ORIGINAL ARTICLE

Journal of Otorhinolaryngology and Facial Plastic Surgery 2022;8(1):1-7.
https://doi.org/10.22037/orlfps.v8i1.39101

Comparison of Endoscopy and CT-scan in Diagnosing Chronic Rhinosinusitis without Polyps

Ali safavi naini[2,1], Golfam Mehrparvar[2,1], Habib Emami[3]

1. Department of Otolaryngology Head and Neck surgery, Chronic Respiratory Diseases Research Center, NRITLD, Masih Daneshvari Hospital. Shahid Beheshti University of Medical Sciences, Tehran, Iran.
2. Hearing Disorders Research Center, Loghman Hakim Hospital, Shahid Beheshti University of Medical Sciences, Tehran, Iran.
3. Departemant of Epidemiology, Faculty of Medicine, Shahid Beheshti University of Medical Sciences, Tehran, Iran.

Article Info

Article Note:
Received: April, 2022
Accepted: June, 2022
Publish Online: August, 2022

Corresponding Author:
Dr. Golfam Mehrparvar

Email:
gmehrparvar@yahoo.com

Keywords:
Paranasal sinus disease;
Paranasal sinuses;
Sinusitis;
Computed tomography;
Nasal endoscopy.

Abstract

Background: Definite diagnosis of Chronic rhinosinusitis (CRS) is challenging mostly because of overlapping symptoms with other disorders. Nowadays it is mostly dependent on cross sectional imaging. When considering the prevalence and cost burden of CRS, reducing the frequency of cross sectional imaging by replacing it with endoscopic evaluation could be a cost effective way if the endoscopic examination proved to be a suitable substitution.

Aim: The aim of this study is to compare the endoscopy with CT scan- as gold standard method- in diagnosis of CRS without polyp and to find out how well the results of the two correlate with each other.

Methods: Adult patients with symptom criteria compatible with EPOS 2020 entered the study. They were evaluated endoscopically, and then scored by Lund Mackay CT score. Cases with obvious polyps seen on rhinoscopy or endoscopic evaluation were not entered the study.

Results: A total of 49 patients entered the study. Comparing endoscopic findings with CT scan showed the sensitivity of 69.70% and specificity of 50%. Cohen Kappa statistics of 0.191 was obtained. Positive and negative predictive value was 74.19% and 44.44% respectively. Of note, all 8 patients with Kennedy score of 4 showed positive CT results, and, all 4 cases with isolated sinusitis had negative endoscopic results. Pearson correlation coefficient was 0.63, which showed a significant positive correlation between Lund Kennedy and Lund Mackay scores ($p<0.05$).

Conclusion: Our observations lead us to a possible need for revision in presented endoscopic criteria to increase the diagnostic power of endoscopy in chronic rhinosinusitis sine nasal polyposis.

Conflicts of Interest: The Authors declare no conflicts of interest.
Please cite this article as: Safavi Naini A, Mehrparvar G, Emami H. Comparison of Endoscopy and CT scan in Diagnosing Chronic Rhinosinusitis without Polyps. J Otorhinolaryngol Facial Plast Surg 2022;8(1):1-7. https://doi.org/10.22037/orlfps.v8i1.39101

Introduction

Chronic rhinosinusitis (CRS) which is clinically defined as nasal obstruction/congestion or discharge (anterior/posterior nasal drip) ± facial pain/ pressure ± hyposmia for 12 weeks or more according to Epos2020 (1) is a common health problem affecting about 10% of population (2-4). It imposes significant costs on healthcare system, which include costs of diagnostic procedures, medical and surgical interventions and indirect costs due to days off work and decreased overall productivity (5).

Although it is a common diagnosis in outpatient visits, the definite diagnosis is challenging mostly because of overlapping symptoms with other rhinologic and non-

This work is distributed under the terms of the Creative Commons Attribution Non Commercial 4.0 License (CC BY-NC 4.0).

Journal of Otorhinolaryngology and Facial Plastic Surgery 2022;8(1):1-7.
https://doi.org/10.22037/orlfps.v8i1.39101

rhinologic disorders. As a result, in addition to historical findings, diagnosis needs an objective evidence of sinonasal inflammation on the basis of sinus computed tomography (CT) or nasal endoscopy (6).

Non-otolaryngologists rely mostly on symptom and imaging based diagnosis (7). In a study of 114 cases, most patients diagnosed with CRS by non-otolaryngologists did not have the condition (8). Otolaryngologists commonly incorporate nasal endoscopy into their examination of patients suspected to have CRS. Due to the importance of osteomeatal complex and sphenoethmoidal recess as the trigger points in pathophysiology of CRS (9, 10), one can assume that endoscopic examination with the ability of demonstrating these critical areas, could be a valuable diagnostic method. It is a minimally invasive and relatively inexpensive procedure, increasingly available in many outpatient units. It also offers high quality image of the mucosal linings provides an opportunity for taking samples and enables the physicians to distinguish masses and polyps (11).

The major limitation of nasal endoscopy is its inability in detecting pathologies confined into sinus cavities or beyond an anterior severe septal deviation. For areas that are not accessible to nasal endoscopy, CT scan can be helpful. Due to several inherent advantages with CT imaging for CRS, it has still remained the gold standard (12). However, it is costly and carries the risk of radiation with potential carcinogenic effects.

When considering the prevalence and cost burden of CRS, reducing the dependency on CT scan for diagnosis or reducing the frequency of cross sectional imaging by replacing it with endoscopic evaluation could be a cost effective way if the endoscopic examination proved to be a suitable substitution.

The aim of this study was to compare the endoscopy with CT scan- as gold standard method- in diagnosis of CRS without polyp and to find out how well the results of the two correlate with each other.

Methods

The institutional review board of Chronic Respiratory Diseases Research Center of Masih Daneshvari Hospital/ Shahid Beheshti University of medical sciences approved this study.

Adult patients attending our ENT clinic who met symptom criteria of CRS entered the study. The criteria included nasal obstruction/ congestion and /or anterior or posterior nasal discharge along with either facial pain/pressure or abnormalities of smell or both without response to 12 weeks of optimal medical treatment. Smokers, patients under 18 years of age, cases of mucocilliary disorders, immunocompromised patients, those with history of previous sinus surgery, pregnant women and patients who declined to participate, did not enter the study. Also, recent upper respiratory tract infection or acute rhinosinusitis superimposed on the chronic disease and active allergic symptoms were exclusion criteria of the study.

After signing in informed consent form, all of the cases were evaluated using nasal endoscopy (Straight Forward Telescope 0°, diameter4 mm, length 11 cm karl Storz). Before decongestion an overall assessment of mucosa was done. Then 10% lidocaine spray and 0.25% phenylephrine drop were applied for local anesthesia and topical decongestion respectively.

The endoscopy was done and interpreted by a specialist blinded to patient symptoms. We used Lund-Kennedy scoring system (13) for reporting endoscopic observations. In this system; edema, polyps, and discharge are scored on 0 to 2 scales for each parameter, for a total possible score of 6. However in our study the maximum total score was 4 due to exclusion of cases with polyp. Clear discharge was scored 1, and thick/ purulent discharge was scored 2. Pink normal-looking mucosa

This work is distributed under the terms of the Creative Commons Attribution Non Commercial 4.0 License (CC BY-NC 4.0).

Journal of Otorhinolaryngology and Facial Plastic Surgery 2022;8(1):1-7.
https://doi.org/10.22037/orlfps.v8i1.39101

was scored 0, mild to moderate edema, was scored 1, and severe edema/ hypertrophy with erythema was scored 2.

Endoscopy was reported as positive in cases of severe edema and/or thick/purulent discharge or both. All of the patients underwent CT scan of paranasal sinuses in axial and coronal views on the same day (64-channel Siemens Multislice CT scanner).

Lund Mackay score calculation was done by another specialist. The severity of sinus mucosal inflammation or fluid accumulation was scored as 0 (complete lucency), 1 (partial lucency) or 2 (complete opacity). The present study used a cutoff point of 4 based on previous studies (14, 15) and positive CT result was assumed when Lund Mackay score of greater than or equal to 4 was obtained. For more clear definition of partial lucency, we scored 1 point for mucosal thickening of more than 2 millimeters in ethmoid sinuses and more than 4 mm in all other sinuses. Additionally opacification of frontal, maxillary or sphenoid sinuses of greater than 50% was defined as isolated sinusitis despite Lund Mackay score of less than 4. Data for endoscopic findings and CT scores were collected and analyzed using SPSS software version 17.0.

Calculation of sensitivity and specificity of nasal endoscopy compared to gold standard CT was done. Agreement between two methods was measured by Cohen's kappa value. Pearson correlation coefficient was used to find correlation between endoscopic and imaging scores.

Results

In the time interval of six months –from December 2018 to May 2019 a total of 61 patients who met our inclusion criteria were enrolled in the study. 8 cases were excluded due to clinical evidence of polyposis in examination and 4 cases refused to do CT scan on the same day. Of remaining 49, 21 (42.85%) were females and 28 (57.14%) were males with age ranged from 18 to 61 years. (37.67±10.65). The symptoms at presentation were as follows: 27(55.1%) patients had nasal obstruction, 40 (81.6%) had anterior or posterior discharge, 44 (89.7%) had facial pain or pressure and 8 (16.3%) had hyposmia.

Overall, in 31 patients (63.26%), endoscopic results were interpreted as positive (defined as severe edema and/or thick mucopus). Figure 1 shows distribution of modified Kennedy score in patients.

Evaluation of imaging studies showed a total of 33 positive scans (67.34%), of which 29 had Lund Mackay score of ≥4 and 4 cases had isolated sinusitis (maxillary sinus was involved in 2 and frontal and sphenoid sinus were involved in the other two cases).

23 patients (46.93%) had positive results in both endoscopic and imaging evaluation. All 8 patients with Kennedy score of 4 showed positive CT results. Table 1 summarizes the findings.

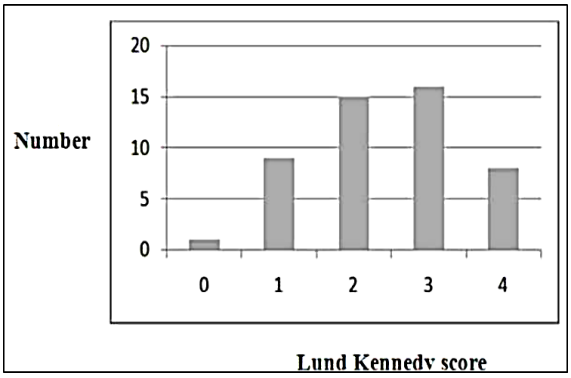

Figure 1: Lund Kennedy score distribution of patients.

Table 1: Summary of endoscopic and imaging results

		Endoscopy results		
		+	-	**Total**
CT results	+	23	10	33
	-	8	8	16
	Total	**31**	**18**	**49**

CT: computed tomography

This work is distributed under the terms of the Creative Commons Attribution Non Commercial 4.0 License (CC BY-NC 4.0).

Journal of Otorhinolaryngology and Facial Plastic Surgery 2022;8(1):1-7.
https://doi.org/10.22037/orlfps.v8i1.39101

Comparing endoscopic findings with gold standard CT scan showed the sensitivity of 69.70 (Confidence Interval: CI: 51.29% to 84.41%) and specificity of 50% (CI: 24.65% to 75.35%). Cohen Kappa statistics of 0.191(95% CI:-0.091 to 0.473) was obtained, representing poor inter-test agreement. Positive and negative predictive value was 74.19% (CI: 62.64% to 83.14%) and 44.44% (CI: 28.18% to 62.00%), respectively.

In order to find the correlation between Lund Kennedy and Lund Mackay scores we calculated Pearson correlation coefficient (Figure 2). Despite poor agreement between two methods, we found a significant correlation between two scoring systems (r= 0.63, p<0.001).

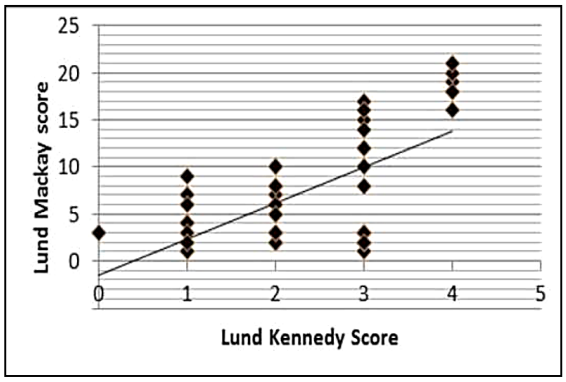

Figure 2: Correlation between endoscopic and imaging scores.

Discussion

Relying on a symptom only diagnosis in CRS will result in 50% or greater chance for misdiagnosis. This creates the need for CT scanning or referral to an otolaryngologist for endoscopic evaluation (16).

CT scan remains the modality of choice for the evaluation of inflammatory diseases of the sinonasal cavities (17). However, it is not considered as the first diagnostic step in all guidelines (1, 12, 18). Concerns regarding imaging include radiation exposure and cost.

In specialty care, where nasal endoscopy is available, otolaryngologists has the opportunity to use this modality as a handful measure to look for objective evidences of inflammation. Validity and reliability of different diagnostic modalities in CRS and consistency of their results in screening, diagnosis or severity assessment has been a challenging topic of considerable interest in recent decades.

In a study conducted by Nass et al. (19), results of nasal endoscopy were compared to the results of CT scanning, 218 patients with wide range of sinonasal symptoms were evaluated. Patients with polyposis in routine rhinoscopy were excluded. Endoscopy and CT evaluation correlated in 90% of the cases. A sensitivity of 89% and a specificity of 87% were reported for endoscopic method, which was more than our measures. However there were differences in method, for example they performed CT scan in patients with endoscopic evidences of middle meatal obstruction, but we specifically excluded patients with middle meatal obstruction caused by polyps. There were also differences in criteria for positive CT results, they searched for soft tissue or bony abnormalities limited to osteomeatal unit, as the aim of study was to diagnosis of surgical cases. On the other hand they excluded patients with inflammatory change within the maxillary, ethmoid and frontal sinus.

The study of Rosbe and Jones (20) was done to determine the value of a combination of symptoms and nasal endoscopy in diagnosing chronic sinusitis. The positive endoscopy was defined as frank purulence or nasal polyps. They suggested that nasal endoscopy is highly specific (95%). The sensitivity of nasal endoscopy was 59%. They did not exclude polyposis, and they also attributed the obtained low sensitivity to flexible method of endoscopy and they expected a higher sensitivity with rigid endoscopes.

Stankiewicz (21) selected 78 patients with ≥3 symptomatic criteria with a grade of ≥ 5 and

This work is distributed under the terms of the Creative Commons Attribution Non Commercial 4.0 License (CC BY-NC 4.0).

Journal of Otorhinolaryngology and Facial Plastic Surgery 2022;8(1):1-7.
https://doi.org/10.22037/orlfps.v8i1.39101

evaluated them endoscopically. Positive endoscopic results included polyps, purulence, polypoid edema, watery edematous mucosa, and marked erythema. Same-day CT scans were graded according to the Metson/Gliklich (22) grading system. They found a sensitivity and specificity of 46% and 86% respectively and concluded that purulence, polyps, or polypoid congested mucosa on endoscopy was a good predictor of sinus disease on CT scan; otherwise nasal endoscopy was a poor predictor of sinus disease. However, a negative endoscopic result was a pretty good predictor of CT results. Although they excluded cases with obvious polyp in rhinoscopy, this study was different with ours in both CT and endoscopic criteria.

Jeelani et al. (23) entered 50 patients on the basis of major and minor criteria in their study and compared the results of endoscopy and CT scan. Kennedy criteria were used to grade nasal endoscopy and either or combination of polyps, mucupus in the middle meatus or diseased mucosa was considered positive. However they did not mention any specific imaging criteria for CRS definition, additionally they only stated the frequency and percentage of each finding and proposed that for most of the findings, there was a good to excellent level of agreement between the results of the two methods.

A more recent prospective study by Lohiya et al (24) did a comparative evaluation between CT scan and endoscopy in diagnosing CRS. They used AAO-HNS2007 (6) symptom criteria. They also defined Lund Kennedy endoscopic score ≥2 and Lund Mackay CT score≥4 as positive results. Low specificity (28.57%) and relatively high sensitivity (88.04%) was obtained in this study. They concluded that endoscopy is unable to exclude the disease. But according to values of positive and negative likelihood ratios suggested that there is a high correlation between CT scan and endoscopic findings and there is no significant difference in diagnosing CRS by endoscopy or CT scan. Inclusion and diagnostic criteria of Lohiya's work were close to present study except for not excluding cases with polyposis. In a prospective observational study of 125 adults with classic symptoms of CRS (25) endoscopy was able to confirm the diagnosis but could not, rule it out. In this study clinical diagnosis of CRS was based on symptoms of at least 2 of nasal congestion, nasal discharge, or facial pain lasting for 12 weeks. A positive sinus CT was defined as at least 1 of osteomeatal complex obstruction, greater than 10-mm mucosal thickening or an air fluid level in any sinus, or less than 10-mm mucosal thickening but involving 4 or more sinuses. A positive endoscopy result was defined by the presence of mucopurulent secretions. The specificity and sensitivity of endoscopy was 100% and 24% respectively.

In another study (26) 55 patients who met the clinical criteria for CRS under EPOS 2020 guidelines were selected. The authors considered Lund Kennedy Score of '0' to be endoscopically negative and a Lund Mackay score of three or less was considered normal. The sensitivity of endoscopy to diagnose CRS was 93.61% with the specificity being 62.5%.

Cohen-Kerem et al. (27) in a similar method in defining of both endoscopic and imaging positive results conducted a prospective cohort on thirty-nine patients who were diagnosed clinically with CRS without polyps. Comparing Lund-Kennedy endoscopic staging system with Lund-MacKay CT scoring system they reported positive predictive value of 68.9%, false positive of 31.1% and false negative of 28%.

Although we did not find a reasonable agreement between the two methods, an interesting finding was positive CT results in all 8 patients with both severe edema and thick/purulent discharge in endoscopy

This work is distributed under the terms of the Creative Commons Attribution Non Commercial 4.0 License (CC BY-NC 4.0).

Journal of Otorhinolaryngology and Facial Plastic Surgery 2022;8(1):1-7.
https://doi.org/10.22037/orlfps.v8i1.39101

(Kennedy score of 4). On the other hand, all 4 cases with isolated sinusitis had negative endoscopic results. Also we found a significant positive correlation between endoscopic and CT scores. In case of a prevalent condition such as chronic rhinosinusitis reducing the dependency on imaging modalities will result in a significant decrease in overall annual costs and radiation exposure. As mentioned, most of previous studies did not address CRS without polyp separately.

Conclusion

Given the lower cost of nasal endoscopy and lack of radiation exposure, a cost effective guideline would rely mostly on endoscopic evaluation rather than CT scan, provided that it does not affect the diagnostic power significantly. Our review demonstrated that various studies applied different diagnostic criteria in endoscopic and imaging definition of CRS, making comparison of results in regard to sensitivity, specificity etc. are unreliable. It seems that there is no a unified criteria for CRS definition in CT scan and endoscopy. Our observations lead us to a possible need for revision in our endoscopic criteria to increase the diagnostic value of nasal endoscopy in CRS without polyps. However, drawing a definite conclusion and developing a cost effective diagnostic algorithm, certainly warrants further studies with standard criteria and larger sample sizes.

Acknowledgments

We deeply thank all the participants who participated in the study. We also appreciate the help and support of department of radiology at Masih Daneshvari Hospital and residents of otolaryngology who helped us throughout the study.

Conflicts of Interest

The authors declare no conflicts of interest.

Financial Support

The authors declare there is no funding support for this study.

Ethics

IR.SBMU.NRITLD.REC.1398.040

Authors' ORCIDs

Dr.Ali safavi naini
https://orcid.org/0000-0001-5686-1094
Dr.Golfam Mehrparvar
https://orcid.org/0000-0003-3682-731X
Dr.Habib Emami
https://orcid.org/0000-0003-4006-2620

References

1. Fokkens WJ, Lund VJ, Mullol. J EPOS 2012: European position paper on rhinosinusitis and nasal polyps 2012. A summary for otorhinolaryngologists. Rhinology 2012;50(1):1-12.

2. Hamilos D L. Chronic rhinosinusitis: Epidemiology and medical management. J Allergy Clin Immun 2011; 128(4), 693–707.

3. Hastan D, Fokkens WJ, Bachert C, et al. Chronic rhinosinusitis in Europe - an underestimated disease. A GA2LEN study. Allergy 2011; 66(9): 1216–1223.

4. Pleis JR, Lucas JW, Ward BW. Summary health statistics for U.S. adults: National Health Interview Survey, 2008. Vital Health Stat 10 2009;(242):1–157.

5. Smith KA, Orlandi RR, Rudmik L. Cost of adult chronic rhinosinusitis: A systematic review. The Laryngoscope 2015; 125(7): 1547–1556.

6. Rosenfeld RM, Andes D, Bhattacharyya N, et al. Clinical practice guideline. Otolaryng Head Neck 2007;137(Suppl):S1–S31.

7. Chow AW. Sinus infections. In: Jong EC, Stevens DL, eds. Netter's Infectious Diseases. Philadelphia: W B Saunders, 2012; 161-171.

8. Novis S J, Akkina SR, Lynn S, Kern HE, Keshavarzi NR, Pynnonen MA. A diagnostic dilemma: chronic sinusitis diagnosed by non-otolaryngologists. Int Forum Allergy Rhinol 2016; 6(5): 486–490.

9. Bandyopadhyay R, Biswas R, Bhattacherjee S, Pandit N, Ghosh S. Osteomeatal Complex: A Study of Its Anatomical Variation Among Patients Attending North Bengal Medical College and Hospital. Indian J Otolaryngol 2015;67(3):281–286.

10. Leung, RM, Kern RC, Conley DB, Tan BK, Chandra RK. Osteomeatal Complex Obstruction is not Associated with Adjacent Sinus Disease in Chronic

This work is distributed under the terms of the Creative Commons Attribution Non Commercial 4.0 License (CC BY-NC 4.0).

Journal of Otorhinolaryngology and Facial Plastic Surgery 2022;8(1):1-7.
https://doi.org/10.22037/orlfps.v8i1.39101

Rhinosinusitis with Polyps. AMJ Rhinol Allergy 2011; 25(6): 401–403.

11. Desrosiers M, Evans G, Keith P, et al. Canadian clinical practice guidelines for acute and chronic rhinosinusitis. Allergy Asthma CL IM 2017:2.

12. Desrosiers M, Evans GA, Keith PK, et al. Canadian clinical practice guidelines for acute and chronic rhinosinusitis. J Otolaryngol Head Neck Surg 2011;40(suppl 2):S99–S193.

13. Psaltis AJ, Li G, Vaezeafshar R, Cho KS, Hwang PH. Modification of the lund-kennedy endoscopic scoring system improves its reliability and correlation with patient-reported outcome measures. The Laryngoscope 2014;124(10): 2216–2223.

14. Bhattacharyya N, Fried MP. The accuracy of computed tomography in the diagnosis of chronic rhinosinusitis. Laryngoscope 2003; 113(1):125-9.

15. Bhattacharyya N, Jones DT, Hill M, Shapiro NL. The Diagnostic Accuracy of Computed Tomography in Pediatric Chronic Rhinosinusitis. Arch Otolaryngol 2004; 130(9): 1029.

16. Lobo B C, Ting JY, Tan BK. Cost-Efficient Workup and Management of Patients with Chronic Rhinosinusitis: Challenges and Unmet Needs. Curr Otorhinolaryngol Rep 2015; 3(2): 94–100.

17. Rathor A, Bhattacharjee A. Clinical-radiological correlation and role of computed tomography staging in chronic rhinosinusitis. WJOHNS 2017; 10(3):169-175.

18. Rosenfeld RM. Clinical practice guideline on adult sinusitis. Otolaryngol Head Neck Surg 2007;137(3):365–77.

19. Nass RL, Holliday RA, Reede DL. Diagnosis of surgical sinusitis using nasal endoscopy and computerized tomography. The Laryngoscope 1989; 99(11): 1158.

20. Rosbe KW, Jones KR. Usefulness of patient symptoms and nasal endoscopy in the diagnosis of chronic sinusitis. Am J Rhinol 1998;12:167–171.

21. Stankiewicz JA, Chow JM. Nasal endoscopy and the definition and diagnosis of chronic rhinosinusitis. Otolaryngol Head Neck Surg 2002;126:623–627.

22. Metson R, Gliklich RE, Stankiewicz JA, et al. Comparison of sinus computed tomography-staging systems. Otolaryngol Head Neck Surg 1997;117:372-9.

23. Jeelani U, Wani UA, handay S, Jahan S, Jeelani H, Wani B. Correlation of computed tomography and nasal endoscopic findings in chronic rhinosinusitis–a clinical study. International Journal of Contemporary Medical Research 2015;2(3):606-611.

24. Lohiya SS, Patel SV, Pawde AM, Bokare BD, Sakhare PT. Comparative Study of Diagnostic Nasal Endoscopy and CT Paranasal Sinuses in Diagnosing Chronic Rhinosinusitis. Indian J Otolaryngol 2016 ;68(2):224-9.

25. Ferguson BJ, Narita M, Yu VL, Wagener MM, Gwaltney JM. Prospective Observational Study of Chronic Rhinosinusitis: Environmental Triggers and Antibiotic Implications. Clinical Infectious Diseases 2011; 54(1): 62–68.

26. Basu S, Agarwal PK.Redefining the need of CT scan in chronic rhinosinusitis-a rational approach.J. Evolution Med. Dent. Sci 2019;8(30):2412-2416.

27. Cohen-Kerem R, Marshak T, Uri N, et al. Is Nasal Endoscopy of Diagnostic Value in Chronic Rhinosinusitis Without Nasal Polyps? ENT 2019, 014556131986457.

This work is distributed under the terms of the Creative Commons Attribution Non Commercial 4.0 License (CC BY-NC 4.0).