Research Article

Correlations between computed tomography and nasal endoscopic findings in patients of chronic rhinosinusitis

Abstract

Objectives: To correlate between computed tomography and nasal endoscopic findings in patients of chronic rhinosinusitis (as per RSTF symptom criteria).

Study design: Cross-sectional study.

Materials and methods: All adult patients presenting for evaluation of Chronic Rhinosinusitis were studied with the use of the rhinosinusitis symptom inventory (RSI), nasal endoscopy, and sinus computed tomography (CT). We determined sensitivity, specificity, positive predictive value (PPV), and negative predictive value (NPV) between scores for symptoms, endoscopy, and CT.

Results: A total of 78 patients were studied with the use of the rhinosinusitis symptom inventory and then data were analysed. For endoscopy, after taking CT scan as gold standard, sensitivity, specificity, positive predictive value, and negative predictive value were calculated as 92.7, 91.3, 96.2, and 84 percent with likelihood ratio 55.59 (p=.000).

Conclusion: In CRS patients, for decision making, Endoscopy and CT scores correlate well with each other but not so well with the symptom score.

Keywords: nasal endoscopy, CT scan, CRS, chronic rhinosinusitis, tomography

Abhishek K Ramadhin
Clinical Associate, Otolaryngology - Head and Neck Surgery, Tufts University School of Medicine, USA

Correspondence: Abhishek K Ramadhin, Rhinology Fellow, Clinical Associate, Otolaryngology - Head and Neck Surgery, Tufts University School of Medicine, St. Elizabeth's Medical Center, Boston, MA, USA, Tel +1 404 955 5906, Email drabhishekkomar4u@gmail.com

Introduction

Chronic RhinoSinusitis (CRS) is a major common medical disorder that has both great personal and economic impact. Given the importance of the disease, an acceptable uniform definition of sinusitis was needed for many years. But there was not a common consensus on it. To resolve this issue, first time in 1996, the American Academy of Otolaryngology–Head and Neck Surgery (AAO- HNS) convened a multidisciplinary RhinoSinusitis Task Force (RSTF) to confront difficult issues related to defining, staging, and research of rhino- sinusitis. The resulting article, "Adult Rhinosinusitis" published in 1997.[1]

In that article, first time officially Rhinosinusitis was explored and defined as "The condition manifested by an inflammatory response involving the following; the mucous membranes of nasal cavity and paranasal sinuses, fluids within these cavities, and / underlying bone". Gradually various researchers found that factors contributing can be mucociliary impairment,[2] infection bacterial, allergy,[3] swelling of the mucosa for another reason, or physical obstructions caused by morphological/ anatomical variations in the nasal cavity or paranasal sinuses.[4,5]

The multidisciplinary RhinoSinusitis Task Force (RSTF) working definition of chronic rhinosinusitis is duration and symptom based and stated that any form of rhinosinusitis lasting for more than 12 weeks and having 2 or more major symptoms or 1 major and 2 minor symptoms, out of twelve major and minor symptoms. These symptom criteria had been useful in establishing a standard in diagnosing rhinosinusitis.[1]

And nasal endoscopy has emerged as another mode of objective assessment of chronic rhinosinusitis used at all the centers worldwide to complement examinations in order to confirm diagnosis of the disease. It provides aids in assessing the integrity of the mucosa, as well as directly seeing mucosal changes, polyps, crusting, and/or discharge.[6]

CT scan is another very important and popular investigation done since decades and got the value of gold standard test for CRS. It can delineate areas which are effective in demonstrating predisposing causes of chronic rhinosinusitis like anatomical variation, trauma and tumor. This can cause narrowing of the ostiomeatal complex and sinus drainage channels. The association between symptom severity and CT scan findings has been a matter of debate with studies providing conflicting reports.[7–10]

Therefore, objective of the study is to correlate between computed tomography and nasal endoscopic findings in patients of chronic rhinosinusitis (as per RSTF symptom criteria).

Materials and methods

The study was a cross-sectional study of 78 patients seen in the Department of Otorhinolaryngology and Head & Neck surgery. The sample comprised of adult patients presenting for evaluation of CRS by using the rhinosinusitis symptom inventory (RSTF symptom criteria's), nasal endoscopy, and paranasal sinus computed tomography (CT). Patients were excluded from the study if they had a history of previous sinonasal surgeries, cystic fibrosis, autoimmune or immune-compromised disorders, recurrent acute rhinosinusitis, or if they were younger than 18 years of age.

Method of collection of data

Rhinosinusitis Symptom Inventory (RSTF symptom criteria): All patients completed the RSTF symptom criteria, which tabulates the guideline symptoms of sinusitis on a six-point Likert scale ranging from zero (absent symptoms) to five (maximally severe symptoms). According to the guideline recommendation, the patient met symptom criteria for CRS if the subject had two or more major symptoms or one major and two or more minor symptoms that lasted for more than 12 weeks. A patient questionnaire was developed to identify the presence of sinusitis symptoms as specified by the RSTF symptom diagnostic criteria (Table 1).

Table I Questionnaire as per RSTF major and minor criteria

Questionnaire	
Beginning of symptoms for more than 12 weeks	YES………. NO……….
Previous episode	YES………. NO……….
Use of antibiotics	YES………. NO……….
	(Period………….)
Major criteria	
Facial pain or facial pressure	YES………. NO……….
Facial; congestion/ fullness	YES………. NO……….
Nasal obstruction/ blockage	YES………. NO……….
Decrease sense of smell	YES………. NO……….
Discolored or purulent nasal or post nasal secretion	YES………. NO……….
Minor criteria	
Headache	YES………. NO……….
Fever	YES………. NO……….
Halitosis	YES………. NO……….
Fatigue	YES………. NO……….
Dental	YES………. NO……….
Cough	YES………. NO……….
Ear pain/ pressure/ fullness	YES………. NO……….

A rigid sinonasal endoscope

As per protocol, nasal endoscopy was performed under topical anesthesia with a Zero degree or/and Thirty-degree rigid 4mm diameter endoscope and quantified using the Lund - Kennedy scoring system. According to this system, the endoscopic appearance of the nose was quantified for the presence of polyps, discharge and edema. The scoring as shown in (Table 2) & (Figure 1) The diagnostic evidence of CRS was defined by a Lund-Kennedy endoscopic score greater than or equal to 2. The endoscopist was blinded to patient's symptom scores.

The CT scan

Another diagnostic evidence of CRS was defined and compared by the gold standard CT scan. Each patient CT scan of the paranasal sinuses was obtained and staged using the Lund Mackay CT scoring system. As shown in (Table 3) & (Figure 2). This system is based on

the appearance of each paranasal sinus on the CT scan. The reviewer was blinded to the RSTF symptom criteria scores and endoscopic findings.

Table 2 Lund- kennedy score of endoscopic assessment

Characteristics	Right	Left
Polyp (0, 1, 2)		
Edema (0, 1, 2)		
Secretion (0, 1, 2)		
Total		

Table 3 Lund Mackay score of CT Scan

Paranasal sinuses	Right	Left
Maxillary (0,1,2)		
Anterior Ethmoid (0,1,2)		
Posterior Ethmoid (0,1,2)		
Sphenoid (0,1,2)		
Frontal (0,1,2)		
Ostiomeatal complex (0,1,2)		
Total		

Note: polyp: 0- absent; 1-limited to the middle meatus; 2- extending to the nasal cavity. Mucosa edema: 0- absent; 1-mild/moderate edema; 2- polypoid degeneration. Secretion: 0-absent; 1-hyaline; 2-thick and/or Mucopurulent

Figure 1 Sinonasal Endoscopy.

0- No abnormality
1- Partial opacification
2- Total opacification

Figure 2 CT Scan for Lund Mackay scoring.

Statistical analysis

Data for symptom criteria, endoscopic findings, and CT scores were tabulated in Excel and imported into SPSS software and then

statistical analyses for sensitivity, specificity, positive predictive value (PPV), negative predictive value (NPV), likelihood ratio was performed to evaluate the symptom criteria for CRS and the diagnostic value of endoscopy and comparing it with gold standard CT scan . Analyses was performed with mild CT scan score i.e. LM score 1 and with moderate CT score i.e. LM score 4 and with endoscopy CRS diagnosis is taken as LK score 2.

Results

Total 78 eligible patients were chosen for analysis. The mean age of final study group was 37 yrs and age group ranged from 18 – 75 years. There were 61.5 % men and 38.5% women.

As only those patients, who met RSTF symptoms criteria, were included in the study. The top symptoms were headache, nasal obstruction, fatigue and facial pain pressure details are in Table 4. For alone major criteria of RSTF, the sensitivity, specificity, positive predictive value, and negative predictive value were 83.63, 30.43, 74.9, and 43.75 percent, respectively, for CRS (P=0.16).

For Nasal Endoscopy, means Lund-Kennedy score was 4.1 with standard deviation 3.1 (Figure 3). Taking Lund-Kennedy score 2 for diagnosis of CRS and RSTF symptom criteria as gold standard, the sensitivity was 67.3%, and taking CT scan as gold standard with Lund MacKay score 1, the sensitivity, specificity, positive predictive value, and negative predictive value were 80.3, 100, 100, and 48. With chi square value 30.06 (p=.000) and likelihood ratio 32.357 (p=.000). and taking strict CT scoring with Lund Mackay score 4 the sensitivity, specificity, positive predictive value, and negative predictive value changes to 92.7, 91.3%, 96.2, and 84 percent, with likelihood ratio 55.59 (p=.000).

Table 4 Detailed result of the symptoms criteria

| RSTF criteria	Prevalence %	Ranking	Mean score	Std. Deviation
Facial pain/pressure	64.1	4	1.74	1.42
Facial congestion	51.3	7	1.35	1.42
Nasal obstruction	85.9	2	2.76	1.38
Purulent nasal/discharge	59	6	1.26	1.22
Hyposmia/Anosmia	25.6	8	0.71	1.25
Fever	3.8	12	0.09	0.46
Headache	94.4	1	2.49	0.8
Halitosis	20.5	9	0.28	0.6
Fatigue	67.9	3	1.23	0.96
Dental pain	6.4	11	0.18	0.71
Cough	62.8	5	1.08	0.95
Ear pain	15.4	10	0.29	0.74
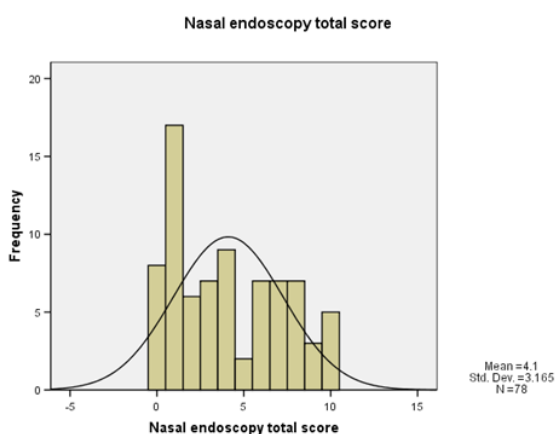
Figure 3 Histogram showing Lund Kennedy scores for nasal endoscopy.

CT scan

The mean Lund Mackay score was 8.35 with standard deviation 6. 03 (Figure 4) for CT scan alone taking Lund-Mackay score 1 and taking RSTF as gold standard, the sensitivity was 84.6%. But after taking only major symptom criteria as gold standard, the sensitivity was 85.5%, specificity was 18.8 %, PPV was 80.3% and NPVwas

25.0 %. With Pearson Chi-Square 0.175 and P= .676, with Lund Mackay 4 taking as diagnostic for CT scan alone taking RSI as gold standard, the sensitivity was 70.5%. And for major symptom criteria as gold standard, the sensitivity was 79.5%, specificity was 43. 8%, PPV- was 83.6% and NPV was 30.4%. With Pearson Chi-Square 1.969 and P=.161. Likelihood ratio 1.87 (p=0.171).
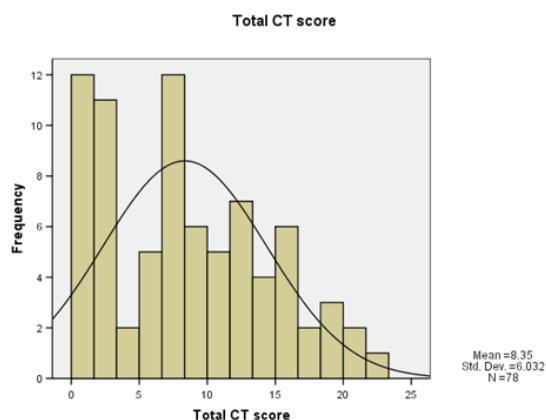

Figure 4 Histogram showing Lund Kennedy scores for CT scan.

Discussion

Chronic rhinosinusitis (CRS) is a common health problem that leads to frequent visits to primary care physicians and to the otolaryngologist. A significant advance in the diagnosis of CRS came with the American Academy of Otolaryngology's Task Force on CRS, with the delineation of clinical criteria for the diagnosis of CRS1. Though the diagnosis of CRS as per the Task Force criteria is based on clinical grounds, the use of nasal endoscopy and CT scan helps in making specific diagnosis and treatment.[11,12]

Symptomatology: In our study we analyzed the symptomatology as of by 1997 Rhinosinusitis task force (RSTF) recommendations 12 criteria. Our evaluations were comparable to the study done by Francis TK et al.[13] The commonest symptoms were headache, nasal obstruction, fatigue, and facial pain pressure.

CT scan

In our study, we have taken (Lund-Mackay score of equal or more than 1 and 4 for diagnosis the CRS). As out of various CT scoring system only Lund-Mackay score is accepted by task force. For Lund MacKay score 1, sensitivity was 85.5%, specificity was 18.8 %, PPV was 80.3% and NPV was 25.5 %. But with Lund MacKay score 4 it changed to sensitivity 79.5%, specificity 43. 8%, positive predictive value 83.6% and negative predictive value 30.4%. (P=.16). Therefore, it could be said that with lenient CT scoring (lund mackay score 1) the specificity reduces a lot.

Hwang PH et al.,[14] had also shown in their study assuming that RSTF symptoms are the gold standard diagnostic criteria, the positive predictive value (65%) and negative predictive value (10%) of CT scan findings were poor. Sensitivity (89%) was marginal, but specificity (2%) was very poor.

Diagnostic nasal endoscopy findings: For endoscopic evaluation we resorted to Lund- Kennedy DNE scoring system parameters, with a minimum score 2 or more than 2 for diagnosing the CRS. In our study, for endoscopy, taking RSTF symptom criteria as gold standard, the sensitivity was 67.3% and after taking CT (Lund MacKay score 4) as gold standard, the sensitivity, specificity, positive predictive value, and negative predictive values were 92.7, 91.3%, 96.2, and 84 percent.

Levine HL[15] study with nasal endoscopy revealed fifty-eight (38.7%) patients with nasal pathology who had not been seen with traditional anterior and posterior rhinoscopic examination.

Kasapoglu, et al.,[16] found sensitivity of CT scan was 93% and overall correlation of diagnostic nasal endoscopy and CT findings were 87%. Stankiewicz JA, Chow JM, et al.,[17] found out in their study that positive endoscopic results correlated well with CT, and negative endoscopic results correlated in 71% of patients with negative CT results.

Considering individually each of the three assessments for the diagnosis of chronic rhinosinusitis, we observed that there was statistically significant difference between them. Moreover, considering the results of agreement and disagreement relative to the disease, the study showed that CT scan and nasal endoscopy presented higher percentage of agreeing results, whereas CT scan and the questionnaire presented the highest proportion of disagreeing results.

Conclusion

In CRS patients, for decision making, Endoscopy and CT scores correlate well with each other but not so well with the symptom score.

In patients who meet guideline symptom criteria for CRS, the addition of nasal endoscopy improves diagnostic accuracy for CRS.

Acknowledgments

None.

Conflicts of interest

The author declares there is no conflict of interest.

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