A Comparative Study of Radiological (CT Scan) and Endoscopic Appearances in Chronic Sinusitis

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ABSTRACT

BACKGROUND

Chronic sinusitis is the commonest cause of patients' visit to an ENT specialist and for CT imaging of paranasal sinuses. The presenting complaints are multiple and vague, while assessment is often inadequate as sinuses cannot be examined directly. Anterior rhinoscopy provides limited information about middle meatus and ostiomeatal unit. The study is carried out with an objective to compare the radiological appearances i.e. Computed Tomography scan findings and nasal endoscopy findings in patients with chronic sinusitis.

METHODS

50 cases of chronic sinusitis which are not responding to routine medical treatment were selected and thoroughly investigated by means of CT scan, nasal endoscopy and operated after.

RESULTS

Findings of both the CT scan as well as diagnostic nasal endoscopy were compared and ultimately correlated with operative findings. Out of 50 patients, 33 underwent bilateral surgery and 17 underwent unilateral surgery, so a total of 83 surgeries were performed.

CONCLUSIONS

In our study, a high association is found between both the modalities of investigation i.e. CT scan and diagnostic nasal endoscopy with one scoring over the other in different parameters. CT scan is found to be highly sensitive for parameters like maxillary sinus, uncinate process and posterior ethmoids. Whereas diagnostic nasal endoscopy is highly sensitive for frontal recess, spheno-ethmoidal recess and hiatus semilunaris. So, a case of sinus disease should be diagnosed as early as possible using both these modalities together as they complement each other. Early diagnosis and effective management cure the pathology and prevent disastrous complications.

KEY WORDS

Paranasal Sinus Disease, CT Scan, Diagnostic Nasal Endoscopy, Middle Meatus, Ostiomeatal Unit

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BACKGROUND

During fetal development, the paranasal sinuses originate as invaginations of the nasal mucosa into the lateral nasal wall, frontal, ethmoid, maxilla and sphenoid bones.¹ Infection of sinuses is commonest cause of patients visit to the otorhinolaryngologist. It is the most common health problem that leads to visits to primary care physicians and to the otolaryngologist.² Surgical clearance of these infected paranasal sinuses with maintaining their ventilation and drainage is the main treatment. To achieve this, there should be some investigative modality which help us towards exact diagnosis and safe intervention. From few decades, both CT and endoscopy are used successfully as diagnostic modality in diseases of sinus.

Sinus disease management has been technologically enhanced in since past few years by improved imaging evaluation, methods for endoscopic visualization and understanding of etiological factors that play a part in chronic hyperplastic rhino sinusitis. CT provides necessary preoperative information for the evaluation of patients undergoing functional endoscopic sinus surgery (FESS). Main aim of CT of the sinuses is to outline the extent of the disease, define any anatomical variants and relationship of the sinuses with the adjacent vital structures. At present, CT scanning is most used imaging technique to assess chronic sinusitis and defining the anatomic abnormality. The primary role of the CT scan is to find out the extent and possibly the primary cause of sinusitis. As a rule, surgeons individualize their surgical planning according to the amount and position of disease they see on CT scan. Endoscopic techniques for Para nasal sinus operation have permitted detailed and total visualization of sinus disease while promising least distress to the patient. The telescopic view of the surgery field shows detail of the sinus anatomy and the disease. It has been possible to see the cribriform and orbital walls which are at risk to produce CSF rhinorrhoea and orbital complications during the surgery.³ At the same time, landmarks to avoid these complications can be defined to guide the surgery as seen through endoscope.

Anterior rhinoscopy gives minimal information regarding the middle meatal cleft and no information about the infundibular opening and maxillary sinus orifice. Endoscopy gives the ability to precisely access these areas for evidence of localized pathology or for anatomical defects that compromise ventilation and mucociliary clearance. Thus, endoscopy and computerized tomography (CT) have revolutionized the understanding and treatment of chronic sinusitis in recent years. Recently combined diagnostic endoscopy and systematic understanding of the lateral nasal wall with CT in the coronal plane has become the corner stone in the assessment of the PNS disease. This is the basis of the new concept of FESS. This preoperative assessment is the most important if the patient is of child group or has undergone a conventional surgery earlier. In our study we have compared the diagnostic endoscopic and CT findings with the operative findings of patients with sinus diseases.

We wanted to compare the computed tomography and endoscopic findings in patients with para nasal sinus disease.

METHODS

A prospective study of sinus pathologies using computed tomography & endoscopy conducted in the Department of Radiodiagnosis, Rajarajeswari Medical College and Hospital, Bengaluru.

Sample

Fifty patients referred to Department of Radiodiagnosis with sinusitis for more than three months not responding to the medical management and who were willing for Functional Endoscopic Sinus Surgery (FESS) were included in the study.

Inclusion Criteria

Patients presenting to Department of Radio diagnosis with proven chronic sinusitis & not responding to medical management.

Major Factors

Facial pain, nasal obstruction, discharge, discoloured postnasal drip, hyposmia/anosmia on examination and fever.

Minor Factors

Headache, raised temperature, bad breath, tooth pain, tiredness, cough and ear tenderness/pressure/fullness. Concurrent signs pertaining to sinonasal inflammation must be present on CT scan.

Exclusion Criteria

Patients who are not interested to undergo FESS, who have acute pain of sinusitis, patients with malignant sinuses and female patients who were pregnant were not included in the study.

Methods of Collection of Data

After taking detailed history taking and subjecting for examination, every patient got a computed tomography of PNS and systematic diagnostic nasal endoscopy done. A complete blood count (HB, BT, CT, TC, DC) and urine routine and microscopy, swab test for middle meatus subjecting to culture-sensitivity along with radiograph of PNS were done. All patients in active disease stage are treated with antibiotics, antihistamines and local decongestants as required. Medical management was initiated for conditions like diabetes, hypertension etc. Steroid therapy or immune therapy was not advised to any patients.

Equipment Used

Siemens Somatom Emotion 128 Slices CT, nasal endoscope with Karl Storz Hopkins rod optical along with cold light source & fibre optic light system, Karl Storz Endovision Telecam deluxe camera system with monitor under topical decongestants & anaesthetic.

Statistical Analysis

The collected data was statistically analysed using descriptive statistics, chi-square test and logistic regression analysis with the aid of statistical software SPSS 20.0 version. Findings were considered statistically significant only if the P value <0.05.

RESULTS

This study had fifty patients among which bilateral surgery was performed in 33 patients & unilateral was done on 17 patients. Thus, a total of 83 surgeries are performed.

Age Distribution

Age of patients in the study varied from 21 yrs. to 55 yrs. Maximum number of patients were in 31 to 35 years of age group, therefore 34% of cases were in early 3rd decade.

Age (Years)	No. of Patients	Percentage
21 – 25	3	6
26 – 30	10	20
31 – 35	17	34
36 – 40	10	20
41 – 45	5	10
46 – 50	3	6
51 – 55	2	4
Total	50	100

Table 1. Age Distribution

Sex Distribution

Our study showed male preponderance i.e 64% male and 36% female patients. Thus, male to female proportion was 1.8:1.

Sex	No. of Patients	Percentage
Male	32	64
Female	18	36
Total	50	100

Table 2. Sex Distribution

Symptoms

Common symptoms of the patients in our study were headache, nasal discharge and nasal obstruction. With sneezing and hawking less commonly. 84% of patients had headache, 84% had nasal obstruction, 70% had nasal discharge, postnasal discharge was seen in 44% of patients and sneezing in 30%.

Symptoms	No. of Patients	Percentage
Nasal Obstruction	42	84
Nasal Discharge	35	70
Headache/Facial Pain	42	84
Postnasal Discharge	22	44
Sneezing	15	30
Others	3	6

Table 3. Symptoms of the Patients

Diagnosis

74% of the patients in our study suffered from chronic sinusitis whereas 26% presented with bilateral nasal polyposis.

Diagnosis	No. of Patients	Percentage
Chronic Sinusitis	37	74
Gross Nasal Polyposis	13	26
Total	50	100

Table 4. Association of Diagnostic Endoscopic Findings with CT Report

Endoscopic Operative Procedures Performed

Before undergoing functional endoscopic sinus surgery every patient underwent computerized tomography (Axial and coronal cuts) through nose and paranasal sinuses and diagnostic nasal endoscopy and the results were confirmed during the operative procedure. The various operative

procedures performed in our study are as follows. Out of fifty cases, thirty-three underwent bilateral procedures whereas seventeen underwent unilateral procedure. So a total of eighty three procedures were carried out.

Correlation of Diagnostic Endoscopy Results with Computed Tomography Results

The parameters correlated in our study include middle turbinate, middle meatus, bulla ethmoidalis, hiatus semilunaris, frontal recess and sphenoethmoid recess. The sensitivity and specificity were considered for diagnostic endoscopy as compared to CT findings. Endoscopy was found to have sensitivities for frontal recess, hiatus semilunaris and sphenoethmoidal recess as 90%, 94% and 100% respectively. While sensitivity for middle turbinate, bulla ethmoidalis and middle meatus was 74%, 62% and 85% correspondingly. The sensitivity of diagnostic endoscopy for frontal recess, middle turbinate & bulla ethmoidalis found as 91%, 84% & 76% respectively & for sphenoethmoidal recess, hiatus semilunaris & middle turbinate as 80%, 53% & 67% correspondingly.

Correlation of CT Findings with OT Findings

The various parameters correlated were, middle meatus, middle turbinate, inferior turbinate, uncinate process, sphenoethmoid recess, frontal recess, maxillary sinus, frontal sinus, ethmoid sinus, sphenoid sinus and septum. The false positive, false negative, sensitivity and specificity of CT as compared to OT were calculated for each parameter. CT displayed maximum sensitivity for maxillary sinus, posterior ethmoid, Haller cell & uncinate processes which were 98%, 92%, 100% and 92% correspondingly. CT established relatively less sensitivity for parameters like infundibulum, hiatus semilunaris, frontal recess & middle meatus. The values were 60%, 77%, 88% and 89% respectively. The specificity of CT found to be best for hiatus semilunaris, Haller cells, frontal recess, inferior meatus, anterior ethmoids, posterior ethmoids & inferior turbinate. The values were 90%, 100%, 94% 97%, 90%, 98% and 96% correspondingly. CT was relatively less specific for bulla ethmoidalis, maxillary sinus, middle meatus & spheno - ethmoid recess. The values were 74%, 84%, 83% and 86% correspondingly.

Correlation of Endoscopy Findings with OT Findings

The different parameters correlated were inferior turbinate, middle meatus, middle turbinate, uncinate process, sphenoethmoid recess, frontal recess, frontal sinus, maxillary sinus, ethmoid sinus, sphenoid sinus and septum. Study showed, sensitivity of nasal endoscopy is highest for middle meatus, uncinate process, hiatus semilunaris, bulla ethmoidalis & agar nasi cell. The values were 93%, 92%, 100%, 91% & 95% respectively. The sensitivity was moderately less for sphenoethmoid recess, frontal recess, inferior meatus & inferior turbinate. The readings were 75%, 83%, 89% & 84% correspondingly. The specificity of diagnostic nasal endoscopy is greatest for hiatus semilunaris, frontal recess, agar nasi cell, inferior meatus & inferior turbinate. The values were 100%, 93%, 96%, 93% and 92% respectively. The specificity is comparatively least for middle meatus, uncinate process, bulla ethmoidalis, sphenoethmoid recess and middle turbinate. The readings are 79%, 79%, 85%, 83% and 88% correspondingly.

Correlation of Endoscopic, Computed Tomographic and Intraoperative Findings

In this study diagnostic endoscopic findings & CT findings associated were very appropriately with the operative findings, with keeping CT better than endoscopy in most of the parameters except for uncinate process, sphenoethmoid recess and Middle meatus.

DISCUSSION

Study by Kirtane MV et al (1991) ⁴ showed that the frequent symptoms were nasal discharge happening in 25 patients (78.1%), headache in 22 patients (68.7%) and nose block in 22 patients (68.7%). The additional complaints were sneezing in 6 patients (18.7%), and anosmia in 2 patients each (6.25%). The period of symptoms varied from 3 months to 30 yrs. Study conducted by Gandotra (March 2000) ⁵ the nasal discharge and headaches were the most common symptoms, and the next common symptoms were postnasal drip and nasal obstruction. The outcome of this study are comparable with all of these studies.

All patients included in this study underwent CT scan followed by diagnostic endoscopy. On endoscopy gross findings such as discharge, subtle evidence of disease in the Ostiomeatal area can be recognized. Among the parameters that were correlated, the diagnostic endoscopy found sensitive modality for the sphenethmoid recess & middle meatal area having sensitivity of 93.75%, 100% & 90% respectively, while the specificity was 53.19%, 80% and 91.71%. However, the sensitivity and specificity for the middle turbinate (74.5% and 84.4%) and middle meatus (85.18% and 67.5%) were not so good as compared to the above parameters. Significant percentage of different parameters that could not be evaluated at diagnostic endoscopy: middle turbinate, middle meatus, bulla ethmoidalis, hiatus semilunaris, frontal recess & sphenoethmoid recess. As in some of the patients it was not possible to guide the endoscope after particular level either because presence of gross pathology like extensive polyposis or due to severe anatomical abnormalities like septal deviation, paradoxical middle turbinate, or concha bullosa. CT scan positively showed to be very useful in these patients.

CT is efficient in showing predisposing causes of chronic sinusitis (eg. Anatomical variants) & gives accurate direction for endoscopic instrumentation. CT with its good ability for showing bone and soft tissues is the current diagnostic investigation of choice for imaging the Ostiomeatal units (Zinreich et al 1987)⁶. Among the various parameters that were correlated, the sensitivity was found to be good for almost all the parameters [maxillary sinus (94.30%) frontal recess (88.0%), and for the ethmoids (88.0%)]. Related observations were done by Kaluskar and Patil (1992)⁷ when they evaluated the sinus pathologies radiologically (plain x-ray and coronal CT) and intraoperatively. The specificity of CT scan was found to be optimal for the ethmoids (90.40%) & sphenoid sinus (92.30%) than for the maxillary sinus (84.20%). So CT is specific modality for the disease in most of the sinuses except the maxillary sinus & its ostium. The CT scan serves as a guide for operating surgeon as he negotiates the most sensitive, hazardous clefts of the paranasal sinus

parts. As total number of procedures that were carried out in our study were 83, all the confirmed operative findings of 83 sides were available. The endoscopy features associated well with the intra-op findings. But, the diagnostic endoscopy drawback was that there were a significant proportion of cases in whom not all the parameters could be evaluated due to presence of gross disease process or severe anatomical abnormality that made it not possible to guide the endoscope past certain point. Almost all the diagnostic endoscopic findings were confirmed at operation. The correlation between Diagnostic endoscopy and CT was calculated using Chi square test.

Chi square $\chi^2 = 77.3$

p Value $P = 1E-11$

Since $p = 1E-11$, <0.05 indicates there is a high association between diagnostic endoscopy and CT.

Advantages of CT Imaging

It shows progressively deeper structures as the surgeon encounters them during operation (e.g.: uncinate process, bulla ethmoidalis, ground lamella, sphenoid sinus, in an A-P direction). It shows the relationships of the above structures to important areas such as the lamina papyracea and skull bone, reducing the morbidity. Dehiscences of the lamina papyracea are better visualized. Comparative study of two sides of the ethmoid labyrinth is possible. Disease confined within the sinus can be visualized. CT scan serves as a guide for operating surgeon as he negotiates the most sensitive, hazardous clefts of the paranasal sinus unit. Its non-invasive, quick, suitable investigation, which helps in documentation & education. CT scan differentiates the extent of pathology, anatomical and pathological differences far better than other modalities.

Disadvantages of CT Scan

Radiation dose to the sensitive areas like cornea and lens is particularly high when axial cuts are taken – nearly 185 times more than that recorded for plain X – rays. Careful positioning of the patient in the scanner can reduce this. Incapability to distinguish fibrous tissue and inflammatory mucosal pathologies. Relatively expensive investigation. CT scan should be used to give additional clinical data to the history and help in directing surgical management to affected areas.

Advantages of Diagnostic Endoscopy

Optical brilliance and clear field of vision, easy handling, office procedure, economic, ability to “look around corners” with deflecting angles, ability to Visualize structures deep in the nasal cavity, ability to work with minimum trauma using local anaesthesia, ability to detect hidden disease, documentation and education.

Limitations of Nasal Endoscopy

Gross septal deviation can make endoscopy difficult and unrewarding, localized disease within the infundibulum, frontal recess and maxillary sinus ostium 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, gives no information regarding position and status of vital relations of spheno-ethmoids disease confined in the sinus cannot be visualized, extent of

disease within the spheno-ethmoid is difficult to be made out. CT imaging of PNS can overcome these limitations. The computed tomographic findings correlated well with the confirmed findings at operation. The coronal section CT scans provided most of the information required for an endoscopic clearance. Overall, the advantages and disadvantages of CT scans can be stated follows:

CONCLUSIONS

This study was undertaken with the purpose of comparing CT findings and findings of diagnostic endoscopic in patients with chronic sinusitis. Fifty patients affected by chronic sinusitis underwent Functional Endoscopic Sinus Surgery after being extensively evaluated by diagnostic endoscopy and CT scan. The factors affecting the drainage of various sinuses along with the state of various sinuses were as per diagnostic endoscopy, computed tomography and surgery were compared. CT scan is necessary prior to functional endoscopic sinus surgery. It helps in assessing the extent of sinus pathology & to know differences and vital associations of the paranasal sinuses. CT helps the surgeon as a "guide" during FESS.

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