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COMPARATIVE STUDY OF CT PARANASAL SINUSES AND DIAGNOSTIC NASAL ENDOSCOPY IN DIAGNOSING CHRONIC RHINO SINUSITIS USING RADIOLOGICAL AND ENDOSCOPIC SCORES

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ABSTRACT

Background: Chronic rhinosinusitis (CRS) is a very common disease that results in significant impact on economy and quality of life. Endoscopic surgery has become the treatment of choice. Computerized tomography (CT) and Diagnostic Nasal Endoscopy (DNE) had become the important investigative modalities to confirm CRS. Hence it is a necessity to have a more conclusive investigative modality, for confirming the diagnosis and deciding further management.

Objective: To evaluate the diagnostic accuracy of DNE and CT for CRS and their comparison to each other using endoscopic and radiological score.

Methodology: 35 cases of CRS patients attending the E.N.T. outpatient department of Sree Gokulam Medical College, who had chronic sinusitis for more than 12 weeks duration not responding to the medical line of treatment and are willing to undergo CT PNS study and diagnostic nasal endoscopy satisfying the inclusion criteria, were studied.

Results: Out of the 35 patients studied, CT scan was able to diagnose 88.5% as CRS based on Lund Mackey score ≥ 4. CRS was diagnosed among 85.7% patients by Lund Kennedy endoscopic scoring of ≥ 2. On correlating endoscopy and CT PNS, it was found that sensitivity was 96.8%, specificity was 100%, positive predictive value was 100% and negative predictive value was 80%. The various anatomical abnormalities are better visualized in CT scan.

Conclusion: CT scan has got a better advantage compared to DNE in detecting the anatomical variants, condition of sinus cavity and the extent of disease in sinuses. DNE can prove to be a better diagnostic modality compared to CT scan in conditions like middle meatal secretions, condition of mucosa, polyps are looked for. Both CT scan and DNE are complimentary to each other.

KEYWORDS : Chronic Rhinosinusitis, Computerized tomography, Diagnostic nasal endoscopy, Diagnostic accuracy.

INTRODUCTION

Chronic rhinosinusitis (CRS) is referred as a group of heterogeneous disorders from a multitude of causes that result in mild to severe symptomatic inflammation of the sinonasal mucosa[1]. CRS, with its classical symptoms of nasal obstruction, nasal discharge (anterior and/or posterior), headache and facial pain, and abnormalities of smell is the most common disease for which consultation of otorhinolaryngologist is sought[2]. CRS, has been classified as occurring in two predominant forms: chronic persistent rhinosinusitis and recurrent acute rhinosinusitis[3,4]. Both types of CRS contribute to the substantial disease burden of CRS[5].

Computerized tomography imaging (CT) of the paranasal sinuses (PNS)s and diagnostic nasal endoscopy (DNE) has become a widely accepted tool for assessing the PNS and providing detailed anatomy of the sinuses as well in diagnosing the disease process. *Prolonged duration of RS symptoms for more than 8-12 weeks is the primary reason to evaluate a patient for CRS3.* Overall individual symptoms of CRS are similar to those seen in Acute Rhino Sinusitis (ARS) but milder and variable in presentation. These symptoms are not sensitive enough for a clear cut diagnosis. Hence it is a necessity to have a more conclusive investigative modality, for confirming the diagnosis and for deciding the further management. CT scan and DNE have come to play a vital role in the assessment of all the sinonasal pathologies and their management nowadays. Both of the two investigative modalities are expensive and both, having merits and demerits of their own, this study will help in having an insight into the necessity if either or both in combination are needed.

CT has become an essential investigation modality for the assessment of patients undergoing functional endoscopic sinus surgery (FESS). One of the aim of CT of the sinuses is to delineate the extent of the disease, define any anatomical variants and relationship of the sinuses with the surrounding important structures. CT is now considered the gold standard for imaging in CRS[6,7].Recently combination of diagnostic nasal endoscopy and systematic understanding of the lateral nasal wall with CT has become the corner stone in the evaluation of the PNS diseases. This is the basis for the concept of FESS[7]. In the present study we have compared CT scan with diagnostic nasal endoscopy in detecting CRS.

METHODOLOGY

The present study was conducted in Sree Gokulam Medical College from 1st August 2016 to 31st July 2018. All the patients attending the E.N.T. outpatient department, who had chronic sinusitis for more than 12 weeks duration not responding to the medical line of treatment and who were willing to undergo CT scan of PNS and diagnostic nasal endoscopy were included in the study. The sample size was calculated using the formula, $n= (Z \alpha/_2+Z\beta)^2/(\gamma^2/1-\gamma^2)$ and got a sample size of 35. All patients who satisfy the inclusion and exclusion criteria during study period are included in the study. Inclusion criteria were clinically diagnosed cases of CRS who will undergo CT PNS and DNE as per the suggestion of ENT surgeon at Sree Gokulam Medical College during the stipulated time period. The exclusion criteria were patients with malignancy of paranasal sinuses, acute rhinosinusitis, pregnancy, immunocompromised state, cystic fibrosis. After obtaining the ethical clearance, CRS patients were selected based on the symptom criteria defined by American task force on rhino sinusitis which is based upon the persistence for more than 12 weeks of two or more major symptoms or atleast one major and two minor symptoms. Major symptoms include facial pain or pressure, nasal obstruction or blockage, nasal discharge or purulence or discolored post nasal discharge, hyposmia or anosmia, purulence in nasal cavity. Minor symptoms include headache, fever, halitosis, fatigue, dental pain, cough, ear pain or pressure.

Using the parameters-120 kV, 500 mA, a complete coronal and axial CT scan will be taken with 3 mm slices concentrating on the osteomeatal complex and paranasal sinuses. Sinus CT scans will be scored with the Lund- Mackay scoring system. A numerical score will be assigned for the maxillary, anterior ethmoid, posterior ethmoid, sphenoid and frontal sinuses and the osteomeatal complex on the following scale: 0-no opacification, 1- partial opacification, 2- complete opacification. However, osteomeatal unit will be scored as 0- no obstruction, 2- total obstruction. Each side of the paranasal sinuses will be scored separately. The total score ranges from 0 to 24. Score ≥ 4 will be considered significant. DNE will be performed on the same patients after packing the nasal cavity with 4% Xylocaine for 15 minutes. The endoscopy will be performed by using a 4mm 0 degree and 45 degree endoscope. Endoscopic findings will be scored according to Lund- Kennedy scoring system. The extent of polyp will be graded on the basis of 3 point classification system (Score 0- No polyp; Score 1- restricted to middle meatus; Score 2- extending to nasal cavity) and a score will be assigned. Discharge will be graded as

follows (0- none; 1- clear and thin; 2- thick and/or mucopurulent); edema will be graded as (0-absent; 1- mild/moderate; 2-severe).Scores ≥ 2 will be considered significant. Data was entered in MS Excel and statistical analysis was carried out in SPSS 20.0 for sensitivity, positive predictive value, specificity, negative predictive value, positive and negative predictive values, p value at 95% confidence interval were done for diagnostic accuracy testing.

RESULTS

The study subjects were 35 clinically diagnosed cases of CRS and the age of the patients varies from 15 years to 69 years. Most of them, 10 (28.6%) belong to the age group of 31 to 40 years and 18 (51.4%) female. Majority of the patients presented with the complaint of nasal discharge 28 (80%) followed by headache 25 (71.4%) and nasal obstruction 24 (68.6%). CT scan was done among the 35 patients and the findings were described in Table1. According to the Lund Mackay scoring of CT PNS for patients with CRS, 10 (28.6%) of them had a score 0-4 followed by16 (45.7%) had a score of 5 to 9, 6 (17.1%) had a score of 10 -14, 3 (8.6%) had a score more than 15. In the CT scan, Maxillary sinus haziness was found in 97% patients, 77.1% patients had OMC opacification, 80% had anterior ethmoid sinus haziness, 48.5% had posterior ethmoid sinus haziness, 34.2% patients each had frontal and sphenoid sinus haziness. The anatomical abnormalities that are observed in CT PNS were Deviated nasal septum for 28 (80%), Concha Bullosa for 15 (42.9%), Agger nasi cells for 17 (48.6%), Pneumatized middle turbinate for 5 (14.3%), Pneumatizaion of uncinate process for 3 (8.6%), Bulla ethmoidalis for 2 (5.7%), Haller cells for 7 (20%).

Table 1: CT findings in study population

Area	Finding	n (%)
Right maxillary sinus	No obstruction	8 (22.9)
	Partial Obstruction	19 (54.3)
	Complete obstruction	8 (22.9)
Left maxillary sinus	No obstruction	5 (14.3)
	Partial Obstruction	26 (74.3)
	Complete obstruction	4 (11.4)
Right anterior ethmoidal sinus	No obstruction	12 (34.3)
	Partial Obstruction	20 (57.1)
	Complete obstruction	3 (8.6)
Left anterior ethmoidal sinus	No obstruction	10 (28.6)
	Partial Obstruction	23 (65.7)
	Complete obstruction	2 (5.7)
Right posterior ethmoidal sinus	No obstruction	25 (71.4)
	Partial Obstruction	9 (25.7)
	Complete obstruction	1 (2.9)
Left posterior ethmoidal sinus	No obstruction	25 (71.4)
	Partial Obstruction	8 (22.9)
	Complete obstruction	2 (5.7)
Right sphenoid sinus	No obstruction	28 (80)
	Partial Obstruction	7 (20)
Left sphenoid sinus	No obstruction	24 (68.6)
	Partial Obstruction	11 (31.4)
Right frontal sinus	No obstruction	27 (77.1)
	Partial Obstruction	7 (20)
	Complete obstruction	1 (2.9)
Left frontal sinus	No obstruction	27 (77.1)
	Partial Obstruction	7 (20)
	Complete obstruction	1 (2.9)
Right osteomeatal complex	No obstruction	15 (42.9)
	Complete obstruction	20 (57.1)
Left osteomeatal complex	No obstruction	19 (54.3)
	Complete obstruction	16 (45.7)

DNE was done among the same 35 patients and the findings were described in Table 2. The abnormalities that were observed in DNE were polyp in 48.5% patients, edema in 62.8% patients and secretion in 80% of patients studied. Lund Kennedy DNE scoring was used for scoring the CRS patients and found 26 (74.3%) had a score of 0 – 4 followed by 7 (20%) had a score of 5-8 and 2 (5.7%) had a score of 9 -12.

Table 2: Findings of diagnostic nasal endoscopy

Side	Finding	n (%)
Right	No polyp	23 (65.7)
	Polyp restricted to middle meatus	7 (20)
	Polyp extending to nasal cavity	5 (14.3)
Left	No polyp	24 (68.6)
	Polyp restricted to middle meatus	7 (20)
	Polyp extending to nasal cavity	4 (11.4)
Right	No edema	19 (54.3)
	Mild to moderate edema	7 (20)
	Severe edema	9 (25.7)
Left	No edema	21 (60)
	Mild to moderate edema	11 (31.4)
	Severe edema	3 (8.6)
Right	No secretions	12 (34.3)
	Clear & thin secretions	13 (37.1)
	Thick & purulent secretion	10 (28.6)
Left	No secretions	14 (40)
	Clear & thin secretions	15 (42.9)
	Thick & purulent secretion	6 (17.1)

The mean CT score was 4 and 31(88.6%) patients had a score more than or equal to 4 were diagnosed with CRS. The mean DNE score was 2 and 30 (85.7%) patients had a score of more than or equal to 2 were diagnosed with CRS. In Chi square test, p value <0.001 indicating the higher number of participants with elevated CT and nasal endoscopy score (85.7%). Considering CT scan as gold standard, accuracy of nasal endoscopy was calculated. The sensitivity of nasal endoscopy is 96.8 %, that is, the probability of diagnosing CRS when it is present is 96.8 %, and the specificity is high, 100 % that is it is able to exclude the disease. Positive likelihood ratio is infinite and negative likelihood ratio is 31.25, therefore indicating that there is a high correlation between CT scan and endoscopic findings. Kappa value is 0.313 which signifies fair agreement between these two studies.

DISCUSSION

The diagnostic utility of CT and DNE has been assessed in relatively few clinical studies only. In the present study age of patients varies between 15 and 75 years, with the maximum number of patients in 31 to 40 years category. In Lohiya et al study done in 100 patients the mean age of patients were 35.6 years[8] and in study conducted by Rafael José Geminiani et al , in 35 patients the mean age turned out to be 40[9]. The study conducted by Zojaji et al (2008) of 51 patients the mean age of the patients is 33 years[10]. By above studies we understand that these age groups are predominant because they are more exposed to the environment, stressful activities, recurrent upper respiratory tract infections, irregular check-up and treatment. The most common symptoms of CRS were considered nasal discharge in 80% patients followed by headache in71.4% and nasal obstruction in 68.6%. In Zojaji et al(2008) study, nasal obstruction was the most common symptom followed by head ache and nasal discharge. The signs and symptoms ranged from 12 weeks to many years[10]. In Sheetal et al(2011) study the commonest complaints is headache in 90% followed by nasal discharge in 80%. The average duration of symptoms varies from 1-5 years[11].

Frontal sinus haziness can only be seen in CT scan as frontal sinus itself cannot be visualized with DNE. 8 (22.9%) cases on the right and 8 (22.9%) cases on the left have frontal sinus haziness on CT scans. A total of 34.2% patients had frontal sinus haziness in our study. Anterior ethmoidal and maxillary sinus haziness can only be seen in CT scan as DNE cannot be used to assess the condition of the sinus cavity except for their ostium. Anterior ethmoidal cells are hazy in 23 (65.7%) on right and 25 (71.4%) on left. Whereas maxillary sinus is hazy in 27 (77.2%) cases on the right and 30 (85.7 %) cases on left indicating anterior group pathology to be more prevalent in our study. In majority of the cases where anterior ethmoidal sinus is hazy, maxillary sinus pathology is also associated with it. Anterior ethmoidal sinus and maxillary sinus haziness in our study population were 80% and 97% respectively. Sphenoid sinus haziness is seen in 7 cases (20%) on the right and 11 cases (31.4%) on the left on CT scans. It is seen mostly associated with other sinus involvement and never as an isolated sphenoidal sinus disease. 34.2% of patients of our study group had sphenoid sinus haziness. Posterior ethmoidal sinus haziness is seen in 10 cases (28.6%) on the right and 10 cases (28.6%) on the left side

which is seen in majority of the cases associated with anterior ethmoidal sinus disease. Posterior ethmoid sinus is involved in 48.5% of our study population.On DNE posterior ethmoidal sinus cannot be assessed. Right OMC was affected in 20 (57.1%) cases and left OMC in 16 (45.7%) cases.OMC were obliterated in a total of 77.1% patients in the present study.

In Lohiya et al study 60.5 % patient had osteomeatal complex opacification, 62.25 % maxillary sinus haziness, 54.5 % anterior ethmoid sinus haziness, 32.25 % posterior ethmoid sinus haziness, 24.5 % frontal sinus haziness and 19.75 % sphenoid sinus haziness – – 8. Overall 80% of maxillary, 45% of anterior ethmoid, 35% of posterior ethmoid, 28.3% of sphenoid and 12.5% of frontal sinuses were found to have mucosal abnormality on CT scanl2. In Sheetal D et al study on CT scan maxillary sinus is found to be the most common sinus to get affected (57% on the right and, 46% on the left side), followed by the anterior ethmoid cells (40% on the right and, 37% on the left side), the posterior ethmoid cells (33% on the right and, 28% on the left side), the frontal sinus (28% on the right and, 26% on the left side) and, the sphenoid (20% on the right and, 13% on the left side) respectively[11]. All the above studies indicate that maxillary sinus and anterior ethmoid sinus are the most common sinuses which are involved. Sphenoidal and posterior ethmoidal sinuses are involved mostly with associated sinus involvement. Our results correlate with these studies.

On scoring according to Lund Mackay scoring of CT PNS, 28.6 % subjects had scores between 0 and 4 of which 11.4% had score less than 4, 45.7 % had scores between 5 and 9, 17.1 % had scores between 10 and 14, 8.6 % subjects had score between 15 and 19. No patients in our study had score between 20 and 24. Out of these significant CT score (value ≥ 4) were found in 31 patients (88.5%). In Lohiya et al study Lund Mackay scoring of CT PNS was found to be: 20 % subjects had scores between 0 and 4, of which 7 % had scores less than 4, 29 % had scores between 5 and 8, 20 % had scores between 9 and 12, 17 % subjects had score between 13 and 16, and only 7 % each had scores between 17–20 and 20–24. The mean score was 9.8 and range 0–24[8].

In our study polyp was seen 48.5% of patients.17% polyps were on right,14% were on left and 17% polyps were noted bilaterally. Edematous mucosa was seen in 62.8% patients, mild edema in 28.5% patients and severe edema noted in 34.3% of patients. Secretion was seen in 80% of our study group, 20% discharge was seen on right,14.3% on left and 45.7% bilaterally. 37.2% patients had purulent discharge while 42.8% patients had thin and serous discharge. In Lohiya et al study, in positive nasal endoscopy findings edematous mucosa was seen in 39 % subjects, mild edema in 10 % and severe edema in 29 % subjects. Discharge was seen in middle meatus in 47 %, on right side discharge was seen in 11 %, on the left side discharge was seen in 22 %, bilateral discharge was seen in 14 %. 16 % subjects had clear and thin discharge while 31 % had purulent discharge. 4 % polyps were seen on right, 6 % on left and bilateral in 17 %, with a total of 27 % subjects having polyps. 5 % subjects had polyp confined to middle meatus, and 22 % had polyp beyond middle meatus[8].

According to Lund Kennedy scoring 74.3% patients had scores between 0 and 4, 20% patients had score between 5 and 8 and 5.7% patients had score between 9 and 12. Out of these 85.7% patients had significant endoscopic scoring a score of ≥2). In Lohiya et al study, 13 % subjects had score <2, 51 % had scores between 2 and 4, 27 % had scores between 5 and 8, and only 9 % subjects had score between 9 and 12 according to Lund–Kennedy scoring system. The mean score was 4.2 and range 0–12[8].

In our study 88.5% Patients had Lund–Mackay score >4 were diagnosed as CRS on CT scan. 85.7 % Patients had Lund–Kennedy score >2 and were diagnosed as CRS on endoscopy. 88.5 % Patients were diagnosed on CT and 85.7% patients were diagnosed on endoscopy scan. Considering CT scan as gold standard, accuracy of nasal endoscopy was calculated. The sensitivity of nasal endoscopy is 96.8 %, that is, the probability of diagnosing CRS when it is present is 96.8 %, and the specificity is high, 100 % that is it is able to exclude the disease. Positive likelihood ratio is infinite and negative likelihood ratio is 31.25, therefore indicating that there is a high correlation between CT scan and endoscopic findings. Chi square $p < 0.001$ indicating the higher number of participants with elevated CT and nasal endoscopy score (85.7%). Kappa value is 0.313 which signifies fair agreement between these two studies.

Rosbe et al. [13] study was done to determine whether a combination of patient symptoms and nasal endoscopy could accurately predict CRS on CT in 92 consecutive patients referred for sinonasal symptoms. They found that 91 % of patients with positive findings on endoscopy had CT scans consistent with CRS. Those patients presenting with chief complaint of nasal obstruction who had a positive finding on nasal endoscopy, 100 % had CT findings consistent with CRS. This study concluded that combined with a symptom history, nasal endoscopy can be a highly specific technique for predicting positive CT findings of CRS.

Lohiya et al[8] compared endoscopy to gold standard CT scan. They found sensitivity 88.04 %, specificity 28.57 %, positive predictive value 94.19 %, negative predictive value 15.38 %, positive likelihood ratio 1.23, negative likelihood ratio 0.42, thereby showing that nasal endoscopy had high sensitivity for diagnosing the disease but not specific enough to refute the diagnosis. The positive likelihood ratio was high(1.23) and negative likelihood ratio was low(0.42) , thereby showing that endoscopic and CT PNS findings are consistent with each other in diagnosing most of the cases.

CONCLUSION

A total of 35 clinically diagnosed patients of chronic rhinosinusitis have undergone CT PNS study and DNE and radiological and endoscopic scores are calculated and compared. We can conclude that CT scan has got a better advantage compared to DNE in detecting the anatomical variants as well as to know the condition of sinus cavity and the extent of disease in sinuses. DNE can prove to be a better diagnostic modality compared to CT scan when conditions like middle meatal secretions, condition of mucosa, polyps are looked for. There is no significant difference in diagnosing CRS using either of these modalities and both must be done prior to any FESS. They help in assessing the extent of sinus disease and to know the anatomical variations. Both CT scan and DNE are complimentary to each other.

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