. There are two forms of CRS: CRS with nasal polyps (CRSwNP) and CRS without nasal polyps (CRSsNP). Albeit these two forms have a lot in common and mutual interfering, they differ to a certain extent in regard to inflammatory profile, clinical manifestations and therapeutic effects⁵. A significant number of patients with CRS is cured on the primary health level, where the diagnosis is made on the basis of the symptoms. At this level physicians have no experience nor adequate equipment for nasal endoscopy⁶, and no possibilities for costly CT diagnostics⁷. This can lead to wrong diagnoses, which can further lead to an inadequate treatment with all the consequences that can arise from it. However, the symptoms are the main diagnostic procedure of CRS, because they are less time-consuming in everyday work enabling a valuable understanding of the condition as well as the assessment of the effect of the administered therapy⁸.

Numerous authors have researched if there is a correlation between subjective symptoms and objective disease parameters in CRS patients with the aim to obtain a much simpler, faster, cheaper, and, which is the most important fact, more reliable way to make a right diagnosis and decide on a right and timely treatment, avoiding all unwanted effects of consequences of the mistakes in diagnostics and treatment. The results of these researches are controversial⁹.

The aim of this paper was to determine if there is a correlation between a subjective symptom severity assessment, nasal endoscopy and CT findings in patients with CRSsNP.

Methods

This study involved 110 patients (47 men and 63 women), aged between 18 to 81. They were all diagnosed with CRSsNP on the basis of the clinical symptoms according to the European Position Paper on Rhinosinusitis and Nasal Polyps 2012 (EPOS 2012) criteria. The symptoms lasted more than 12 weeks in all patients. They all had previous primary and/or secondary health level medical treatments that lasted at least six weeks. Some of them were treated at a tertiary health level by otorhinolaryngologists who are not experts on rhinology. Since the results of the treatments were not satisfying, the patients were sent to specialists on rhinology to be reviewed for a surgery. The patients with allergic rhinitis, CRSwNP, benign or malignant tumors in the nose, acute infections of the upper respiratory tract and the patients who had had nasal or paranasal surgical procedures were excluded from the study. Also, the patients with chronic headaches, cystic fibrosis, immunocompromised conditions, pregnant women, breastfeeding women and subjects younger than 18 were also excluded. The research was done in accordance with the principles of the Helsinki declaration and it was approved by a local ethical committee. All the patients were thoroughly informed on the procedures of the study and gave a written consent to participate in it after fully understanding it. They were free to leave at any point of the study without any influence on their further treatment and the way they were treated.

Each patients' symptoms were recorded (nasal congestion, nasal discharge, facial pain /pressure, reduction or loss of smell). Intensity of every symptom was assessed on the visual analogue scale (VAS) from 0–10, with 0 indicating that there was no symptoms, and 10 the maximum intensity of the symptoms. Also, by using the same scale, the patients assessed the severity of the disease as a whole 0–10 cm. During the same examination every patient underwent nasal endoscopy with the endoscope of 30 degrees 4 mm. The state of nasal mucosa and the quantity of secretion were observed. The state of nasal mucosa in relation to the existence of edema for both parts of the nose was assessed as follows: 0 – absence of edema, 1 – mild and 2 – severe edema. The maximum value for this parameter is 4. The amount of secretion for each side of the nose was assessed as follows: 0 – no secretion, 1 – clear, thin secretion, 2 – thick, purulent nasal secretion. The maximum value of this parameter is 4 as well.

The states of nasal mucosa on both sides and the secretion on both sides were added up and the obtained result was considered as the endoscopic finding of the nose with the maximum value of 8. CT scanning of the nose and paranasal sinuses were done after collecting the data on the symptoms and nasal endoscopy in the period between 2 and 4 days on multiple detector (MD) CT Siemens devices, models Sensatin 64 and Emotion 16, by a series of direct axial cross-sections with reconstructing intervals of 1 mm and multiplanar reconstruction (MPR) coronal cross-sections with reconstructive intervals of 2 mm. By using Lund-Mackay (LM) scale for every paranasal sinus on both sides (maxillary, frontal, anterior ethmoids, posterior ethmoids and sphenoid), the state of sinus opacification was assessed from 0 – no opacification, 1 – partial opacification, 2 – total opacification (for both ostio-meatal complexes 0 – non occluded, 2 – occluded). The maximum value of CT LM score is 24.

After collecting all the data, the correlations between every individual symptom severity and CT findings were examined as well as the correlations between the severity of the disease as a whole and CT finding of the nose and paranasal sinuses. Afterwards, the correlations between the severity of every individual symptom and endoscopic nasal findings were examined as well as between the assessment of the severity of the disease as a whole and endoscopic nasal findings. At the end, the correlation between nasal endoscopy and CT finding of the nose and the paranasal sinuses was examined.

Numerical data are presented as measures of central tendency (mean, median) and the measures of variability (standard deviation, minimum, maximum). The connection testing between two properties was done by using Pearson's

coefficient of correlation (r). Statistical analysis was performed using IBM SPSS Statistics 21.

Results

Out of total of 110 examined patients with CRSsNP in this paper there were 63 (57.27%) women and 47 (42.73%) men with the ratio of 1.34 : 1. The average age of the examined patients was 42.09 years, ranging between 18 and 81 years of age.

The prevalence of certain symptoms, the mean values of symptoms severity and the disease as a whole, the values of endoscopic score and CT LM score as well as their standard deviations, minimums, maximums and ranges are shown in Table 1. The assessment of the disease severity as a whole with the average value of 4.91, nasal discharge 5.15, nasal congestion 4.29 and the sensation of facial pain/pressure 3.08 belonged to moderate symptoms, while reduction or loss of smell with the mean value of 2.23 belonged to mild symptoms.

The severity of the disease as a whole ($r = 0.509$) and nasal discharge ($r = 0.562$) moderately correlated with CT values. Nasal congestion ($r = 0.354$) and the reduction of loss of smell ($r = 0.324$) mildly correlated with CT values, while facial pain/pressure ($r = 0.218$) had a very weak correlation with CT values (Table 2).

The severity of the disease as a whole ($r = 0.717$) and nasal discharge ($r = 0.821$) strongly correlated with nasal endoscopy. Nasal congestion ($r = 0.525$) had a moderate correlation with nasal endoscopy finding while facial pain/pressure ($r = 0.345$) and the reduction of the loss of smell ($r = 0.394$) had a mild correlation with this finding (Table 3).

Table 1

The values of symptom intensity and the disease as a whole, the values of nasal endoscopic and computed tomography Lund-Mackay (CTLM) scores in patients with chronic rhinosinusitis (n = 110)

| Parameters | Mean \pm SD | Median | Minimum–Maximum |
|----------------------------|------------------|--------|-----------------|
| Disease as a whole | 4.91 \pm 2.118 | 5 | 1–10 |
| Nasal congestion | 4.29 \pm 2.006 | 4 | 0–10 |
| Nasal discharge | 5.15 \pm 2.605 | 5 | 0–10 |
| Facial pain/pressure | 3.08 \pm 2.638 | 4 | 0–10 |
| Reduction or loss of smell | 2.23 \pm 2.459 | 2 | 0–10 |
| State of nasal mucosa | 2.09 \pm 1.088 | 2 | 0–4 |
| Nasal secretion | 1.11 \pm 1.061 | 1 | 0–4 |
| Nasal endoscopic score* | 3.2 \pm 1.999 | 3 | 0–8 |
| CT LM score | 9.37 \pm 5.312 | 8 | 1–22 |

Note: The values of the state of nasal mucosa and the values of the nasal secretion were added up and the obtained result was considered as nasal endoscopic score.

SD – standard deviation.

Table 2

Correlations between symptoms and computed tomography finding in patients with chronic rhinosinusitis (n = 110)

| Parameters | Disease as a whole | Nasal congestion | Nasal discharge | Facial pain/pressure | Reduction or loss of smell |
|------------|--------------------|------------------|-----------------|----------------------|----------------------------|
| r | 0.509 | 0.354 | 0.562 | 0.218 | 0.324 |
| p | 0.000 | 0.000 | 0.000 | 0.022 | 0.001 |

r – Pearson's correlation coefficient; p – statistical significance.

Table 3

Correlations between symptoms and nasal endoscopy finding in patients with chronic rhinosinusitis (n = 110)

| Parameters | Disease as a whole | Nasal congestion | Nasal discharge | Facial pain/pressure | Reduction or loss of smell |
|------------|--------------------|------------------|-----------------|----------------------|----------------------------|
| <i>r</i> | 0.717 | 0.525 | 0.821 | 0.345 | 0.394 |
| <i>p</i> | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |

r – Pearson's correlation coefficient; *p* – statistical significance.

A moderate correlation was found between nasal endoscopy and CT score ($r = 0.630$), (Figure 1).

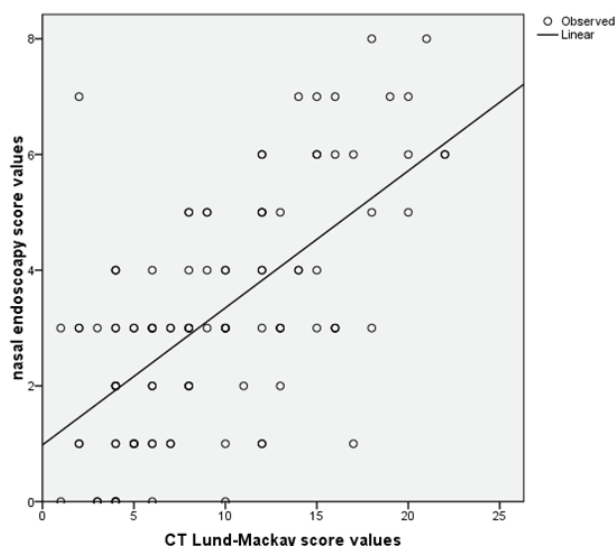


Fig. 1 – Correlation between findings of nasal endoscopy and computed tomography (CT) in patients with chronic rhinosinusitis (n = 110).

Discussion

CRS is a greatly widespread condition with the prevalence of 15.5% in the United States¹. The European prevalence is 10.9%, depending on every country individually ranging from 6.9% to 27.1%¹⁰. Besides the EPOS guidelines for making a diagnosis of CRS in 2012 in everyday practice, certain unclarities and misdiagnoses arise, which leads to wrong treatments. There are numerous reasons for that; considering a great number of such patients and diverse systems of health care organizations of certain countries, these patients are diagnosed and treated at different levels of health care at general practitioners, pediatricians, specialists in internal medicine, allergologists, otorhinolaryngologists and others. At every level of health care, there is different knowledge and different experience in diagnosing and treating of CRS, unequal availability of diagnostic procedures such as nasal endoscopy and CT diagnostics of the nose and paranasal sinuses. Also, patients are often unable to distinguish clearly the symptoms of this condition, they often mix the sensations of nasal congestion and facial pain/pressure¹¹. Patients often mistake headaches that are usually of neurogenous nature for CRS and they describe them as facial pain/pressure⁵. The symptoms that characterize CRS can oc-

cur in patients with infections of upper respiratory tract, allergic rhinitis and other rhinological ailments¹¹. All this, if not scrutinized, can lead to mistakes in diagnostics and treatment of this condition, and mistakes can occur when examining the correlations of the symptom severity and nasal endoscopy and CT scanning of the nose and paranasal sinuses, which all can lead to a wrong estimation of their values when diagnosing CRS.

The average age of the examined patients in our paper was 42.09 ranging from 18 to 81 years of age, which is very similar to the researches of other authors¹²⁻¹⁵. The examinees in the research of Ryan et al.¹¹ were slightly older with the average age of 51, while the average age of examinees in the papers of Pokharel et al.⁷ Nair¹⁶, and Gairolae et al.¹⁷ was about 32 years of age. There were more female than male patients in this study with the ratio of 1.34 : 1. The majority of female patients was also found by other authors examining the correlations of subjective and objective findings in patients with CRS^{7, 14-16}. On the other hand, Deepthi et al.¹², Birch et al.¹³ and Gairola et al.¹⁷ had significantly more male patients in their studies. These data on the age and gender can be of significance, because they can have an impact on the subjective sensation of the disease severity⁵. Baumann et al.¹⁸ have found that female CRS patients have the values of the 20-Item Sino-Nasal Outcome Test (SNOT-20) significantly higher than male patients, while the severity of the condition determined by imaging diagnostics was the same in both genders. Also, subjective assessments of the disease severity can be influenced by cultural and ethnic characteristics of the patients as well their socioeconomic status along with their comorbidities and other factors⁵.

Previous studies on correlations between subjective assessment of the disease severity and CT score in CRS patients differ greatly. Our results showed that there are moderate correlations between a subjective assessment of the disease severity as a whole and nasal discharge, which is the most intense symptom in patients in our study, and CT finding. The correlations between nasal congestion and reduction of loss of smell and CT finding were mild, while the correlation between facial pain/pressure and CT finding was very weak. Kenny et al.¹⁴ have found the results mildly similar to ours with a positive correlation between all the symptoms (of diverse degrees of significance), as well as the total symptom score and CT findings, except between the sensation of facial pressure and headache and CT finding, where there is no significant correlation. Numerous studies have found significant correlations between symptom severity assessment and CT LM score^{7, 12, 16, 19}. On the other hand, there are numerous studies which found a partial or no correlation between

these two parameters. Basu et al.²⁰ as well as Holbrook et al.²¹ have found that there is no correlation between a subjective assessment of the disease severity and CT LM score in CRS patients, while Holbrook et al.²¹ state that there is no correlation between the opacification region on CT scans and the region where the patients feel actual facial pain. Wabnitz et al.²² have found that there is no correlation between individual symptom severity characterizing CRS and CT findings, but when the whole symptom score and CT LM score are observed, there is a weak but statistically significant correlation between them. Rosbe and Jones²³ have shown that, only when dealing with nasal congestion as the major symptom, CT findings confirm CRS, while the patients complaining about facial pain/pressure most probably do not have CRS. The differences in the results regarding these two parameters, besides the mentioned demographic characteristics of the examinees, have other reasons. The degree of symptoms plays an important role (mild, moderate, heavy)⁵ – the heavier the symptoms, the bigger the probability of the correlation between them and CT findings^{7,21}. Also, the time that passes between a subjective assessment of the symptom severity and doing CT scanning is very important (whether it was simultaneously, or the gap is expressed in days, sometimes weeks). Considering the course of the disease, the longer the period between these diagnostic procedures, the weaker the validity of the correlation. Also, the results of these studies depend on the kind, notably the sensitivity of the test implemented for the subjective assessment of the symptom severity and also if the study excluded the patients with nasal polyposis or not.

The results of this study showed strong correlations between the severity of the disease as a whole and nasal discharge, as the most intense symptoms in the patients of this study, and nasal endoscopy finding. Nasal congestion had a moderate correlation with nasal endoscopy finding while reduction or loss of smell and facial pain/pressure have mildly correlated with this finding. More significant correlations that we found between symptoms and nasal endoscopy finding in relation to the correlations between symptoms and CT score, could be explained by a better observing nasal mucosal edema by nasal endoscopy than by using CT²⁴. In this regard, nasal endoscopy enables also a better assessment of nasal secretion amount than CT. Also, in about 30% of asymptomatic adult examinees, there are incidental mucosal changes on CT²⁵. Numerous studies have found a significant correlation between the symptoms and nasal endoscopy findings^{7,12,19}. On the other hand, Liu et al.²⁶ have found that only weakened or lost olfactory function is in correlation with endoscopic findings, while between other symptoms, as well as the total subjective score of the disease and endoscopic findings, there is no significant correlation in CRS patients. Birch et al.¹³, as well as Gairola et al.¹⁷, did not find any kind of correlation between a subjective condition severity and endoscopic finding in these patients. Gairola et al.¹⁷ state that the most probable reason for that is CRS patients

overestimate the severity of their symptoms. Other reasons of these contradictory findings that arise when comparing these two parameters could be explained in a similar way as the contradictions of the results comparing a subjective assessment of the condition severity and CT finding, as mentioned before.

Although doing a CT scanning of the nose and the paranasal sinuses is considered a “golden standard” in diagnosing CRS, this method is very expensive and not always feasible, and patients undergo a significant amount of radiation. On the other hand, nasal endoscopy is relatively simple and not so expensive, fast to perform, moderately sensitive and very specific in predicting the results of CT findings²³. The results of this research have shown that there is a moderate correlation between nasal endoscopy findings and CT LM score in patients with CRSsNP. Most authors state that there is a significant correlation between nasal endoscopy and CT findings^{7,12,27,28}. This is the very reason why Bhattacharyya and Kepnes³ and the Lohiya et al.²⁹ recommend using medicamentous therapy for CRS in patients with positive symptoms and positive endoscopic results, and doing diagnostic CT only in the patients whose symptoms persist after maximum medicamentous therapy. Also, diagnostic CT should be done in patients with positive symptoms and negative endoscopic findings. Ryan et al.¹¹ have found a very high degree of correlation between endoscopic and CT findings in the patients after endoscopic sinus surgical procedure and explained that these patients have a significantly better visibility of sinus cavities in relation to nonsurgical patients. On the basis of these findings, they recommended endoscopy as the main diagnostic procedure in the patients whose symptoms persist after endoscopic surgical procedure. On the contrary of most studies, Stankiewicz and Chow³⁰ have found a very poor correlation between nasal endoscopy and CT findings with nasal endoscopy having sensitivity of 46%, specificity of 86%, positive predictive value 74% and negative predictive value of 64%.

Conclusion

The severity of the disease as a whole and nasal discharge have more significant correlations both with nasal endoscopy and CT score in relation to the correlations between other symptoms and nasal endoscopy and CT score. Facial pain/pressure in relation to other symptoms correlate in a very weak way with nasal endoscopy and especially with CT score. More significant correlations between the symptoms and nasal endoscopy in relation to the correlations between the symptoms and CT score and the existence of a moderate correlation between nasal endoscopy and CT score, enable CT diagnostics to be used only in patients who do not respond to medical therapy, and also in the patients in whom there is no correlation between the symptom severity and nasal endoscopy, as well as in patients who are on the waiting list for surgical treatments.

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