The Correlation Between the CT-Scan Scoring System and the SNOT-22 Score in Adult Chronic Rhinosinusitis

Original Article

Iriana Maharani and Widia Isa Aprillia Sujana

Department of Otorhinolaryngology-Head and Neck Surgery, Faculty of Medicine, Brawijaya University/Dr. Saiful Anwar General Hospital, Malang, Indonesia

ABSTRACT

Introduction: Chronic Rhinosinusitis (CRS) produce economic strain to patients and health system. The Sinonasal Outcome Test 22-item (SNOT-22) measured the subjective symptoms of CRS. This questionnaire was beneficial for clinical practice to understand the amplitude of patient's symptoms. While the objective measurement from CT-Scan was developed to evaluate the disease severity such as the Lund-Mackay Score (LMS) and the Harvard staging system.

Objective: To examine the correlation between the SNOT-22 and the CT-Scan scoring system of Lund-Mackay Score and Harvard staging system in patients diagnosed with CRS.

Material and Methods: This was a retrospective cross-sectional study using medical records between 1 January 2019 and 30 September 2021 in Otorhinolaryngology Head and Neck Surgery Department. A total of 29 patients were included in this study. The SNOT-22 score and CT-Scan were obtained as part of routine preparations before surgery and recorded in the medical records.

Result: The correlation coefficient between the total score of SNOT-22 and LMS was 0.77 (*p-value*<0.05). There was a significant correlation between the total score of SNOT-22 and the Harvard staging (*p-value* <0.05). A significant correlation between SNOT-22 domain of rhinologic, sleep dysfunction, and psychological dysfunction domain with the Harvard staging system were found with the correlation coefficient of 0.57 (*p-value* <0.05), 0.44 (*p-value* = 0.02), 0.47 (*p-value* 0.01), respectively.

Conclusions: In specific domains of SNOT-22, both CT-Scan scoring were correlated with the nasal domain. While only the Harvard staging system showing additional correlation with the sleep and psychological dysfunction domains.

Key Words: Domain SNOT-22, harvard staging system, lund-mackay scoring system, SNOT-22.

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Corresponding Author: Widia Isa Aprillia Sujana, MD, Department of Otorhinolaryngology-Head and Neck Surgery, Faculty of Medicine, Brawijaya University/Dr. Saiful Anwar General Hospital, Malang, Indonesia, **Tel.:** +6287855349909, **E-mail**: widiaisaaprillia@gmail.com

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INTRODUCTION

Chronic Rhinosinusitis (CRS) produce physical, emotional, and economic strain to patients and health system. A prolonged sinonasal symptoms affects the quality of sleep which lead to mood disturbance. These symptoms reduce the patient's productivity and quality of life. Thus, the current research was focused on the development of subjective and objective measurement tools to evaluate the CRS symptoms[1].

The Sinonasal Outcome Test 22-item (SNOT-22) was a well-known and -studied measurement tool to evaluate the subjective symptoms of CRS. This questionnaire was beneficial for clinical practice to understand the amplitude of patient's symptoms. While the objective measurement from CT-Scan was developed to evaluate the disease severity such as the Lund Mackay Score (LMS)[1] and the Harvard staging system. These scoring systems were widely adopted because it is relatively easy to use especially for a non-radiologist physician. The study showed that there is a high correlation between the LMS and the Harvard staging system in measuring the severity of CRS using CT-scan[2]. While the other study suggested a minimal correlation between the total SNOT-22 score and CT-Scan scoring system. However, there was a significant correlation between the SNOT-22 specific domains and the CT scan score[2–5]. A few studies known to the authors that exploring this association which requires further evaluation. Therefore, this study main objective is to examine the correlation between the SNOT-22 score and the CT scan scoring system of Lund Mackay Score and Harvard staging in patients diagnosed with CRS.

PATIENT AND METHODS

This was a retrospective cross-sectional study using medical records between 1 January 2019 and 30 September 2021 in Otorhinolaryngology Head and Neck Surgery Department. This study was approved

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by the Saiful Anwar Public Hospital ethical committee (No. 400/229/K.3/302/2021). The inclusion criteria were patients diagnosed with CRS with and without polyp between the age of 18- and 60-years old. Patients with other diseases involving paranasal sinuses (granulomatosis with polyangitis, sinonasal tumor, cystic fibrosis, facial trauma and anomaly, primary ciliary dyskinesia, systemic vasculitis and cocaine abuse), previous history of nasal or sinus surgery, incomplete medical records were excluded from the study. A total of 29 patients were included in this study. Age, sex, main symptoms (nasal blockage/ obstruction/congestion, nasal discharge, facial pain/ pressure, reduction/loss of smell), sinus involvement and the presence of nasal polyps were obtained from the medical record. The SNOT-22 score and CT-Scan were obtained as part of routine preparations before surgery and recorded in the medical records. The CT-scan examination was done using Toshiba Aquillion CXL with 3-5 mm slice thickness bone setting with axial, coronal, and parasagittal section. The SNOT-22 questionnaire used was based on Indonesian Cross-Cultural Adaptation, Translation, and Validation of Sino-Nasal Outcome Test (SNOT)-22 by Juanda *et al*[6] that had been previously validated and published. This questionnaire was printed and asked by ORL-HNS resident before the surgery was done. Harvard staging and LMS score was a routine procedure by Radiologist and ORL-HNS resident that had been trained to read CT-Scan scoring on our hospital.

The correlation analysis of LMS and Harvard Staging with SNOT-22 were done using Statistical Package of Social Science (SPSS) version 25. The Pearson correlation test was used for normally distributed data and Spearman correlation test was used if the data is not normally distributed. A *p-value* of less than 0.05 is considered statistically significant.

RESULT

A total of 29 patients with chronic rhinosinusitis was included in this study with the age ranged from 18 to 60 years old with a mean age of 36.8±16.7 years. There were 15 men and 14 women included in this study. The main symptoms observed among the patients were nasal obstruction, nasal discharge, and facial pain for 44.8%, 27.6% and 27,6%, respectively. Most of the sinuses involved were maxillary sinus (93.1%) and anterior ethmoidal sinus (82.7%).

The mean of SNOT-22 total score was 53.97 ± 6.2, with the highest score observed from rhinologic domain for 26.03 ± 3.7. The demographic and clinical characteristics details can be seen in (Table 1).

The correlation coefficient between the total score of SNOT-22 and LMS was 0.77 with a *p-value* of less than 0.05. Similarly, the correlation between the rhinologic domain of the SNOT-22 and LMS was found to be significant (r=0.85, $p<0.05$). While the correlation between the total score of SNOT-22 with the Harvard staging were found to be statistically significant with correlation coefficient of 0.80 (*p-value* <0.05). A significant correlation between SNOT-22 domain of rhinologic, sleep dysfunction and psychological dysfunction domain with the Harvard staging Scorre were found with the correlation coefficient of 0.57 (*p-value* <0.05), 0.44 (*p-value* = 0.02), 0.47 (*p-value* 0.01), respectively. The result of the correlation analysis between the CT-scan scoring and SNOT-22 score can be seen in (Table 2).

Table 1: Demographic and Clinical Characteristic of patients with Chronic Rhinosinusitis

Variables (N=29)			
Age, mean ± SD	36.8 ± 16.7	Lund-Mackay Score, mean ± SD	10.38 ± 6.2
Sex, n (%)		Presence of nasal polyps, n (%)	
Male	15 (51.7)	With nasal polyps	15 (51.7)
Female	14 (48.3)	Without nasal polyps	14 (48.3)
Main Symptom, n (%)		Harvard Staging, n (%)	
Nasal blockage/obstruction/congestion	13 (44.8)	I	1 (3.4)
Nasal discharge	8 (27.6)	II	8 (27.6)
Facial pain/pressure	8 (27.6)	III	7 (24.1)
Reduction/loss of smell	0 (0.0)	IV	13 (44.8)
Diseased sinus, n (%)		SNOT-22 Score, mean ± SD	
Maxilla	27 (93.1)	Total	53.97 ± 6.2
Anterior Ethmoid	24 (82.7)	Rhinologic domain	26.03 ± 3.7
Posterior Ethmoid	17 (58.6)	Ear/facial domain	8.52 ± 1.7
Sphenoid	18 (62.0)	Sleep dysfunction domain	15.52 ± 2.7
Frontal	16 (55.1)	Psychological dysfunction domain	3.97 ± 6.2

SD: Standard Deviation

Table 2: The Correlation Analysis of Lund-Mackay Score and Harvard Staging with SNOT-22

SNOT-22	Correlation Coefficient between SNOT-22 and LMS	*p-value*	Correlation Coefficient between SNOT-22 and Harvard Staging	*p-value*
Total Score	0.77	<0.05*	0.80	<0.05*
Rhinologic domain	0.85	<0.05*	0.57	<0.05*
Ear/facial domain	0.25	0.19	0.30	0.12
Sleep dysfunction domain	0.28	0.14	0.44	0.02*
Psychological dysfunction domain	0.29	0.13	0.47	0.01*

*, marked a significant *p-value*

DISCUSSION

The study found that CRS was found to be affected patients in their productive age with the age range between 18 to 65 years old[7]. Our research found a similar mean age of patients affected with CRS for 36.8 ± 16.7 years old. The other survey in Canada and Europe show an increasing prevalence of CRS with the increase in age and the prevalence flattened after the age of 69 years[8]. The mucosal defense, chronic inflammation, and microbiomes disturbances were known to be the major factors involved in CRS pathogenesis. With the increase in age, the production of the S100 family protein was decreased which causing the cell proliferation, repair, and epithelial defense to be impaired and lead to the increased risk of abnormal microbial colonization following the chronic inflammation. Hence, these changes may potentially reform the CRS pathophysiology in elder adults[9].

The subjects were dominated by male (51.7%) compared to female (48.3%) in this study. This was similar to the study conducted by Shi *et al*.,[10] that found the slightly higher prevalence of CRS in male (8,79%) than female (7,28%). The other study in Korea showed a consistent finding of male predominance in CRS disease. However, a female predominance CRS was observed in the Western countries[8]. This discrepancy might be explained by the difference in the perception and lifestyle of CRS associated with the sex difference. The more active male than female in outdoor activities made them more likely to be exposed with pollution and other environmental risk factors of CRS. Moreover, the higher prevalence of smoking in male than female contributed to the difference in the CRS prevalence. These factors can induce physiological nasal response which lead to increasing airway resistance, nasal irritation and congestion and rhinorrhea[10]. Thus, these changes was 2.7 times more likely to be seen in CT-scan as a diffuse opacity in male than female[11].

A strong correlation between the total SNOT-22 score and LMS was observed in this study. When compared with the SNOT-22 domains, only the rhinologic domain showed a significant correlation with LMS score. Similarly, the total SNOT-22 score, rhinologic, sleep dysfunction, and psychological dysfunction domain showed to be correlated with the Harvard Staging. A similar finding was found in other study showing significant correlation between the CT-scan findings and specific symptoms specifically nasal or extra nasal domain of SNOT-22[3–5,12]. The correlation may be explained by the inflammation process involving the nasal mucosa. This study observed nasal congestion (44.8%) and rhinorrhea (27.6%) for the main symptoms experienced by the CRS patients which contributed to the high nasal domain score of SNOT-22. These symptoms were shown to be strongly associated with CT-scan abnormalities of paranasal sinuses. Therefore, both the LMS and Harvard staging provide consistent information with rhinologic domain of SNOT-22 score in terms of evaluating the nasal mucosal abnormalities.

The Harvard staging was correlated with the sleep and psychological dysfunction domain of SNOT-22 score. In contrast, there was no correlation of these domains with the LMS score. This might show that the Harvard staging was more superior than the LMS in predicting these domains of SNOT-22. However, the Harvard staging was not measuring the osteomeatal complex abnormalities. Moreover, in terms of practicability and reliability the LMS scoring was more superior than the Harvard staging. Therefore, it was essential to further explore the potential of CT-scan scoring in predicting the CRS disease stage.

CONCLUSION

The CT-scan scoring was correlated with the total SNOT-22 score. In specific domains of SNOT-22, both CT scan scoring were correlated with the nasal domain. While only the Harvard staging showing additional correlation with the sleep and psychological dysfunction domains. Further study was needed to explore these association before its application in predicting the CRS disease.

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CONFLICT OF INTERESTS

There are no conflicts of interest.

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