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Diagnostic Value of Clinical Symptoms in Chronic Sinusitis and Their Concordance with CT Scan Findings in Patients Undergoing Functional Endoscopic Sinus Surgery

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Abstract

introduction: Establishing more accurate clinical diagnostic criteria is essential to improve both bedside diagnosis and the appropriate selection of patients for computed tomography (CT) imaging. This study aimed to evaluate the diagnostic value of clinical symptoms in chronic sinusitis and to assess their concordance with CT scan findings (Lund-Mackay score) in patients undergoing functional endoscopic sinus surgery (FESS).

Methods: A cross-sectional study was conducted on 206 patients referred for paranasal sinus CT scans due to suspected chronic sinusitis and subsequently underwent surgery after diagnosis. Clinical symptoms, including nasal congestion, postnasal drip, facial pain, headache, and sleep disturbances, were recorded. CT scans were analyzed using the Lund-Mackay scoring system. Diagnostic accuracy indices were calculated to evaluate the ability of clinical symptoms to predict CT scan findings. Sensitivity and specificity were determined for each clinical symptom using CT findings as the reference standard. In addition, the positive predictive value and negative predictive value were calculated to assess the probability of disease presence or absence given the clinical symptoms. Positive and negative likelihood ratios were also computed to further evaluate the diagnostic performance of clinical symptoms.

Results: The chi-square test showed that the CT scan findings had a significant association with the patients' smoking status (P = 0.01). The CT scan results based on patients' postnasal drip status are presented. The chi-square test showed that the CT scan findings had a significant association with postnasal drip in patients (P = 0.004). The sensitivity and specificity values of the evaluated symptoms were as follows: nasal discharge showed a sensitivity of 53.2% and a specificity of 58.9%. Post pharyngeal drip had a sensitivity of 37.8% and a specificity of 42.1%. Nasal congestion demonstrated a sensitivity of 66.67% and a specificity of 29.47%. The sensitivity and specificity for the history of headaches were 47.75% and 53.68%, respectively. Sleep disturbances showed a sensitivity of 47.7% and a specificity of 62.1%.

Conclusion: While certain clinical symptoms, such as postnasal drip, show a significant concordance with CT scan findings in patients undergoing FESS, other symptoms appear to have limited diagnostic value in predicting the severity of radiological sinusitis. Therefore, relying solely on clinical symptoms is insufficient, and CT imaging remains essential for accurate preoperative evaluation and surgical planning.

Key words: Chronic sinusitis, Clinical diagnosis, CT scan, Sensitivity, Specificity

Introduction

Chronic rhinosinusitis (CRS) refers to inflammation of the nasal and paranasal sinuses lasting at least 12 weeks (1). This condition is highly prevalent, affecting 1–4% of the general population, with nearly 29 million adults in the United States suffering from it (2). CRS is not merely a physical ailment but also significantly impacts daily

functioning and mental health. Most patients experience nasal congestion, mucosal thickening, reduced sense of smell, headaches, facial pain, and diminished quality of life, often leading them to seek treatment from multiple physicians (3).

The clinical symptoms of chronic sinusitis include rhinorrhea, nasal congestion, postnasal drip, and facial pain or pressure (4). The exact etiology remains unclear, though a wide range of bacteria—including aerobic, anaerobic, and fungal organisms—are frequently identified in patient secretions (5). Despite its high prevalence, diagnosing CRS is challenging because clinical criteria and plain radiography lack sufficient sensitivity and specificity (6). Clinical diagnosis relies on nonspecific symptoms such as nasal obstruction, facial discomfort, nasal discharge, and olfactory dysfunction, which can overlap with other ear, throat, or neurological disorders (7).

The diagnostic value of these symptoms has been debated for a long time. Currently, the gold standard for diagnosing chronic sinusitis is computed tomography (CT) imaging, which clearly depicts paranasal sinus anatomy, osteomeatal complex abnormalities, mucosal thickening, and bony wall density changes (8). CT scans have significantly advanced the diagnosis of inflammatory conditions in the ethmoid and osteomeatal sinuses, which are the primary sites of sinusitis pathology. Beyond confirming sinusitis, CT scans help identify underlying causes.

However, studies have reported conflicting findings on the correlation between clinical symptoms and CT evidence of sinusitis. For instance, Stankiewicz et al. (9) concluded that chronic sinusitis symptoms have low predictive value and require re-evaluation. Similarly, Kenny et al. (10) found poor agreement between patient-reported symptoms and textbook descriptions of sinusitis.

To date, no similar studies have been conducted in Iran. Given potential differences in predisposing factors, findings may vary from those in other countries. Due to the prevalence and risk of serious complications—such as orbital or intracranial involvement—early diagnosis and treatment are critical. Establishing more accurate clinical diagnostic criteria is essential to improve both bedside diagnosis and the appropriate selection of patients for CT imaging.

Since clinical symptoms form the basis of initial suspicion and CT scans confirm the diagnosis, this study aimed to evaluate the diagnostic value of clinical symptoms in chronic sinusitis and assess their concordance with CT scan findings (Lund-Mackay score) in patients undergoing functional endoscopic sinus surgery (FESS).

Materials and Methods

Study Design

A cross-sectional study was conducted to evaluate the diagnostic value of clinical signs of chronic sinusitis using paranasal sinus CT as the reference standard. This study was conducted in the Radiology Department of Razi Hospital, Birjand, from 2022 to 2023.

Participants

Convenience sampling was used in this study and performed on patients suspected of chronic sinusitis, with or without classic clinical manifestations, who were referred by an otolaryngologist (study supervisor). Referral was based on a comprehensive assessment of each patient's medical history and clinical findings. The inclusion criteria were as follows: the patients provided written informed consent to participate in the study and completed the prescribed clinical questionnaire in full. Exclusion criteria also included patients who did not consent to participate in the study or who withdrew during the study, incomplete completion of the questionnaire, and a history of sinus surgery for other reasons (e.g., tumors).

Sample Size

The sample size was based on the study by Mozaffarinia et al. (8), considering a type I error of 0.05 and a 10% attrition rate of 225.

Data Sources/Measurement

After obtaining the ethics code from Birjand University of Medical Sciences (IR.BUMS.REC.1402.378), the researchers were referred to Razi Specialized Hospital in Birjand, Iran, and data were collected using a standard questionnaire. According to the Lund–Mackay staging system, any scan with a score of 0 was considered normal, and any scan with a score greater than 0 was considered abnormal (11). Operational definition: In this study, the Lund–Mackay scoring system was used to diagnose CRS on CT scans. After obtaining informed consent, the inclusion and exclusion criteria were reviewed, and the individual was included in the study, and the questionnaire was completed. The collected data included demographic information (age and gender),

symptom duration, and clinical symptoms (postnasal drip, rhinorrhea, and nasal congestion, facial or frontal pain, facial pressure, and history of allergies or sinus/nasal surgery).

The CT scan imaging protocol also included all patients undergoing a non-contrast CT scan of the paranasal sinuses using a Toshiba CT scanner, and its standardized parameters included slice thickness: 5 mm, Kilovoltage (kVp): 120, Milliampere-seconds (mAs): 140.

All CT scans were radiologically evaluated by a radiologist (blinded) who was unaware of the patients' clinical symptoms to ensure an unbiased assessment.

Diagnostic criteria for chronic sinusitis were based on CT scan and the presence of one or more of the following findings for chronic sinusitis: obstruction of the maxillary infundibulum, osteomeatal complex obstruction, sphenoethmoidal recess obstruction, polyposis, mild mucosal thickening without obstruction, and increased bone density of the sinus walls.

Incidental findings on CT scans, such as retention cysts, minor deviations without sinusitis, or incidental findings, were classified as negative.

The severity and extent of sinus and nasal disease were determined using the Lund-Mackay scoring system. A Lund-Mackay score of 0 was defined as normal, while any score greater than 0 was considered abnormal (11).

Data Analysis

After collection, the data were entered into SPSS (version 18). Quantitative data were reported as central and dispersion indices (mean ± SD) and qualitative data as frequency (%). Then, the normality of quantitative variables was checked using the Kolmogorov-Smirnov test. To examine the hypotheses regarding the non-normal distribution of CT scan findings, the Mann-Whitney U test was used to analyze the data. The chi-square test was used to compare CT scan results based on demographic variables. A significance level of less than 0.05 was considered. In addition, the positive predictive value (PPV) and negative predictive value (NPV) were calculated to assess the probability of disease presence or absence given the clinical symptoms. Positive likelihood ratio (LR+) and negative likelihood ratio (LR−) were also computed to further evaluate the diagnostic performance of the clinical symptoms.

Results

A total of 211 patients were initially enrolled in the study. Following screening, 5 patients were excluded due to CT scan findings suspicious for tumors, resulting in a final study population of 206 patients. The mean age of the participants in this study was 31.28 ± 8.84 years (11-76 years), and their sex distribution was 107 female patients (51.9%), and 99 male patients (48.1%).

Table 1 demonstrates that the highest proportion of participants was in the 11–30-year age group (41.3%), while the lowest frequency was observed in the 51–76-year age group (23.7%), indicating that the study predominantly focused on younger individuals. More than half of the participants (54%) exhibited abnormal CT findings. The vast majority of female participants (91.7%) reported irregular menstrual patterns. A significant proportion of the study population (85.4%) had no history of asthma. Among those with a history of smoking, the distribution of regular (51%) and irregular (49%) smokers was approximately equal, suggesting a diverse smoking pattern within the study.

Table 1. Frequency Distribution of the Demographic Variables Under Study

Variable		No. (%)
Sex	Male	99 (48.1)
	Female	107 (52)
Age group	11-30 years	85 (41.3)
	31-50 years	72 (35)
	51-76 years	49 (23.7)
CT	Normal	95 (46.1)
	Abnormal	111 (54)
Menstrual pattern in women	Yes	17 (8.3)
	No	189 (91.7)
History of asthma	Yes	30 (14.6)
	No	176 (85.4)
Smoking history	Regular	57 (51)
	Irregular	55 (49)

The frequency of clinical symptoms among the study participants was examined. The most common clinical symptom was nasal congestion, reported by 68.4% of participants. The second most prevalent symptom was frequent cough, experienced by more than half of the participants (53.4%). Postnasal drip, postpharyngeal drip, and a history of headaches were each present in approximately 47% of participants. Sleep disturbances, with a prevalence of 43.2%, were the least frequently reported symptom; however, they were still observed in a considerable proportion of the study population.

The association between CT scan results (normal vs. abnormal) and gender was examined. Among the 95 participants with normal CT scans, 51 (53.7%) were male, and 44 (46.3%) were female. Of the 111 participants with abnormal CT findings, 48 (43.3%) were male, and 63 (56.7%) were female. Although descriptively, a higher proportion of women exhibited abnormal CT scans (56.5% vs. 43.3% in men) and a higher proportion of men had normal CT results (53.7% vs. 46.3% in women), this difference did not reach statistical significance ($P = 0.16$).
Tables 2 and 3 present the results of an analysis comparing the mean Lund score with respect to the patients' clinical symptoms; the Lund Scale did not differ based on demographic and clinical variables.

Table 2. Analysis of Lund Scale Results with Demographic Variables.

Variable		Mean ± SD	*P* value
Sex	Male	7.9±2.8	0.47
	Female	8.3±3	
CT	Normal	7.6±2.7	0.62
	Abnormal	8.0±3.1	
Menstrual pattern in women	Yes	8.4±2.9	0.32
	No	7.8±2.6	
History of asthma	Yes	8.9±3.2	0.18
	No	7.9±2.7	
Smoking history	Regular	8.1±2.9	0.88
	Irregular	8.0±3.0	

Table 3. Analysis of Lund Scale Results with Clinical Symptoms.

Clinical symptoms	Yes Mean ± SD	No Mean ± SD	*P* value	Sensitivity	Specificity	PPV	NPV	LR+	LR−
Nasal discharge	8.1 ± 2.9	7.9 ± 2.8	0.82	53.2	58.9	60.2	51.9	1.29	0.79
Post pharyngeal drip	10.2 ± 2.6	6.8 ± 2.4	**0.001**	**37.8**	**42.1**	**43.3**	**36.7**	**0.65**	**1.47**
Nasal congestion	8.0 ± 2.7	7.9 ± 3.0	0.89	66.67	29.47	52.48	43.08	0.94	0.13
History of headaches	8.7 ± 3.1	7.8 ± 2.6	0.19	47.75	53.68	54.64	46.79	1.03	0.97
Sleep disturbances	8.3 ± 2.8	7.9 ± 2.7	0.53	47.7	62.1	59.6	50.4	1.26	0.84

Abbreviations: PPV, positive predictive value; NPV, negative predictive value; LR+, positive likelihood ratio; LR−, negative likelihood ratio.

According to the results, patients who reported nasal congestion had a significantly higher mean compared to those without this symptom (P=0.001). Similarly, the presence of retropharyngeal discharge was associated with a significantly greater mean Lund score (P=0.001). Other symptoms that demonstrated a statistically significant association with higher Lund scores included a feeling of pressure in the face (P=0.01) and a history of sleep disorders (P=0.001). A significant difference was also observed for patients with a frequent cough (P=0.03).
In contrast, no statistically significant difference in mean Lund scores was found between patients with and without facial or forehead pain (P=0.76) and a history of headaches (P=0.42). (Table 4).

Table 4. Comparison of the Mean Lund Score with Respect to the Patients' Clinical Symptoms.

Clinical Complaint	Lund Score (with sign) Mean ± SD	Lund Score (without sign) Mean ± SD	*P* value
Nasal congestion	10.5 ± 2.1	6 ± 1.8	0.001
Retropharyngeal discharge	11.2 ± 3	5.5 ± 2.5	0.001
Frequent cough	9 ± 2.8	7.2 ± 2.9	0.03
Facial or forehead pain	8.5 ± 4.1	7 ± 2.7	0.76
Feeling of pressure in the face	10 ± 2.5	7 ± 2.7	0.01
History of headaches	8.9 ± 3.9	8.1 ± 4	0.42
History of sleep disorders	12 ± 3.5	7.5 ± 3	0.001

Discussion

This study aimed to evaluate the diagnostic value of clinical symptoms in chronic sinusitis and assess their concordance with CT scan findings (Lund-Mackay score) in patients undergoing FESS. Chronic sinusitis refers to inflammation of the sinuses lasting more than 12 weeks, which may result from bacterial, viral, or other infections, with symptoms including nasal congestion, thick nasal discharge, reduced sense of smell, and facial pain. CT scanning serves as an important diagnostic tool for determining the severity and type of chronic sinusitis, providing detailed information about sinus conditions and helping identify potential complications.

Studies have shown variable concordance between clinical symptoms and CT scan results. Except in specific cases, the clinical symptoms of chronic sinusitis have limited utility for diagnosis and treatment. Therefore, the evaluation of chronic cases nearly always requires CT scanning. The role of CT scans in diagnosis, surgical planning, and intraoperative monitoring is particularly significant. Today, advanced CT monitoring techniques and sophisticated endoscopic surgical methods have helped prevent many surgical complications, such as blindness, cerebrospinal fluid leaks, and orbital hematomas. In the study by Stankiewicz et al., only 37 out of 78 patients (47%) with a clinical diagnosis of sinusitis showed true sinusitis on CT scans, while in our study, 111 out of 206 patients (53.9%) with a clinical diagnosis had confirmed sinusitis based on CT findings (9). This aligns with the study by Mozafari Nia et al., where 55.5% of patients showed evidence of chronic sinusitis on CT scans. Similarly, in the study by Safavi Naini et al., 111 out of 198 patients (56.1%) had positive CT scan findings (8). These studies indicate a relatively weak concordance between clinical diagnosis and objective CT scan findings. In none of these studies did a high percentage of patients with a clinical diagnosis receive definitive confirmation of sinusitis on CT scans. This finding underscores the critical importance of CT scans in diagnosing and evaluating chronic sinusitis, as clinical symptoms alone can be misleading.

In our study, nasal congestion showed the highest sensitivity (66.67%), although it had low specificity (29.47%). This contrasts with the study by Mozaffari Nia et al., where nasal congestion and facial or frontal pain showed the highest sensitivity, and with Orlandi et al.'s study, which reported nasal congestion and facial pressure as the most sensitive symptoms. In our study, postnasal drip showed a sensitivity of 69% and specificity of 41.5%, whereas clinical textbooks often cite it as the most common symptom of chronic sinusitis. Hamdan et al. found that postnasal drip and facial pain were the only clinical symptoms significantly associated with sinusitis (12, 13).

Mozaffari Nia et al. reported facial pressure as having the highest specificity, though with similarly low sensitivity. In our study, nasal congestion had the highest PPV, and NPV, while frequent cough had the lowest PPV and postnasal discharge had the lowest NPV. Mozaffari Nia found facial pressure (70.6%) and nasal congestion to have the lowest PPV, with facial or frontal pain having the lowest overall. Kenny et al. reported that headache and facial pressure or pain had low predictive value for sinusitis diagnosis.

In Safavi Naini et al.'s study, nasal congestion (78.4%) was the most sensitive symptom, while frequent cough (69%) was the most specific (14). The kappa coefficients for nasal congestion and nasal discharge (0.171 and 0.181, respectively) indicated weak agreement between these symptoms and positive CT scans. Patients suffering from nasal

congestion and frequent cough had more severe sinusitis based on Lund-Mackay scores. Their study concluded that nasal congestion, nasal discharge, and frequent cough had better specificity and predictive value than other symptoms. Similarly, Fouladvand et al. found that only 29 out of 83 patients (35%) had positive CT findings, with 72.4% being female. The ethmoid sinus was most commonly involved, and nasal congestion had the highest PPV, while facial and dental pain had the lowest. They emphasized that clinical symptoms alone have limited predictive value (15.7%) and must be evaluated alongside CT findings (15). Overall, this comparison shows that although some clinical symptoms like nasal congestion and postnasal discharge have high sensitivity in diagnosing chronic sinusitis, their low specificity means they cannot be relied upon solely. CT scan findings remain the gold standard for confirming the diagnosis, determining disease severity, and planning treatment. The concordance between clinical symptoms and radiological findings is relatively weak across various studies, including the present one. The limitations of the present study included conducting the study in a single center and the limited sample size. Future studies should be performed as multicenter investigations with larger sample sizes to improve the generalizability and statistical power of the findings.

Conclusion

Based on our results, nasal congestion and postnasal discharge showed the highest sensitivity, while sleep disturbances had the highest specificity for diagnosing chronic sinusitis. Postnasal discharge also had the highest positive and negative predictive values. However, no single symptom was sufficient for definitive diagnosis; clinical symptoms must be used in conjunction with CT scan findings. Overall, the diagnostic accuracy of clinical symptoms alone for chronic sinusitis is low and should always be confirmed with CT imaging.

Ethics Approval and Consent to Participate

This study was conducted in accordance with the ethical principles of the Declaration of Helsinki. Ethical approval was obtained from the Ethics Committee of Birjand University of Medical Sciences, Birjand, Iran, under the approval code IR.BUMS.REC.1402.378. All participants were informed of the objectives and procedures of the study, and written informed consent was obtained from all participants prior to their inclusion in the study.

Consent for Publication

Not applicable.

Data Availability Statement

The datasets generated and/or analyzed in the current study are available from the corresponding author upon reasonable request.

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Authors' Contributions

M.A contributed to the study conception and design, data collection, clinical evaluation of patients, interpretation of the findings, and drafting of the manuscript. I. A contributed to data analysis, literature review, interpretation of results, manuscript writing, and critical revision of the manuscript. Both authors read and approved the final version of the manuscript and agreed to be accountable for all aspects of the work.

Conflict of Interest

The authors declared no conflicts of interest.

Declaration of Generative Artificial Intelligence in Scientific Writing

The authors declare that no generative artificial intelligence tools or AI-assisted technologies were used for writing, editing, data analysis, interpretation of results, or preparation of this manuscript. All parts of the manuscript were prepared and reviewed solely by the authors.

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