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Research Article

A Comparative Study of Radiological and Endoscopic Findings in Paranasal Sinus Disease

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Abstract: The objective of the study was to elicit the importance of radiology and nasal endoscopy in the diagnosis of chronic rhinosinusitis and comparative study between nasal endoscopy and CT scan for diagnosis of paranasal sinus disease. It was a randomized prospective study which was a tertiary hospital based study. It included 40 diagnosed patients of chronic rhinosinusitis on the basis of detailed history and physical examination not responding to 3 weeks of medical treatment. Overall correlation between X-ray and endoscopic findings was 57.5%.Variations in middle turbinate, pneumatisation of ethmoidal air cells was better seen in CT as compared to nasal endoscopy. Accessory nasal ostia was a nasal endoscopic finding. In conclusion, nasal endoscopy was better for assessment of localised disease like polyp, pathological secretion, and condition of mucosa while CT gave a better idea of condition of paranasal sinus and the ostiomeatal complex. In some cases it was impossible to pass endoscope beyond a certain point due to the presence of gross pathology, there CT proved very helpful. CT scan delineates the extent of disease, anatomical and pathological variations far better than any other method.
Keywords: Nasal endoscopy, Computerized Tomography, Ostiomeatal complex

INTRODUCTION

Paranasal sinus disease is a significant health problem affecting a large bunch of population. In India alone almost 15% of the population is suffering from chronic rhinosinusitis [1].

The task force of Rhinology and Paranasal Sinus committee (1997) has defined Rhinosinusitis as the condition manifested by an inflammatory response involving the following the mucous membrane of nasal cavity and paranasal sinuses, fluids within these cavities and underlying bone. The Task Force has classified Rhinosinusitis based upon the duration of illness as acute, subacute, recurrent acute, chronic and exacerbation of chronic state [2].

Acute rhinosinusitis presents clinical symptoms in less than four weeks, the subacute one in more than four weeks but less than twelve weeks and chronic rhinosinusitis in more than twelve weeks [3].

Variations in intranasal and sinus anatomy amongst other factors have been implicated in the etiology of chronic and recurrent rhinosinusitis and CT imaging has become an important diagnostic tool as it provides detailed information and an unparalleled view of the sinuses especially the bony anatomy. CT scan delineates areas which are poorly shown on plain X-ray films like anterior ethmoid cells and ostiomeatal complex. CT scan is effective in demonstrating predisposing causes of rhinosinusitis like anatomical variation, trauma and tumour which can cause narrowing of the ostiomeatal complex and sinus drainage channels. It is extremely useful in providing the road map prior to endoscopic sinus surgery [4].

Diagnostic nasal endoscopy enables clear visualisation of all structures of the middle meatus and of the ostiomeatal complex. It is a primary mean of diagnosis of all anatomic variations and other pathogenic factors of the lateral nasal wall, which cannot be diagnosed by using anterior/posterior rhinoscopy. Furthermore, the effects of therapy can be endoscopically controlled and if possible a surgical procedure may be performed [5]. However, the limitations of nasal endoscopy includes inability to discern the extent of disease within the ethmoidal sinus, difficulty in identifying disease in a constricted middle meatus and the presence of hidden air space such as posterior ethmoid cells [6].

Aims and Objectives

Effective role of conventional radiology, CT (coronal and axial section) vs nasal endoscopy as a diagnostic

modality in the management of chronic rhinosinusitis individually defining the importance of each examination for diagnostic conclusion

MATERIAL AND METHODS

This present study entitled "Comparative study of endoscopic and radiological findings in Paranasal sinus disease" a prospective study using diagnostic endoscopy, conventional radiology and Computed tomography was conducted in the department of ENT, Gajra Raja Medical College, Gwalior from Oct 2011 to Oct 2012.

Source of Data

All the patients attending the ENT outpatient department who were diagnosed with chronic rhinosinusitis on the basis of detailed history and physical examination and not responding to three weeks of medical treatment were taken in this study. The patients clinical history and examination were considered to be strong or suggestive of chronic rhinosinusitis on the basis of major and minor complex as described by Lanza and Kennedy [7].

Major factor	Minor factor
Facial pain/ pressure	Headache
Nasal congestion	Fever
Nasal obstruction	Halitosis
Nasal discharge	Dental pain
Purulence	Cough
Post nasal discharge	Ear pain/fullness
Hyposmia/Anosmia	

A strong history consistent with the diagnosis of chronic rhinosinusitis includes the presence of two or more major factors or one major and two minor factors or three minor factors.

Sample Size: 40
Sampling: Prospective study

Inclusion Criteria

- Patients > 15 years of age
- Patients with chronic rhinosinusitis not responding to three weeks of medical treatment

Exclusion Criteria

- Patients with previous facial trauma
- Paranasal sinus malignancy, chronic granulomatous disease
- Clinical evidence of sinusitis of dental origin
- Previous major nasal surgery

Collection of Data

- An informed consent was taken from all the patients
- A detailed history and clinical examination was done
- A routine haemogram (Hb %, TLC, DLC, BT, CT) and urine examination (albumin, sugar, and microscopy) along with X-ray PNS were done for all the patients.

Equipments Used

- Nasal endoscope 0^0 with 4mm diameter
- Self illuminated light source
- Camera system with monitor
- Topical decongestants and anaesthetic agent 4% xylocaine with 1:100,000 adrenaline
- Anti fog solution (savlon)

While waiting for the topical anaesthetic effect the endoscopic procedure was explained briefly to the patient. The patient was encouraged to vocalise promptly in case of any discomfort or if the patient felt like sneezing or coughing during endoscopic examination.

Position

Supine with head slightly elevated and turned towards the examiner who was standing on the right side of patient.

Procedures

Pass 1: along the floor of nasal cavity between the inferior turbinate and septum without touching either of the structures. Septum is studied for any spurs and deviations. Inferior turbinate is examined for any hypertrophy. Nasopharynx is examined for adenoids, Eustachian tube opening and fossa of rosenmuller.

Pass 2: scope was directed along the floor upto the posterior choana. It is then moved upward, medial to the middle turbinate along the roof of posterior choana and the anterior surface of sphenoid. Structures visualised are superior turbinate, superior meatus, sphenoethmoidal recess and sphenoidal ostium.

Pass 3: the third pass is made to examine the contents of middle meatus. Structures visualised are uncinate process, bulla ethmoidalis, hiatus semilunaris and frontal recess area

During endoscopy care was taken not to cause mucosal damage and misting of the telescope lens was avoided using anti-fog solution.

The present study was undertaken to evaluate endoscopy versus radiology for diagnostic efficacy in 40 patients selected for study from ENT OPD of J.A Group of hospitals.

DISCUSSION

Age:

In the present study maximum number of patients were in the age group 26-35 that is the second and the third decade. This is in concordance with the study carried out by V.P Sood [8] and K. Sinha [9] where

majority of patients were in the age group 20-40 and 17-48 years respectively. The probable explanation of disease being most common in middle age is that people in this age group are more exposed to environmental pollution, are more aware and conscious of their health and can access medical facilities at the earliest.

Sex

In this study of 40 patients the male to female ratio was 1.5:1.In the study conducted by V.P Sood [8] and K. Sinha [9] showed male to female ratio of 0.9:1 and 1.6:1 respectively. The factor contributing to less number of female patients in present series may be illiteracy and lack of health consciousness amongst the females. Also males are more exposed to pollution as they remain outdoors more than females.

Symptoms

The symptomatology was dominated by nasal discharge in 29(72.5%) patients followed by nasal obstruction in 26(65%) cases. The infrequent symptoms included sneezing in 7(17.5), abnormalities of smell in 6(15%), cough in 3(7.5%) and fever in 2(5%). In a study conducted by Mackay and Lund [10] 650 patients who underwent FESS,74% of the patients presented with nasal discharge followed by headache and facial pain in 72% and nasal blockage in 70%. Thus the study showed that nasal discharge, headache and nasal blockage are major presenting symptoms.

In the study conducted by Kirtane *et al*. [11] the commonest complaint was nasal discharge occurring in 25 patients (78.1%) followed by headache in 22 patients (68.7%) and nasal obstruction in 22 (68.7%).The other complaints were sneezing in 6 patients (18.7%), anosmia and cacosmia in 2 patients each (6.25%).The duration of symptoms varied from 3 months to 30 years. The less percentage of patients presenting with headache/facial pain in our study may be due to ignorance and poverty in this area, as many of them failed to recognise these as symptoms.

Clinical Examination

The most common abnormality detected in anterior detected in anterior rhinoscopy was deviated nasal symptom in 27(67.5 %) cases. Discharge ranging from mucoid to frankly purulent was seen in 22(55%). But the exact site of discharge was difficult to assess in anterior rhinoscopy. Turbinate hypertrophy was seen in 20 (50%) of patients. Congested mucosa was seen in 22(55%) patients. Synechiae was seen in 2(5%) of patients.

In the study conducted by Venkatchalam V. P *et al*. [12] clinical findings were hypertrophied inferior turbinate (10%), hypertrophied middle turbinate (17.14%), congested mucosa (15.71%), sinus tenderness (7.14%) and ethmoidal polyp(12.81%).

Anterior rhinoscopy is the most frequently used modality to visualise structures of nasal cavity but it has its limitations in visualising the deeper and more posteriorly placed structures.

Nasal Endoscopy vs Radiology

On nasal endoscopy deviated nasal septum was seen in 27(67.5%).Endoscopy was useful in determining the functional significance of deflection and spur. The X-ray examination is designed to give information that is complementary to the clinical findings. By themselves radiographic changes are non-specific and require correlation with historical and physical examination and findings to ensure greatest diagnostic usefulness. Likewise X-ray PNS provides little information of nasal cavity and its anatomical or pathological state .On CT scan 33 cases (82.5%) were diagnosed with DNS.

According to Shahizon *et al*. [13] minor bony deviations can be seen on CT scan while in endoscopy nasal septal deviation was documented only if it was moderate to severe or caused obstruction to caudal zone. This was reflected in this study as CT identified a higher frequency of nasal septal deviation due to over reporting as even minor deviations ie less than 5mm was considered significant. Mucopus in middle meatus was seen in significant number of cases 18(45%). In the study carried out by V.P Sood in 1990 [8] the numbers of cases were 21(14%) while in K. Sinha's study [9] the numbers of cases were 22 (52%) respectively.

Mucoid discharge in middle meatus was seen in 12(30%) cases. The findings seen in V.P Sood's [8] and K. Sinha's [9] study were 6(4%) and 10(23%) respectively.

Oedematous orpolypoidal infundibular mucosa was seen in 11(27.5%) cases. Kamal *et al*. [14] in their study found this in 15.18% of cases. Out of 8 cases diagnosed as Grade I i.e., normal on X-rays, only 2(25%) were found to be normal on nasal endoscopy while 4 of them were diagnosed with mucosal thickening and 2 with muco purulent secretion. Out of 18 cases diagnosed with Grade II i.e., reduced translucency 10(55.56%) were found to be normal, 2 were diagnosed with mucosal thickening, 4 with muco purulent secretions and 2 with mucoid discharge. In Grade III i.e., mucosal thickening and partial opacity out of 24 patients, 10(41.67%) were found to be normal on nasal endoscopy. Out of total 22 patients diagnosed as Grade IV i.e., complete opacity on X-ray, 6(27.26%) were found to be normal , 6 were diagnosed with mucosal thickening, 8 with mucopurulent secretion and 2 with polyp. So X-ray misdiagnosed 42 out of 80 cases (52.5%). CT has limitation in diagnosing polyps, diseased mucosa and mucopus. Hence intranasal endoscopy is more helpful in determining whether soft tissue seen on CT scan is mucosal oedema, polyps or muco pus.

Bulla ethmoidalis: the bulla may be extensively pneumatised thus occluding the ethmoidal by overlapping the hiatus semilunaris. In this study enlarged bulla ethmoidalis was seen in 9(22.5%) cases on nasal endoscopy. K. Sinha in 1993 found this in 4(9.52%) cases and Kamal *et al*. [14] reported this in 19.62%.On CT in the present study 8(20%) cases were reported. In X-ray PNS bulla ethmoidalis is not visualised. The overall correlation between X-ray and endoscopic diagnosis was 57.5%.

On CT scan in the present study 9 cases (22.5%) were diagnosed. CT scan has limitation in the diagnosis of localised disease. This finding is in concordance with Shahizon *et al*. [13] who in this study found the correlation to be 40%.

Accessory maxillary ostium: was seen in 19(47.5%) cases on nasal endoscopy. In chronic rhinosinusitis accessory maxillary ostium is found to be more in number as compared to general population. It is not visualised either on X-ray or CT scan.

Hypertrophied inferior turbinate was found in 23(57.5%) cases on nasal endoscopy while on CT scan it was reported in 28(70%) cases. Higher number was documented with CT scan due to over reporting as even mild thickening of the overlying mucosa was considered significant Turbinates are not visualised on X-ray.

Narrowing of infundibulum: In the present series narrowing of infundibulum or any associated paranasal pathology was precisely visualised on CT scan. It was seen in 25(62.5%) cases. Nasal endoscopy has its limitations in visualising paranasal sinus. This was also reflected in the study conducted by Shahizon *et al*. [13]. X-ray PNS has no role in visualising infundibulum.

Anterior and Posterior ethmoidal cells: In the present study 19 cases each (47.5%) with clouding in anterior and posterior ethmoidal cells were reported on CT scan. Limitation of endoscopy includes inability to discern the extent of disease within the ethmoidal sinus.

Agger nasi cells/ Onodi cells/ Haller cells: In the present study these were visualised on CT scan in 13(32.5%), 6(15%) and 7(17.5%) cases. These cells are types of ethmoidal cells (modified Kuhn classification) which have to be removed in order to reach the frontal sinus during FESS. Therefore a preoperative CT scan is mandatory to visualise their exact location and extent of pneumatisation. Nasal endoscopy has its limitation in detecting these hidden air cells. X-ray PNS have no role in diagnosing these hidden air cells.

Table 1: comparison of X-ray with endoscopic finding

Sr. no.	X-ray findings	Total no.	normal	Mucosal thickening	Muco-purulent secretion	Mucoid discharge	Polyp	cyst
1	Grade I	4	1	2*	1*	0	0	0
2	Grade II	9	5*	1	2	1	0	0
3	Grade III	12	5*	2*	5	0	0	0
4	Grade IV	11	3*	3	4	0	1*	0
5	Polyp	2	0	1*	0	0	1	0
6	Cyst	2	1*	0	0	0	0	1

*indicates that X-ray examination has given incorrect information. It has given incorrect information in 21cases (52.5%).

Table 2: comparison of reliability of endoscopy with x-rays

X-ray findings	Total no. Diagnosed radiologically	X-ray diagnosis in agreement with endoscopic diagnosis	%
Grade I	4	1	25
Grade II	9	4	44.45
Grade III	12	7	63.67
Grade IV	11	7	63.67
Polyp	2	1	50
Cyst	2	1	50

The above table shows X-ray diagnosis was correct in 25% cases in grade I and increased to 63.67 % in grade III and grade IV.

Table 3: Comparable parameters between endoscopy and CT Scan

Sl. No.	Parameters	Nasal Endoscopy	CT Scan	P Value
1	DNS	27	33	0.0005 Statistically highly significant
2	Nasal Polyp	16	9	
3	Hypertrophied inferior turbinate	23	28	
4	Variations in MT	14	18	
5	BE	9	8	
6	Accessory MO	19	0	

The above study concludes that CT scan has replaced conventional X-ray PNS as gold standard diagnostic modality in chronic rhinosinusitis. Nasal endoscopy is superior to CT scan in determining localised pathology such as mucosal oedema, polyp, tumour or purulent discharge and in determining functional significance of deflection and spur while CT scan is helpful in proper visualisation of paranasal sinuses, hidden air spaces and variations in middle turbinate. All the patients included in our study underwent diagnostic endoscopy followed by CT scan. On endoscopy, in addition to gross findings, subtle evidence of disease in ostiomeatal area may be identified. In some cases where it was impossible to pass endoscope beyond certain point due to the presence of gross pathology like extensive polyposis or due to severe anatomical abnormalities like a severely deviated nasal septum, paradoxical turbinate or concha bullosa, CT scan proved to be very helpful. In addition it also proved to be helpful in detection of hidden air spaces.

Advantages of diagnostic nasal endoscopy

- Optical brilliance, clear field of vision
- Easy handling ,office procedure ,economic
- Ability to look around corners with deflecting angles
- Ability to visualise structures deep in nasal cavity
- Ability to work with minimal trauma using local anaesthesia
- Ability to detect hidden disease
- Documentation and education

Disadvantages of diagnostic nasal endoscopy

- Gross septal deviation can make nasal endoscopy difficult and unrewarding
- Localised disease within infundibulum ,frontal recess is difficult to diagnose
- Optical illusory effect: due to this a beginner may find difficult to orient the anatomy especially when using different optical views.
- Depth perception is not there because of absence of binocular vision
- Extent of disease within spheno ethmoid is difficult to decipher. CT PNS can overcome this limitation

Advantage of CT scan

- It shows progressively deeper structures e.g., uncinate process, bulla ethmoidalis, ground lamella, sphenoid sinus in an anteroposterior direction.
- It shows relationship of the above structures to important areas such as lamina papyracea and skull bone
- Dehiscences of lamina papyracea are better visualised
- Comparative study of two sides of ethmoid labyrinthis possible

CT scan serves as a road map for the potentially hazardous clefts of the PNS. It is non-invasive, rapid, convenient investigation which helps in documentation and education.

CT scan delineates the extent of disease, anatomical and pathological variations far better than any other method

Disadvantage of CT scan

- Radiation dose to sensitive areas like cornea and lens is potentially high when axial cuts are taken nearly 185 times more than recorded for plane X-rays. Careful positioning of the patient in the scanner can reduce this.
- Relative expensive
- CT scan must be done to provide supplementary data to clinical and nasal endoscopic examination

CONCLUSION

Nasal endoscopy was better for assessment of localised disease like polyp, pathological secretion, condition of PNS and the ostiomeatal complex. In some cases it was impossible to pass endoscope beyond a certain point due to the presence of gross pathology there CT proved very helpful. CT scan delineates the extent of disease, anatomical and pathological variations far better than any other method.

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