10.5005/jp-journals-10013-1313

ORIGINAL ARTICLE

Correlation of Computed Tomographic Findings and Intraoperative Findings in Patients with Chronic Sinusitis

[1]Swati Tandon, [2]Praveen K Rathore, [3]Anoop Raj, [4]Anjali Prakash, [5]Vikram Wadhwa

ABSTRACT

Objective: Chronic sinusitis affects more than 30 million people each year worldwide. Computed tomography (CT) has become a standard diagnostic tool in the evaluation of paranasal sinuses (PNS), but medical literature lacks studies correlating preoperative CT and intraoperative findings of functional endoscopic sinus surgery (FESS). The aim of our study was to evaluate ostiomeatal unit on multidetector CT (MDCT) and correlate findings of MDCT with intraoperative findings during FESS in patients with chronic sinusitis and hence check for its usefulness during surgery.

Study design: Prospective clinical study.

Materials and methods: Forty-nine patients with chronic sinusitis who visited the Lok Nayak Hospital, Delhi, India, between October 2010 and February 2012 were included in the study. All such patients underwent preoperative CT scan of PNS before surgery, i.e., FESS with or without septoplasty under general anesthesia.

Results: Maxillary sinus was found to be the most common sinus involved in chronic sinusitis. Preoperative CT findings correlated well with intraoperative findings for all sinuses except left maxillary sinus.

Conclusion: Multiplanar CT of nose and PNS helps to delineate the anatomy of nose and PNS, and drainage pathways of sinuses preoperatively. Therefore, the operating surgeon should be well versed with it. Progress of endoscopic sinus surgery can be partially attributed to revolution in imaging modalities.

Keywords: Functional endoscopic sinus surgery, Multidetector computed tomography, Ostiomeatal complex, Paranasal sinuses, Rhinosinusitis.

How to cite this article: Tandon S, Rathore PK, Raj A, Prakash A, Wadhwa V. Correlation of Computed Tomographic Findings and Intraoperative Findings in Patients with Chronic Sinusitis. Clin Rhinol An Int J 2017;10(2):78-85.

Source of support: Nil

Conflict of interest: None

[1]Senior Resident, [2,3]Director Professor, [4]Professor, [5]Consultant

[1,5]Department of ENT, Maulana Azad Medical College, New Delhi, India

[2,3]Department of Otorhinolaryngology, Maulana Azad Medical College and Lok Nayak Hospital, New Delhi, India

[4]Department of Radiodiagnosis, Maulana Azad Medical College New Delhi, India

Corresponding Author: Swati Tandon, Senior Resident Department of ENT, Maulana Azad Medical College, New Delhi India, Phone: +919891778593, e-mail: drswatitandon86@gmail.com

INTRODUCTION

Rhinosinusitis has been defined as inflammation of mucosa of nose and paranasal sinuses (PNSs).[1] Evaluation of a patient with chronic sinusitis relies on the patient reporting a series of highly subjective symptoms. Computed tomography (CT) has become a standard diagnostic tool in the evaluation of PNSs.

Modern surgical techniques aim at preservation of anatomy and restoration of normal physiology. It is a well-known fact that PNSs are subject to intersubject and intrasubject variations. Various vital structures lie in close relationship to PNS, these are of great importance from both clinical and surgical point of view.

Functional endoscopic sinus surgery (FESS) has revolutionized the treatment of chronic sinusitis. It is based on the concept of facilitation of mucociliary clearance of nose and PNS. Obstruction of draining pathways is the most important cause of sinusitis. Clearance of this obstruction is the main aim of endoscopic surgery.

Imaging has also progressed with FESS, and CT can now demonstrate the sinus anatomy and patterns of sinusitis in exquisite detail. Technical developments in computer-assisted CT, such as multidetector CT (MDCT) can help the surgeon by increasing diagnostic accuracy.

Presently, a combination of diagnostic nasal endoscopy and CT has become the cornerstone in the evaluation of sinus disease. The precise knowledge of existing anatomical variations, pathological changes, and neighbouring vital structures is of immense value for a functional, safe, and effective sinus surgery.

The aim of our study was to correlate findings of MDCT with intraoperative findings during FESS in patients with chronic sinusitis.

MATERIALS AND METHODS

Study Organization and Patient Characteristics

The present study was conducted at Maulana Azad Medical College and Loknayak Hospital, associated GB Pant Hospital, and Gurunanak Eye Centre, Delhi, India, between October 2010 and February 2012. After fulfilling the necessary criteria for enrollment, first 49 patients with chronic sinusitis were included in the study. Patients who have failed medical management, i.e., prolonged course of broad spectrum antibiotics for 3 weeks and trial of corticosteroid nasal spray, were included in the study. Patients with revision surgery were excluded from the study.

Methodology

After fulfilling the desired criteria, patients were then subjected to endoscopic examination of nose. In all the selected patients, MDCT of PNS was done. Computed tomography was done on 128 slice scanner (Defination AS Siemens, Germany). Axial images were acquired using thin collimation, followed by reformats in all three planes, i.e., axial, coronal, and sagittal, with soft tissue and bony algorithms.

Technique of CT Scan of Nose and PNS used

All the CT scans were performed on 128 slice scanner (Defination AS Siemens, Germany). Various parameters used were:

- Plane of acquisition – axial
- Plane of reconstruction – coronal and sagittal. Axial CT images were acquired using thin collimation, followed by reformats in all three planes, with bone and soft tissue algorithms
- Slice thickness – 3 mm
- Patient position – supine
- Field of view – superiorly till superior border of frontal sinus and inferiorly just inferior to the lower border of hard palate
- Radiation level – 11.50 mGy
- Scan time – 4.53 seconds
- Scanning parameters – 80 Ma and 120 Kv
- Window settings – wide window settings. Kernel – H60 sharp
- Magnification factor – zero
- Rotation time – 1 second
- No contrast was used

Preoperative CT scans were assessed. Computed tomography scan findings for each sinus were noted on each side. Preoperative CT scoring was done using Lund and Mackay score. The anterior ethmoid, posterior ethmoid, sphenoid and maxillary sinus findings were assessed.

Preoperative CT scans were assessed by the same radiologist for all patients. Computed tomography scan findings for each sinus were noted on each side. Computed tomography scoring was done using Lund and Mackay score. Sinuses were scored on a ternary scale based on the presence of

- No disease (0)
- Partial opacification (1)
- Total opacification (2)

Partial and total opacification were considered abnormal findings on CT. Anatomical variants were also noted.

Functional endoscopic sinus surgery was done using Messerklinger technique by the same surgeon. Intraoperative findings were noted for all sinuses on each side and were scored as normal, mucosal thickening, and polyposis, i.e., polyp completely filling the sinus. Mucosal thickening and polyposis were considered abnormal findings intraoperatively.

Computed tomography findings and intraoperative findings were correlated as

- Normal – when parameters correlated are normal on CT and intraoperatively
- Abnormal – when parameters correlated are abnormal on CT and intraoperatively
- False positive – when parameter is normal intraoperatively but abnormal on CT
- False negative – when parameter is abnormal intraoperatively but normal on CT

Statistical Analysis

Statistical Package for the Social Sciences software version 17 (IBM company) was used for statistical analysis. For agreement between CT and intraoperative findings, Kappa agreement was used. It was a two-tailed test.

RESULTS

Characteristics of Patients

Of the 49 patients, 22 were females and 27 were males in the age group 10 to 50 years.

Clinical Symptoms

Among the clinical symptoms, chronic nasal discharge was the most common symptom seen in 39 patients, followed by nasal obstruction in 38, postnasal drip in 33, headache in 29, anosmia in 8, and facial pain in 5 patients.

Computed tomography Findings of Sinuses

On the left side, maxillary sinus was most commonly involved in 43 patients, followed by anterior ethmoids in 37, posterior ethmoids in 35, frontal in 25, and sphenoid sinus in 22 patients.

On right side, maxillary sinus was involved in 45, anterior ethmoids in 41, posterior ethmoids in 35, frontal in 26, and sphenoid sinus in 24 patients.

Also, partial opacification was the most common finding on CT bilaterally.

Intraoperative Findings of Sinuses

On left side, maxillary sinus was the most common sinus affected in 41 patients, anterior ethmoids in 39, posterior ethmoids in 33, frontal and sphenoid in 21 patients.

On right side, maxillary sinus was affected in 42, anterior ethmoids in 40, posterior ethmoids in 33, frontal and sphenoid in 20 patients.

Gap between Surgery and CT

The gap between surgery and CT has a mean of 6.52 weeks (1 to 24 weeks, standard deviation – 4.344 weeks).

Agreement between CT and Intraoperative Findings (Table 1)

Maxillary Sinus

On left side, none of the patients had normal findings on both CT and intraoperatively, 12 patients had thickened mucosa intraoperatively, which correlated with CT findings of partial opacification, and 7 patients had complete opacification which correlated with polyp completely filling the sinus intraoperatively.

Nine patients showed false-positive result and six showed false-negative result. Kappa agreement score was 0.008 (poor agreement).

On right side, in 36 patients, CT findings correlated well with intraoperative findings. False-positive result was seen in four patients and one showed false-negative result. The kappa value was 0.475 (fair agreement).

Anterior Ethmoid

On the left side, 38 patients had intraoperative findings correlating with CT findings (Figs 1 and 2). False-positive result was seen in one patient and three patients showed false-negative results. The kappa value was 0.641 (good agreement). On right side, kappa value was 0.427 (fair agreement).

Table 1: Results: agreement between CT and intraoperative findings

1. Maxillary sinus Lt * max sinus Lt cross-tabulation
Count

		Maxillary sinus Lt			
		0	*1*	*2*	*Total*
Maxillary sinus Lt	0	0	4	2	6
	1	6	12	7	25
	2	3	8	7	17
Total		9	24	16	49

Symmetric measures

		Value	*Asymp. std. error*[a]	*Approx. T*[b]	*Approx. Sig.*
Measure of agreement	Kappa	0.008	0.102	0.073	0.942
N of valid cases		49			

2. Maxillary sinus Rt * max sinus Rt cross-tabulation
Count

		Maxillary sinus Rt			
		0	*1*	*2*	*Total*
Maxillary sinus Rt	0	3	1	0	4
	1	4	18	5	27
	2	0	5	13	18
Total		7	24	18	49

Symmetric measures

		Value	*Asymp. std. error*[a]	*Approx. T*[b]	*Approx. Sig.*
Measure of agreement	Kappa	0.475	0.113	4.265	0
N of valid cases		49			

[a]Not assuming the null hypothesis; [b]using the asymptotic standard error assuming the null hypothesis

3. Anterior ethmoidal Lt * ant ethm Lt cross-tabulation
Count

		Anterior ethmoidal Lt			
		0	*1*	*2*	*Total*
Anterior ethmoidal Lt	0	9	3	0	12
	1	1	19	3	23
	2	0	4	10	14
Total		10	26	13	49

Symmetric measures

		Value	*Asymp. std. error*[a]	*Approx. T*[b]	*Approx. Sig.*
Measure of agreement	Kappa	0.641	0.097	6.239	0
N of valid cases		49			

[a]Not assuming the null hypothesis; [b]using the asymptotic standard error assuming the null hypothesis

4. *Anterior ethmoidal Rt cross-tabulation
Count

		Anterior ethmoidal Rt			
		0	*1*	*2*	*Total*
Anterior ethmoidal Rt	0	4	4	0	8
	1	5	17	3	25
	2	0	5	11	16
Total		9	26	14	49

Symmetric Measures

		Value	*Asymp. std. error*[a]	*Approx. T*[b]	*Approx. Sig.*
Measure of agreement	Kappa	0.427	0.113	4.055	0
N of valid cases		49			

[a]Not assuming the null hypothesis; [b]using the asymptotic standard error assuming the null hypothesis

(Cont'd…)

(Cont'd…)

5. Posterior ethmoidal Lt *posterior ethmoidal LT cross-tabulation
Count

		Posterior ethmoidal Lt			
		0	*1*	*2*	*Total*
Posterior ethmoidal Lt	0	12	4	0	16
	1	4	12	2	18
	2	0	4	11	15
Total		16	20	13	49

Symmetric measures

		Value	*Asymp. std. error*[a]	*Approx. T*[b]	*Approx. Sig.*
Measure of agreement	Kappa	0.569	0.099	5.625	0
N of valid cases		49			

[a]Not assuming the null hypothesis; [b]using the asymptotic standard error assuming the null hypothesis

6. Posterior ethmoidal Rt *posterior ethmoidal RT cross-tabulation
Count

		Posterior ethmoidal Rt			
		0	*1*	*2*	*Total*
Posterior ethmoidal Rt	0	10	4	0	14
	1	6	10	2	18
	2	0	5	12	17
Total		16	19	14	49

Symmetric measures

		Value	*Asymp. std. error*[a]	*Approx. T*[b]	*Approx. Sig.*
Measure of agreement	Kappa	0.478		4.753	0
N of Valid Cases		49			

[a]Not assuming the null hypothesis; [b]using the asymptotic standard error assuming the null hypothesis

7. Frontal Sinus Lt * frontal Lt cross-tabulation
Count

		Frontal Lt			
		0	*1*	*2*	*Total*
Frontal sinus Lt	0	19	4	1	24
	1	8	7	0	15
	2	1	2	7	10
Total		28	13	8	49

Symmetric measures

		Value	*Asymp. std. error*[a]	*Approx. T*[b]	*Approx. Sig.*
Measure of agreement	Kappa	0.461	0.112	4.431	0
N of valid cases		49			

[a]Not assuming the null hypothesis; [b]using the asymptotic standard error assuming the null hypothesis

8. Frontal sinus Rt * frontal Rt cross-tabulation
Count

		Frontal Rt			
		0	*1*	*2*	*Total*
Frontal sinus Rt	0	19	3	1	23
	1	8	5	2	15
	2	2	2	7	11
Total		29	10	10	49

Symmetric measures

		Value	*Asymp. std. error*[a]	*Approx. T*[b]	*Approx. Sig.*
Measure of agreement	Kappa	0.402	0.107	3.972	0
N of valid cases		49			

[a]Not assuming the null hypothesis; [b]using the asymptotic standard error assuming the null hypothesis

9. Sphenoid Lt * sphenoid Lt cross-tabulation
Count

		Sphenoid Lt			
		0	*1*	*2*	*Total*
Sphenoid Lt	0	21	5	1	27
	1	5	5	1	11
	2	2	2	7	11
Total		28	12	9	49

Symmetric measures

		Value	*Asymp. std. error*[a]	*Approx. T*[b]	*Approx. Sig.*
Measure of agreement	Kappa	0.446	0.111	4.282	0
N of valid cases		49			

[a]Not assuming the null hypothesis; [b]using the asymptotic standard error assuming the null hypothesis

10. Sphenoid Rt * sphenoid Rt cross-tabulation
Count

		Sphenoid Rt			
		0	*1*	*2*	*Total*
Sphenoid Rt	0	21	3	1	25
	1	7	2	1	10
	2	1	3	10	14
Total		29	8	12	49

Symmetric measures

		Value	*Asymp. std. error*[a]	*Approx. T*[b]	*Approx. Sig.*
Measure of agreement	Kappa	0.451	0.104	4.338	0
N of valid cases		49			

[a]Not assuming the null hypothesis; [b]using the asymptotic standard error assuming the null hypothesis

(Cont'd…)

(Cont'd…)

11. Middle Meatus Lt * middle meatus Lt cross-tabulation
Count

		Middle Meatus Lt			
		0	1	2	Total
Middle Meatus Lt	0	7	2	3	12
	2	3	0	34	37
Total		10	2	37	49

Symmetric measures

		Value	Asymp. std. error[a]	Approx. T[b]	Approx. Sig.
Measure of agreement	Kappa	0.570	0.124	4.354	0
N of valid cases		49			

[a]Not assuming the null hypothesis; [b]using the asymptotic standard error assuming the null hypothesis

12. Middle Meatus Rt * middle meatus Rt cross-tabulation
Count

		Middle Meatus Rt			
		0	1	2	Total
Middle Meatus Rt	0	6	1	1	8
	2	1	1	39	41
Total		7	2	40	49

Symmetric measures

		Value	Asymp. std. error[a]	Approx. T[b]	Approx. Sig.
Measure of agreement	Kappa	0.722	0.122	5.646	0
N of valid cases		49			

[a]Not assuming the null hypothesis; [b]using the asymptotic standard error assuming the null hypothesis

13. Infundibular Lt * infundibular Lt cross-tabulation
Count

		Infundibular Lt			
		0	1	2	Total
Infundibular Lt	0	7	2	3	12
	2	3	0	34	37
Total		10	2	37	49

Symmetric measures

		Value	Asymp. std. error[a]	Approx. T[b]	Approx. Sig.
Measure of agreement	Kappa	0.570	0.124	4.354	0
N of valid cases		49			

[a]Not assuming the null hypothesis; [b]using the asymptotic standard error assuming the null hypothesis

14. Infundibular Rt * infundibulane Rt cross-tabulation
Count

		Infundibular Rt			
		0	1	2	Total
Infundibular Rt	0	6	1	1	8
	2	1	1	39	41
Total		7	2	40	49

Symmetric measures

		Value	Asymp. std. error[a]	Approx. T[b]	Approx. Sig.
Measure of agreement	Kappa	0.722	0.122	5.646	0
N of valid cases		49			

[a]Not assuming the null hypothesis; [b]using the asymptotic standard error assuming the null hypothesis

15. Frontal recess Lt * frontal recess Lt cross-tabulation
Count

		Frontal recess Lt			
		0	1	2	Total
Frontal recess Lt	0	21	3	3	27
	1	3	1	2	6
	2	4	0	12	16
Total		28	4	17	49

Symmetric measures

		Value	Asymp. std. error[a]	Approx. T[b]	Approx. Sig.
Measure of agreement	Kappa	0.455	0.109	4.019	0
N of valid cases		49			

[a]Not assuming the null hypothesis; [b]using the asymptotic standard error assuming the null hypothesis

16. Frontal recess Rt * frontal recess Rt cross-tabulation
Count

		Frontal recess Rt			
		0	1	2	Total
Frontal recess Rt	0	19	3	2	24
	1	3	1	1	5
	2	5	0	15	20
Total		27	4	18	49

Symmetric measures

		Value	Asymp. std. error[a]	Approx. T[b]	Approx. Sig.
Measure of agreement	Kappa	0.500	0.106	4.342	0
N of valid cases		49			

[a]Not assuming the null hypothesis; [b]using the asymptotic standard error assuming the null hypothesis

Note: The agreement classification based on value of Kappa (k); 0.93 to 1.00 – excellent agreement; 0.81 to 0.92 – very good agreement; 0.61 to 0.80 – good agreement; 0.41 to 0.60 – fair agreement; 0.21 to 0.40 – slight agreement; 0.01 to 0.20 – poor agreement; *Rt: Right; Lt: Left

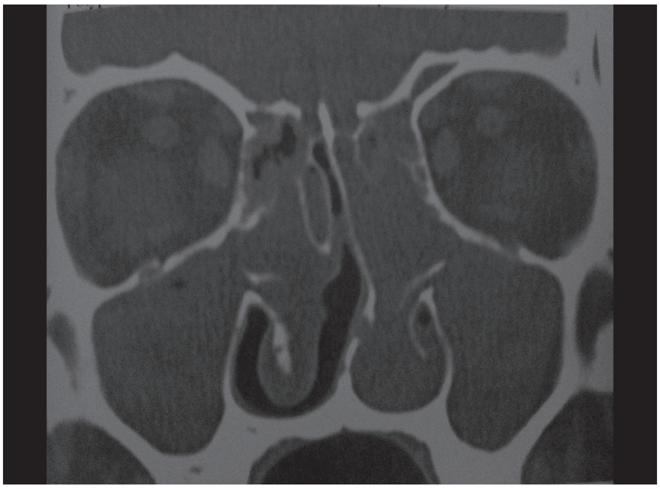

Fig. 1: Coronal CT scan of PNS showing polyposis in maxillary and ethmoid sinuses

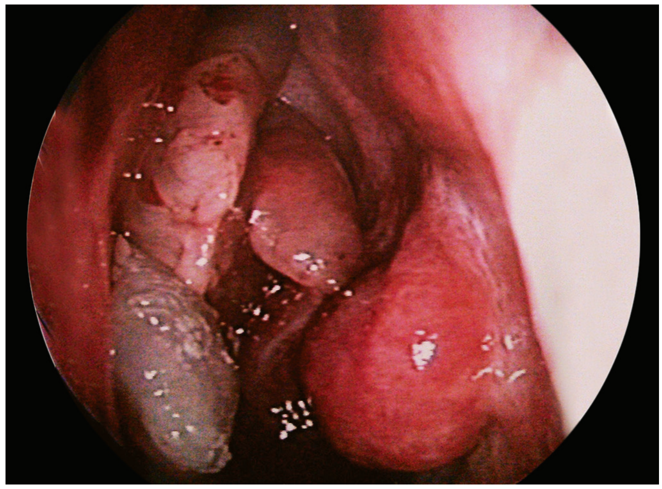

Fig. 2: Intraoperative view of polyposis

Posterior Ethmoid

On left side, in 35 patients, CT findings correlated well with intraoperative findings. False-positive result was seen in four and false-negative result was seen in four patients. The kappa value was 0.569 (fair agreement). On right side, 32 patients had significant correlation between CT and intraoperative findings. False-positive result was seen in six patients and false-negative result was seen in four patients. The kappa value was 0.478 (fair agreement).

Sphenoid Sinus

On left side, 33 patients had significant correlation between CT and intraoperative findings. In seven patients, false-positive result was seen and six showed false-negative result. The kappa value is 0.446 (fair agreement). On right side, 33 patients had significant correlation between CT and intraoperative findings. In four patients, false-negative result was seen and in eight false-positive result was seen. The kappa value is 0.451 (fair agreement).

Frontal Sinus

On left side, in 33 patients, significant correlation was seen between CT and intraoperative findings. False-positive result was seen in nine and false-negative result was seen in five patients. The kappa value is 0.461 (fair agreement). On right side, 31 patients had significant correlation between CT and intraoperative findings. False-positive result was seen in 4 and false-negative result was seen in 10 patients. The kappa value is 0.402 (fair agreement).

Anatomical Variations

The most common variation seen was deviated nasal septum in 40 patients, concha bullosa in 7, paradoxical middle turbinate in 1, Haller cells in 1, Onodi cells in 1, and pneumatization of vomer in 1 patient.

DISCUSSION

Chronic rhinosinusitis (CRS) is a group of disorders characterized by inflammation of mucosa of nose and PNS for at least 12 consecutive weeks duration.[2] In 1996, the American Academy of Otolaryngology – Head and Neck Surgery multidisciplinary rhinosinusitis task force (RTF) defined adult rhinosinusitis diagnostic criteria. In 2003, the RTF's definition was amended to require confirmatory radiographic or nasal endoscopic or physical examination findings in addition to suggestive history.[3,4] Rhinosinusitis task force has given a list of symptoms. For diagnosing CRS, at least two major factors or one major with two or more minor factors (listed below), or purulence on nasal examination for 12 weeks have to be present. Major factors are (1) facial pain, (2) facial congestion, (3) nasal obstruction, (4) nasal discharge, (5) hyposmia/anosmia, (6) purulence in nasal cavity, and (7) fever.

Minor factors are (1) headache, (2) fever, (3) halitosis, (4) fatigue, (5) dental pain, (6) cough, and (7) earpain/pressure.

Sinusitis significantly impacts quality of life measures with decrements in general health perception, vitality, and social functioning comparable with that observed in patients with angina or chronic obstructive pulmonary disease.[5]

To evaluate the pattern of sinusitis, one must understand the drainage pathways of sinuses. The anatomy of drainage revolves around the ostiomeatal unit, which is not a single morphologic structure but a combination of the following structures: Uncinate process, ethmoid bulla, middle turbinate, infundibulum, and hiatus semilunaris.

According to Mackay and Lund, the ostiomeatal complex acts as a drainage pathway for maxillary, anterior ethmoids and frontal sinus. In several areas of ostiomeatal complex, two mucosal layers contact each other, thus increasing the likelihood of local impairment of mucociliary clearance.

Traditionally, plain films were the modality of choice in the evaluation of sinus pathology. In recent years, it has become evident that sinusitis is primarily a clinical diagnosis.

The role of imaging is to document the extent of disease, to answer questions regarding ambiguous cases, and to provide an accurate display of the anatomy of sinonasal system. Today, CT has become the modality of choice for imaging evaluation of the morphology in this area. The introduction of MDCT has widened the range of applications of helical CT in clinical imaging, especially in the field of virtual imaging. With the help of MDCT, it is possible to rapidly obtain thin sections with improved z-axis resolution, high-quality multiplanar resolutions, and volume-rendered images. Volume acquisition makes it possible to retrospectively reconstruct overlapping images, thus producing high-quality three-dimensional reconstruction. Multidetector CT possesses the potential for reduction in radiation dose by 20%; therefore, it should be the imaging method of choice in chronic sinusitis.[6]

Patients with persistent disease require surgical intervention. The surgical treatment has undergone revolutionary changes in the last 10 to 20 years. These advances are due to an improved understanding of the mucociliary clearance pathways of PNS, improved endoscopes, and availability of high-resolution CT images that provide an accurate display of the regional anatomy. Computed tomography is effective in demonstrating predisposing causes of sinusitis and provides precise guidance for endoscopic instrumentation.

Frontal recess is the anatomical region most difficult to manage during FESS owing to its anterior location and its tight confines between the orbit and anterior skull base. Furthermore, the frontal recess has a significant predilection for stenosis post-FESS.[7]

Computed tomography has always been the gold standard for preoperative evaluation, but coronal CT fails to provide detailed anatomy of this area. The incomplete removal of cells in frontal recess is one of the most common causes of FESS failure. Published series have reported persistent frontal sinusitis symptoms at short-term follow-up in 2 to 11% of post-FESS patients[8] and long-term failure rates of 15 to 20%, with up to 11% of these patients requiring revision surgery.[9] A detailed understanding of frontal recess anatomy is thus critical to avoid surgical failure.[10]

Multiplanar CT reformations provide clearer understanding of frontal sinus drainage pathway.[11] In our study, sagittal reconstruction of frontal sinus and recess was done for every patient. Kew et al[12] found that preoperative review of both sagittal and coronal reformatted images together significantly alter surgical planning in over one half of cases when compared with review of coronal scans alone. In our study, frontal sinus showed highest false-positive results, therefore sagittal reconstruction CT must be done to study the frontal recess anatomy.

In our study, a significant correlation was seen between CT and intraoperative findings. Similar observation was seen by Kaluska and Patil[13] when they compared sinus disease radiologically with surgery.

Maxillary sinus was found to be the most common sinus involved in patients of sinusitis in our study. It was in accordance with a study conducted at the ENT clinic HUKM[14] involving 40 patients with chronic sinusitis. Maxillary sinus was found to be the most common sinus involved followed by anterior ethmoid, posterior ethmoid, frontal, and sphenoid sinus. Similar results were also seen in a study by Sheetal et al.[15]

False-positive and false-negative results were also seen in our study. False-positive results could be due to remission of disease as all patients received medical therapy preoperatively. In our case also, patients received medical therapy prior to surgery. This could have led to remission of the disease leading to false-positive results. Another important factor is the time lag between CT and surgery, especially when CT scan is not repeated after medical management. This time lag could be due to many factors: Excessive patient load causing delay in surgery especially in a government hospital like us, delay in patient follow-up post-CT scan, patient being referred from general practitioner with CT scan PNS without medical management for sinusitis, and poor affordability of patient causing inability for repeat CT scan prior to surgery. CT scan is gold standard for evaluation of sinusitis. But CT scan must be critically evaluated. It is very sensitive in demonstrating virally mediated and postinfectious (residual or resolving) inflammatory changes in sinuses. There is an impressive radiographic lag of 6 to 12 weeks in clearing of sinuses after clinical cure occurs.[16] Therefore, if a CT scan is ordered in the acute phase of the disease, inflammatory changes in the sinuses will be interpreted as opacification by the radiologist, and hence diagnosis of chronic sinusitis will be inappropriately made. It is important to avoid overdiagnosing this condition. In a study[2] in Iran, on 51 patients with chronic sinusitis, only 60% had mucosal thickening on CT and during FESS. This discrepancy attributed to 40% of asymptomatic individuals has incidental opacification of PNS. They also concluded that nasal findings obtained by endoscopy were more conclusive in elucidation of diagnosis than CT. Since asymptomatic individuals can have opacification of sinuses, it is very important to correlate CT scan with clinical history and endoscopic findings of the patient. Based on the history and clinical examination, the surgeon can better correlate CT report than a radiologist. It is rightly said that operative findings are better consistent with surgeon's CT scan interpretation than with radiologist's report.

False-negative result could be due to variable nature of sinus disease, time lag between CT imaging and surgery, and inability of CT to recognize minimal changes in mucosa. In our study also, there was a time lag of 6.52 weeks between CT and surgery, which could be responsible for false-negative results. Therefore, the time frame between CT and surgery is an important factor to avoid false-negative results and it should be as short as possible.

There are a large number of anatomical variations in nose. Various anatomical variations seen in our study are deviated nasal septum, concha bullosa, Haller cells, paradoxical turbinate, and Onodi cells. Wani et al[17] emphasized a thorough preoperative CT evaluation of patients undergoing FESS was necessary to detect various anatomical variations in the ostiomeatal complex. Concha bullosa was found to be the commonest variation by them, whereas deviated nasal septum was the commonest in our study. Therefore, every surgeon must know these variations and their impact on drainage of sinuses, and they can be diagnosed preoperatively by CT scan.[18]

Thus, the operating surgeon should be well versed with the reading of CT scan of nose and PNS. Computed tomography scan is a roadmap for FESS and must be done in all patients with CRS before surgery, but a thorough knowledge of anatomy of nose and sinuses is of utmost importance.

CONCLUSION

Multiplanar CT helps to delineate the anatomy of nose and sinuses, and drainage pathways of sinuses preoperatively. It is helpful in evaluating the site and extent of ostiomeatal complex pathology. It is also very essential to identify various anatomical variations preoperatively in order to prevent complications and for better results.

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