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Radiological and Endoscopic correlation in Chronic Rhinosinusitis

Radiology

KEYWORDS: Paranasal sinus disease, CT scan, Diagnostic nasal endoscopy, Middle meatus, Osteomeatal unit.

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ABSTRACT

Background: In paranasal sinus disease, local examination is limited as sinuses cannot be examined directly. **Objective:** This study was carried out with an objective to evaluate and compare CT scan findings and Nasal endoscopy findings in patients with paranasal sinus disease. **Methods:** 30 cases of chronic Rhinosinusitis not responding to routine medical treatment were operated after CT scan and nasal endoscopy. Both investigative modalities were compared to each other and correlated with operative findings. **Results and conclusion:** A high association was found between both the modalities i.e. CT scan and nasal endoscopy with one scoring over the other in different parameters. Nasal endoscopy is found to be highly specific for anatomical variants in the osteomeatal complex, whereas CT scan is highly sensitive for parameters like frontal recess pathology and sphenoethmoid recess disease. So, a case of sinus disease should be diagnosed using both these modalities as together they complement each other.

Introduction:

During fetal development, the paranasal sinuses originate as invaginations of the nasal mucosa into the lateral nasal wall, frontal, ethmoid, maxilla and sphenoid bones. Infection of these sinuses is one of the most common causes of patient's visit to the otorhinolaryngologist. Around one in five cases seen in outpatient department is concerned with sinus disease. Surgical clearance of these chronically infected sinuses while maintaining their ventilation and drainage is the treatment of choice[1]. To achieve this goal, different diagnostic modalities help in exact diagnosis and safe intervention. Over the past decade, both CT and nasal endoscopy have been used successfully as diagnostic modality in sinus diseases. Sinus disease management has been technologically enhanced in recent years by improved radiographic evaluation, methods for intranasal visualization and understanding of etiological factors which play a pivotal role in the development of chronic rhinosinusitis.

To perform functional endoscopic sinus surgery effectively and safely, the surgeon must have detailed knowledge of the anatomy of the lateral nasal wall, paranasal sinuses and surrounding vital structures. Computerized Tomography (CT) provides essential preoperative information for the assessment of patients undergoing functional endoscopic sinus surgery (FESS).[2] The aim of CT of sinuses is to delineate the extent of the disease, define any anatomical variants and relationship of the sinuses with the surrounding vital structures. Anterior rhinosocopy reveals little information with regard to the middle meatal cleft and no information regarding the infundibular opening and maxillary sinus. Endoscopic techniques have allowed detailed and complete visualization of sinus disease while promising minimum distress to the patient. The telescopic view of the operative field shows detail of the sinus anatomy and its disease. It has been possible to see areas of the cribriform and orbital wall that are at risk to produce cerebrospinal fluid rhinorrhoea and orbital complications during the surgery. At the same time, landmarks for avoiding these complications can be defined to guide the surgeon during the surgery as seen through the endoscope. Hence endoscopy and computerized tomography (CT) have revolutionalized the understanding and management of chronic sinusitis in recent times.

Recently combination of diagnostic endoscopy and systematic understanding of the lateral nasal wall with CT in the coronal plane has become the corner stone in the evaluation of the PNS disease. This is the basis of the new concept of FESS.[2] & this preoperative evaluation is all the more important if the patient is of paediatric age group or has undergone a conventional surgery earlier.[3]

In this study we have evaluated and compared the endoscopic and CT findings of patients with chronic rhinosinusitis.

Materials and Methods:

This prospective study was carried out at a tertiary care hospital in India. 30 patients who presented to the outpatient department with clinically proven chronic rhinosinusitis not responding to routine medical line of treatment were included in the study. Patients with history of chronic headache without any apparent sinus pathology on conventional radiology wherein non-sinus causes like ophthalmological, neurological, dental or migraine were ruled out and those with recurrence of symptoms of chronic rhinosinusitis after surgical management (revision cases) were also included. Exclusion criteria included patients with acute rhinosinusitis, sinus neoplasia and those not willing to undergo CT-PNS or FESS. Nasal endoscopy was done by a 4mm 0° and 30° Karl Storz Hopkins rod optical with cold light source and fibre optic light delivery system connected to a Karl Storz Endovision Telecam deluxe camera system with monitor. The patient was placed in supine position with head slightly elevated (30^0) and turned towards the examiner. Local anesthesia was given by the (Moffat's technique) [4] wherein wicks impregnated with a solution of 4 cc topical decongestant 4% Xylocaine with 4 drops of adrenaline (1:1000) was kept in the floor of nasal cavity (inferior meatus), middle meatus and sphenoethmoid recess (medial to middle turbinate). Endoscopy was performed by three passes as originally described by Kennedy[3]

All patients were subjected to a CT-PNS with 3-5 mm coronal and axial cuts using a 16 slice multislice CT-scan machine and findings recorded.

Selection of patients for FESS was done on the following critirea: Chronic rhinosinusitis not responding to conservative line of management, Patients with gross polposis or polypoidal mucosa blocking the osteomeatal unit and any anatomical variant causing blocking the osteomeatal complex and hence responsible for the patient's complaints.

Patients underwent FESS (Messerklinger technique and its modifications thereof) either under GA or LA depending on the patient factors like pain threshold and anxiety; personal preference, extent of surgery and other systemic factors like hypertension.[5,6] Post-operatively patients were called for follow up on 7^{th} day and then weekly for at least 1 month.

RESULTS

Our study showed male preponderance 60% male v/s 40% female.

Male to female ratio was 1.5:1. Common presenting symptoms of the patients in our study were nasal obstruction (96.7%) & nasal discharge (73%). Sneezing (46.6%) and headache (43.3%). Olfactory disturbances (10%) and epistaxis (6%) were occasional symptoms.

Endoscopic findings of the patients as listed in **Table1** included, polypoidal change in the mucosa of osteomeatal area with blocked maxillary ostia being the commonest finding 58.33% followed by deviated nasal septum 13(44%) patients. CT scan findings of the patients are listed in table 2 below. Commonest CT scan findingsas listed in **Table 2**, included osteomeatal pattern of disease (58.33%) with sinonasal pattern and sphenoethmoidal recess pattern following it (16.66%).

Table 3 is a demonstration of correlation between intraoperative endoscopy and CT PNS findings. Excluding patients of sino nasal polyposis where the causal factors could not be determined; it was found to be in the middle meatus. Nasal endoscopy was successful in localizing the causal factor to the osteomeatal complex in 23 (76%) cases; while CT was successful in 21 (70%) cases.

DISCUSSION &CONCLUSION

In our study, we have attempted to standardize an organized method for complete nasal endoscopic and CT evaluation to find out the causal factor for the patient's complaints. We have evaluated and analyzed our results and compared with the latest available contemporary studies of the stalwarts in our field. The most common symptoms were nasal obstruction (96.7%); nasal discharge (73.3%); Sneezing (46.6%) and headache (43.3%). Olfactory disturbances contributed to (10%) of the total, but the incidence would have been higher if objective assessment of olfaction had been routinely performed. Hosernan et al [8] administered a semi qualitative and quantitative olfactory function test to each side of nose in 111 patients of chronic sinusitis undergoing endoscopic sinus surgery. Before surgery 65% were hyposmic/anosmic whereas after surgery only 8% remained anosmic.-Richard and Doty et al[9] revealed that surgical or medical interventions do not on average lead to compete recovery of olfactory function. Histo-pathological studies have demonstrated significant olfactory epithelial compromise in sinonasal syndromes. Less common complaints were sleep apnea, epistaxis, fever, cough, visual complaints etc. Most of our patients presented before they developed symptoms pertaining to the ear.

35 sides (58%) had polypoidal change in the osteomeatal complex on endoscopic examination. CT-PNS revealed a more precise evaluation of the extent of disease. 40 sides (67%) had polypoidal change in the osteomeatal complex on CT study, Half of the above patients (20 sides- 34%) had anatomical variations of either middle turbinate or uncinate process &/or with a contact area with a localized spur or general deflection of the septum. Polypoidal change in the osteomeatal complex in these cases was a secondary pathology. However there was only edema of the osteomeatal complex mucosa in the remaining half of the cases. 5 cases (17%) had bilateral diffuse sinonasal polyposis. CT-PNS was found to be more sensitive than nasal endoscopy in identifying disease in sphenoethmoid and frontal recess area **(Table 4)**. However fallacies do exist in interpretation of CT PNS. Occasionally grossly hyperplastic mucosa may appear on CT as a mildly enhancing polypoidal mass. 2 patients in our study were misdiagnosed on CT with a polypoidal mass in the maxillary sinus with secondary infection and debris. Maxillary sinus endoscopy revealed only hyperplastic mucosa with secondary infection and with extrafungal fungal debris in one case. MRI may be helpful in such cases[9]. Signal intensity depends on the degree of hydration Hyperplastic mucosa has low signal intensity on T1 weighted images and high signal intensity on T2 weighted images. Sinonasal polyps have mixed signal intensity on T1 and T2 weighted images depending on the water content of polyp, mucosal hypertrophy and sinonasal secretions. In revision cases CT cannot readily differentiate between fibrosis and hyperplastic disease aside from other signs evident on CT such as overall pattern of disease and presence of sclerosis of bony walls. Freidman and Katsantonis[10] studied the-role of CT in 34 patients previously operated with chronic sinusitis. They concluded the sensitivity of CT as 100% in identifying the pathology but the specificity as 88% due to inability of readily differentiating between fibrosis and hyperplastic mucosal disease They established that the ethmoid was the most common site of recurrence. However Kaluskar et al[11] in their study of correlation of the CT and intraoperative endoscopic findings, found that while the maxillary sinuses correlated well; in the ethmoids the mucosal disease was found to be far more spread than detected on CT scan.

In our study, 60 sides were operated upon by the Messerklinger technique removing all hyperplastic mucosa identified on CT. Middle turbinate was preserved in all cases Anterior ethrnoids were opened in 35 cases (58%). Posterior ethmoids were opened in 11 cases (18%); Intact bulla technique of infundibulotmy was possible in only 5 cases (8%) wherein there was only limited infundibular type of disease pattern on CT. Sphenoid sinus surgery was done in only those patients who demonstrated significant disease in sphenoethmoid area on CT (3 cases-5%). However in presence of minimal disease, only the ostium was widened preserving the sphenoid sinus mucosa (1 case). Frontal recess surgery was done only if significant stenosis was identified on CT. (4 cases- 7%). Recently Mitomycin-C has been used as a topical antineopiastic antibiotic for prevention of frontal recess stenosis in a study by Gady Har et al[12]

In 1987 W.E.Bolger et al[6], in their study of coronal plane CT Scan of 202 patients, noted the incidence of bony anatomic variants as follows. Paradoxical curvature of the middle turbinate was found in 26.1% of patients, Haller's cells in 45.1%, pneumatization of uncinate process in 2.5% and lamellar cell of the middle turbinate was seen in 46.2% of the cases. In 31.2% pneumatization was noted in the bulbous part of the turbinate and 'true' concha bullosa in 15.7% of the patients. The agger nasi cell was present in 98.5% of patients, crista galli pnuematization in 83.7%, and bulla galli in 5.4% and deviated nasal septum in 18.8%. However NS Jones[13] et al showed that, bony anatomical variations appear not to influence the prevalence of rhinosinusitis. Intrinsic mucosal disease is probably of much more importance than the bony anatomy. He compared one hundred computerized tomography (CT) scans from patients with rhinosinusitis with 100 CT scans from patients with intraorbital disease. There were no significant bony anatomical differences between the rhinosinusitis group and the control group and there remained no difference when 17% of the control group, who were incidentally found to have mucosal changes, were excluded from the control data. None of the anatomical bony variations compared between the two groups showed any significant difference, including any associated with narrowing of the ostiomeatal complex (P = 0.41).

The incidence of various anatomical variants interfering with the physiology of the osteomeatal unit in our study was as follows **(Table 5).** These were compared to the incidence data in a study by Nayak et al[13] evaluating the efficacy of endoscopic assisted septoturbinoptasty conducted at the Kasturba Hospital Manipal between 1993 & 1999 comprising 480 cases with a follow-up of 3.months to 6.6 years. Hence, nasal endoscopy was more sensitive in detecting osteomeatal anatomic variants.

The limitations of our study were small sample size, lack of long term follow-up and lack of objective assessment of outcome based on olfactory testing.

Legends: (total 5)

Table 1: Showing endoscopic findings in patients of chronic rhinosinusitis

ENDOSCOPIC FINDINGS	No. of sides	Percentage
Polypoidal change in mucosa of osteomeatal area	35	58.33
Blocked maxillary ostia	35	58.33
Deviated nasal septum	13	44.00
Septal spur impinging into middle meatus	4	13.33
Sino-nasal polyposis	10	16.66
Inferior turbinate hypertrophied	10	16.66

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Hypertrophied middle turbinate	1	05.00
Enlarged ethmoid bulla	4	06.66
Suprabullar cells	--	--
Concha bullosa	7	08.33
Paradoxical middle turbinate	3	05.00
Partially resected middle turbinate	1	01.66
Pneumatized uncinate process	1	01.66
Medially turned uncinate process	4	06.66
Haller cells	--	--
Accessory ostia	2	03.33
Agger nasi cells	1	01.66
Blocked frontal recess area	1	01.66
Polypoidal change in spheno-ethmoid area	2	03.33
Onodi cell		
Extra mucosal fungal sinusitis	1	01.66
Any other finding like skull base/orbital erosion	-	-
Any positive findings in nasopharynx	-	-

Table 2: showing radiological pattern of disease

Pattern of inflammatory disease on each side	No. of sides	Percentage
Osteomeatal pattern	35	58.33%
Sinonasal polyposis	10	16.66%
Infundibular pattern	05	09.00%
Sphenoethmoidal recess pattern	10	16.66%
Unclassified/sporadic pattern	--	--

Table 3 : Correlation between intraoperative endoscopy and CT-PNS findings.

Pathological entity	Endoscopic diagnosis int raoperatively	Radiological diagnosis
Deviated nasal septum/spur	17	15
Polypoidal osteomeatal mucosa	35	40
Blocked maxillary sinus ostia	37	40
Gross nasal polyposis	10	10
Hypertrophic middle turbinates	03	01
Concha bullosa	05	05
Paradoxical middle turbinate	03	01
Resected middle turbinate	01	00
Pneumatized uncinate process	01	01
Medially turned uncinate process	04	01
Enlarged ethmoid bulla	02	00
Accessory maxillary sinus ostia	02	00
Haller cells	01	01
Blocked frontal recess	04	04
Agger nasi cells	03	03
Suprabullar cells	02	02
Onodi cells	00	01
Frontal sinus haziness	--	05
Maxillary sinus haziness	38	40
Sinus retention cyst/mucocele	01	03
Anterior ethmoid opacification/disease	33	35
Posterior ethmoid opacification/disease	05	10
Disease in sphenoid	03	04
Evidance of fungal sinusitis (extramucosal)	01	00
Evidence of orbital/anterior skull base erosion	00	00

Table 4: Sensitivity of CT-PNS to identify disease

Area of disease	endoscopy	CT-PNS	Intra-operative endoscopy findings
Frontal recess	1 sides (1.6%)	4 sides (6.4%)	4 sides (6.4%)
Spheno-ethmoid recess	2 sides (3.2%)	10 sides (16.3%)	8 sides (13.3%)
Osteomeatal complex	35 sides (58%)	35 sides (58%)	33 sides (55%)
Maxillary	--	40 sides (67%)	38 sides (63.33%)

Table 5: Sensitivity of CT PNS v/s nasal endoscopy to identify anatomic variants

ANATOMICAL VARIANTS	OUR STUDY (N=30)			NAYAK'S STUDY (N=480)
	Pre-op. findings	Intra- op. findings	CT	
Deviated nasal septum	17(57%)	15	15(50%)	56.25%
Septal spur impinging on middle meatus &/or contact area between MT and septum	4(13%)	4	4(13%)	36%
Middle turbinate (hypertrophied/polypoidal)	1(3.3%)	3	1(3.3%)	-
Concha bullosa (unilateral/bilateral)	7(23%)	5	5(17%)	26%
Paradoxical middle turbinate	3(10%)	3	1(3.3%)	25%
Abnormal uncinate process	5(17%)	5	1(3.3%)	21%
Accessory ostia	2(7%)	2	0	--
Haller cells	0	1	1 (3.3%)	--
Suprabullar cell	0	2	2(6.66%)	13%
Agger nasi	1(3.3%)	3	3(10%)	--

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