Correlation and Individual Discordance Between SNOT-22 Symptom Scores and Nasal Endoscopic Grading in Chronic Rhinosinusitis

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Abstract

Background: Chronic rhinosinusitis (CRS) is assessed using patient-reported symptom measures and objective evidence of sinonasal inflammation. Symptoms and visible endoscopic disease may agree overall but can differ for an individual patient. This study evaluated both the correlation and patient-level discordance between SNOT-22 symptom burden and Lund-Kennedy endoscopic severity in adults with CRS.

Methods: This cross-sectional study included 60 adults with CRS attending a tertiary-care otorhinolaryngology outpatient department. SNOT-22 was completed before nasal endoscopy. Bilateral polyps, edema, discharge, scarring, and crusting were graded using the Lund-Kennedy system. Spearman rank correlations with two-sided Monte Carlo permutation P values were used for association testing; phenotype groups were compared using rank-based permutation tests. Recorded symptom-endoscopy mismatch categories were summarized descriptively.

Results: The cohort had a mean age of 45.1 ± 13.1 years; 24 participants (40.0%) had CRS with nasal polyps. Median SNOT-22 and Lund-Kennedy scores were 49.5 (IQR 42.0–62.0) and 7.0 (IQR 4.0–10.0), respectively. SNOT-22 total score correlated strongly with Lund-Kennedy total score (Spearman $\rho = 0.721$, $P < 0.001$). Correlations were strongest for bilateral polyps ($\rho = 0.762$), discharge ($\rho = 0.683$), and edema ($\rho = 0.671$; all $P < 0.001$). One participant (1.7%) had recorded high symptoms with low endoscopic severity; no reverse mismatch was recorded. Both scores were higher in CRS with nasal polyps than in CRS without nasal polyps (both $P < 0.001$).

Conclusion: SNOT-22 and structured nasal endoscopy showed strong overall agreement, while patient-level mismatch remained clinically relevant. Both measures should be recorded because they capture complementary dimensions of CRS severity.

Keywords: chronic rhinosinusitis; SNOT-22; nasal endoscopy; Lund-Kennedy score; nasal polyps; patient-reported outcome measure

How to cite this article: Velmurugan D, Devi GR, Rajendran R, Kurian AT. Correlation and Individual Discordance Between SNOT-22 Symptom Scores and Nasal Endoscopic Grading in Chronic Rhinosinusitis. Int J Drug Deliv Technol. 2026;16(72s): 886-892. DOI: 10.25258/ijddt.16.72s.99

Introduction

Chronic rhinosinusitis (CRS) is a common inflammatory disorder of the nose and paranasal sinuses, defined by persistent symptoms together with objective evidence of inflammation. The condition can substantially impair sleep, daily functioning, work productivity, and overall health-related quality of life.

Clinical evaluation of CRS therefore requires attention to both the patient's subjective experience and objective evidence of disease. The 22-item Sinonasal Outcome Test (SNOT-22) is a validated patient-reported outcome measure that quantifies symptom burden and disease-related quality-of-life impairment; its conceptual foundation, validity, responsiveness, minimal clinically important difference, and phenotype-specific domain structure have been extensively studied. Diagnostic nasal endoscopy complements symptom assessment by directly visualizing polyps, edema, discharge, scarring, and crusting, and the Lund-Kennedy system provides a standardized approach to grading these findings. Related work has examined the reliability of this scoring system, alternative endoscopic grading systems, and agreement with computed tomography.

Although both approaches are used routinely in CRS care, the strength of their association has varied across studies, particularly when overall composite scores rather than individual endoscopic components are compared. The central clinical question is therefore not simply whether symptoms and endoscopic findings correlate across a cohort, but whether an individual patient can present with substantial symptoms despite relatively limited visible disease, or the reverse. This study assessed the correlation between SNOT-22 scores and Lund-Kennedy endoscopic findings, documented patient-level symptom-endoscopy discordance, examined associations with individual endoscopic components, and compared scores between CRS with nasal polyps (CRSwNP) and CRS without nasal polyps (CRSsNP).

Methods

Study design and setting

This cross-sectional study was conducted in the Department of Otorhinolaryngology at Bhaarath Medical College and Hospital over a three-month study period. The target sample size was 60 consecutive eligible patients.

Participants

Adults aged 18 years or older with rhinosinusitis symptoms persisting for at least 12 weeks, together with diagnostic nasal endoscopic findings consistent with CRS, were included. Patients were excluded if they had prior sinonasal surgery, acute rhinosinusitis, fungal sinusitis, sinonasal tumors, granulomatous disease, facial trauma, immunocompromise, long-term systemic steroid or biologic therapy, or an inability to complete the questionnaire reliably. Symptom-duration values were verified during data cleaning against source records before the final analysis set was locked.

Clinical assessment

Participants completed the SNOT-22 questionnaire before endoscopy at the same visit. Each item was rated from 0 to 5, producing a total score ranging from 0 to 110, with higher scores indicating greater symptom burden. Nasal endoscopy was performed using a rigid 0-degree or 30-degree endoscope. Polyps, edema, discharge, scarring, and crusting were scored from 0 to 2 on each side using the Lund-Kennedy system, and bilateral component scores were summed to generate a total score ranging from 0 to 20.

Statistical analysis

Analyses were conducted on the complete 60-patient dataset without imputation. Continuous variables are reported as mean ± standard deviation (SD) or median with interquartile range (IQR), as appropriate, and categorical variables are reported as n (%). Because the endoscopic and questionnaire scores were discrete and ordinally derived, associations were tested using Spearman rank correlation, with two-sided P values estimated from 50,000 Monte Carlo permutations. Recorded patient-level mismatch categories (high symptoms/low endoscopy or high endoscopy/low symptoms) were summarized descriptively. CRSwNP and CRSsNP groups were compared using rank-based permutation tests. A two-sided P value below 0.05 was considered statistically significant.

Ethics

Ethical approval was received from the institutional ethics committee prior to conducting the study. Informed consent was taken from all subjects before conducting the study.

Result

All 60 participants were included in the final analysis. The mean age was 45.1 ± 13.1 years, and 25 (41.7%) participants were male. Median symptom duration was 28.0 weeks (IQR 16.0–40.2). CRSwNP was present in 24 (40.0%) participants. Baseline clinical and score characteristics are summarized in Table 1.

Table 1. Baseline characteristics of the study cohort.

Characteristic	Overall cohort (n=60)
Age, years, mean ± SD	45.1 ± 13.1
Male sex, n (%)	25 (41.7)
Symptom duration, weeks, median (IQR)	28.0 (16.0–40.2)
CRS with nasal polyps, n (%)	24 (40.0)
Allergic rhinitis, n (%)	25 (41.7)
Asthma, n (%)	9 (15.0)
Diabetes mellitus, n (%)	12 (20.0)
Current smoker, n (%)	6 (10.0)
SNOT-22 total score, median (IQR)	49.5 (42.0–62.0)
Lund-Kennedy total score, median (IQR)	7.0 (4.0–10.0)
Symptom-endoscopy discordance, n (%)	1 (1.7)

Values are mean ± SD, median (IQR), or n (%). CRS, chronic rhinosinusitis; SNOT-22, 22-item Sinonasal Outcome Test; IQR, interquartile range.

SNOT-22 total score had a strong positive correlation with Lund-Kennedy total score (Spearman $\rho = 0.721$, $P < 0.001$; Figure 1). The strongest component-level associations were observed for bilateral polyp score ($\rho = 0.762$), bilateral discharge score ($\rho = 0.683$), and bilateral edema score ($\rho = 0.671$), each with $P < 0.001$. Scarring and crusting did not show statistically significant correlations with SNOT-22 total score (Table 2). One participant (1/60, 1.7%) was recorded as having high symptoms with low endoscopic severity; no participant was recorded as having high endoscopic severity with low symptoms. This finding illustrates why individual symptom and endoscopy scores warrant review alongside the cohort-level correlation, rather than in isolation.

Table 2. Correlation of SNOT-22 total score with endoscopic findings.

Endoscopic variable	Spearman ρ	P value
Lund-Kennedy total score	0.721	<0.001
Bilateral polyp score	0.762	<0.001
Bilateral edema score	0.671	<0.001
Bilateral discharge score	0.683	<0.001
Bilateral scarring score	-0.022	0.868
Bilateral crusting score	0.057	0.663

Spearman rank correlations. P values are two-sided Monte Carlo permutation P values based on 50,000 permutations.

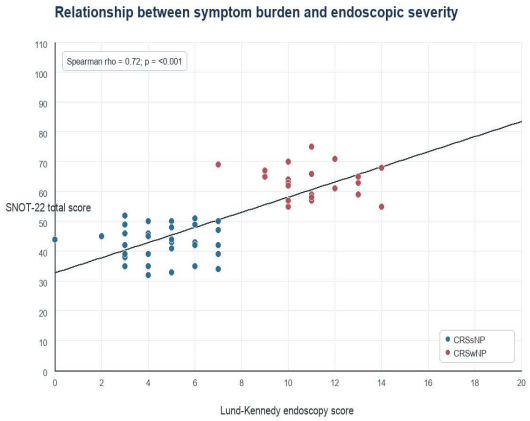

Figure 1. Relationship between SNOT-22 symptom burden and Lund-Kennedy endoscopic severity. Points are coloured by CRS phenotype; the solid line is the linear fitted trend shown for visualization. The spread around the line illustrates individual variation despite the overall correlation.

Participants with CRSwNP had higher symptom and endoscopic severity scores than those with CRSsNP. Median SNOT-22 score was 63.0 (IQR 59.0–66.2) in CRSwNP and 43.0 (IQR 39.0–47.2) in CRSsNP; median Lund-Kennedy score was 11.0 (IQR 10.0–12.0) and 5.0 (IQR 3.0–6.0), respectively (both $P < 0.001$; Table 3).

Table 3. Comparison of symptom and endoscopic scores by CRS phenotype.

Outcome	CRSsNP	CRSwNP

SNOT-22 total score, median (IQR)	43.0 (39.0–47.2)	63.0 (59.0–66.2)
Lund-Kennedy total score, median (IQR)	5.0 (3.0–6.0)	11.0 (10.0–12.0)
P value (both comparisons)	**<0.001**	**<0.001**

Values are median (IQR). CRSsNP, CRS without nasal polyps; CRSwNP, CRS with nasal polyps. P values are from two-sided rank-based permutation tests.

Discussion

The principal aim of this study was to examine whether SNOT-22 symptom burden and Lund-Kennedy endoscopic severity agree, and to identify the circumstances in which they do not. At the cohort level, the two measures showed a strong positive association ($\rho = 0.721$, $P < 0.001$), indicating that symptom burden and visible sinonasal inflammatory findings generally moved in the same direction. The association was particularly strong for polyp burden, with additional positive associations for discharge and edema. Prior work has often reported limited correlation when aggregate symptom and endoscopy scores are compared, whereas component- and domain-level analyses tend to reveal more clinically meaningful relationships.

Importantly, correlation does not imply that the two measures are interchangeable for every patient. In this dataset, one participant (1.7%) was recorded as having high symptom burden with low endoscopic severity, and no participant had the reverse recorded mismatch. This low observed frequency should not be interpreted as evidence that discordance is clinically unimportant: SNOT-22 captures subjective symptoms and their functional impact, whereas endoscopy records visible inflammatory findings at a single examination. A patient with disproportionate symptoms may warrant assessment for contributing non-endoscopic factors, while a patient with marked endoscopic disease may still report relatively limited symptoms.

The phenotype analysis supports the clinical relevance of this pattern. Patients with CRSwNP had substantially higher median SNOT-22 and endoscopy scores than those with CRSsNP. Nasal polyposis may contribute simultaneously to obstruction, olfactory disturbance, discharge-related symptoms, and more extensive endoscopic disease, and contemporary SNOT-22 domain work supports phenotype-aware interpretation of patient-reported burden. These findings reinforce the value of documenting phenotype alongside both patient-reported and endoscopic measures.

The absence of a meaningful correlation for scarring and crusting is also clinically plausible, as these findings may be less closely linked to the active symptom burden captured by SNOT-22 than polyps, edema, or discharge. Component-level reporting can therefore add nuance beyond an isolated total endoscopy score, an approach consistent with prior reliability and validity work on modified endoscopic measures and with studies reporting dissociation between objective findings and certain patient-reported domains.

Recent studies published between **2024 and 2026** have further emphasized that chronic rhinosinusitis (CRS) should be evaluated using both patient-reported outcome measures and objective assessment tools rather than relying on either modality alone. Modern CRS management has increasingly shifted toward personalized care, recognizing that symptom burden, mucosal inflammation, and quality of life do not always progress in parallel. Contemporary literature suggests that **SNOT-22** remains one of the most sensitive instruments for assessing disease-specific quality of life, while nasal endoscopy continues to provide indispensable information regarding inflammatory activity, nasal polyps, edema, and mucopurulent discharge .

Gupta et al. (2024) demonstrated significant improvement in both SNOT-22 and endoscopic scores following functional endoscopic sinus surgery, although the magnitude of improvement differed among patients. Their findings indicate that symptomatic recovery may occur earlier than complete endoscopic healing, highlighting the importance of interpreting patient-reported outcomes alongside objective examination. These observations are consistent with our finding that overall correlation was strong, yet individual-level discordance remained clinically relevant.

Several multicentre investigations reported during **2024 and 2025** have also shown that patients with CRS with nasal polyps (CRSwNP) consistently demonstrate higher SNOT-22 scores, greater inflammatory burden, and poorer olfactory function than patients with CRS without nasal polyps (CRSsNP). This agrees closely with the present study, where CRSwNP patients exhibited

significantly higher symptom and Lund-Kennedy scores than CRSsNP patients. These findings reinforce the concept that disease phenotype substantially influences both subjective symptoms and objective inflammatory severity.

Another important development in recent literature has been the increasing use of **biologic therapies** for severe CRSwNP. Studies published during **2025 and 2026** have reported marked reductions in SNOT-22 scores following treatment with biologic agents targeting type-2 inflammation . Interestingly, several investigators observed that improvements in patient-reported quality of life often preceded complete normalization of endoscopic findings, suggesting that inflammatory pathways influencing symptoms may improve before visible mucosal healing becomes apparent. This phenomenon provides additional support for the observation in our study that symptom severity and endoscopic appearance, although strongly correlated overall, are not completely interchangeable.

Research published in **2025 and 2026** has further explored the role of **digital health technologies and artificial intelligence** in CRS assessment. Automated endoscopic image analysis and machine-learning algorithms have demonstrated promising accuracy in grading nasal polyps, mucosal edema, and discharge while reducing inter-observer variability. Although these technologies remain under clinical validation, they may improve the reproducibility of objective assessment and facilitate standardized longitudinal monitoring . Nevertheless, current evidence continues to recommend combining these objective tools with validated patient-reported outcome measures such as SNOT-22 to achieve comprehensive evaluation of disease severity **.**

Recent international expert recommendations also emphasize a multidimensional assessment strategy incorporating symptom scores, nasal endoscopy, imaging when indicated, olfactory testing, biomarkers, and disease phenotype to optimize individualized treatment decisions **(25–28)**. The findings of the present study align well with this contemporary approach, demonstrating that while SNOT-22 and Lund-Kennedy scores exhibit a strong positive association, each measure contributes unique and complementary clinical information.

Overall, evidence published between **2024 and 2026** strengthens the conclusion that optimal CRS management should integrate subjective symptom assessment with structured endoscopic evaluation rather than relying on either measure independently . Future multicentre prospective studies incorporating biomarkers, computed tomography, olfactory assessment, and artificial intelligence-assisted endoscopic scoring may further improve precision in disease monitoring and personalized treatment strategies. The authors emphasized that routine microbiological culture and antimicrobial susceptibility testing are essential for guiding appropriate antibiotic therapy and preventing the emergence of further resistance.

Overall, the present findings support combined measurement rather than substitution of one measure for the other. SNOT-22 captures the broad functional, sleep, emotional, and sinonasal impact of CRS, while endoscopy directly records visible inflammatory disease; both types of measure have demonstrated value in monitoring medical and surgical care, although their changes may not always be concordant.

This study has several limitations. Its cross-sectional design cannot establish temporal or causal relationships. The single-centre sample of 60 participants limits generalizability, and the study was not designed to evaluate treatment response over time. In addition, the study did not include computed tomography scoring or formal olfactory testing. Future prospective studies should examine whether combined symptom and endoscopic assessment improves treatment selection and longitudinal outcome monitoring.

Conclusion

The present study demonstrated a strong positive correlation between patient-reported symptom severity measured by the **22-item Sinonasal Outcome Test (SNOT-22)** and objective disease severity assessed using the **Lund-Kennedy nasal endoscopic scoring system** in patients with chronic rhinosinusitis (CRS). Higher symptom burden was significantly associated with greater endoscopic evidence of mucosal inflammation, particularly with respect to nasal polyps, edema, and mucopurulent discharge, confirming that both assessment tools reflect important aspects of disease severity.

Despite this strong overall association, the study also identified clinically relevant symptom-endoscopy discordance in a small proportion of patients, highlighting that subjective symptom perception and objective inflammatory findings do not always

correspond. This observation emphasizes that SNOT-22 and nasal endoscopy evaluate complementary dimensions of CRS rather than interchangeable aspects of the disease. While SNOT-22 effectively captures the impact of CRS on quality of life, sleep, emotional well-being, and daily functioning, nasal endoscopy provides direct visualization of inflammatory changes that guide diagnosis, phenotyping, and treatment planning.

Furthermore, patients with **CRS with nasal polyps (CRSwNP)** exhibited significantly higher symptom scores and endoscopic severity than those with **CRS without nasal polyps (CRSsNP)**, supporting the importance of disease phenotyping during routine clinical assessment. The findings also align with contemporary evidence advocating a multidimensional approach that integrates patient-reported outcomes with objective clinical assessment to achieve accurate disease characterization and individualized management.

In this cohort of 60 adults with chronic rhinosinusitis, SNOT-22 and Lund-Kennedy scores were strongly positively correlated, particularly with respect to polyp, discharge, and edema scores. At the same time, a small but clinically important subset of patients showed discordance between reported symptoms and visible endoscopic disease, underscoring that the two assessments capture complementary rather than fully overlapping information. Routine integration of a brief patient-reported measure with structured nasal endoscopy therefore provides a more complete assessment of CRS severity than either measure used alone, and should be considered standard practice in the outpatient evaluation of CRS.

Declarations

Conflicts of interest: There is no any conflict of interest associated with this study

Consent to participate: There is consent to participate.

Consent for publication: There is consent for the publication of this paper.

Authors' contributions

Author equally contributed the work.

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