



## A COMPARITIVE EVALUATION BETWEEN PRE-OP CT SCAN FINDINGS AND INTRAOPERATIVE FINDINGS IN FESS

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### ABSTRACT

**INTRODUCTION:** Chronic rhino sinusitis is one of the most common chronic diseases and affects nearly 50 million individuals every year world over. The advent of CTscan in the deliniation of the sinonasal pathology and anatomical variants has proven invaluable to the otolaryngologists in the pre-operative planning but CTscan is not always accurate in depicting the disease and anatomical variants. These discrepancies though minor, need further evaluation and correlation of CTscan findings to that of findings observed during Functional endoscopic sinus surgery.

#### OBJECTIVE:

- To correlate the preoperative computed tomography(CT) findings with operative findings in functional endoscopic sinus surgery .
- To understand the anatomical variants in patients undergoing Functional Endoscopic Sinus Surgery , preoperatively.
- To correlate the clinical diagnosis with CT diagnosis.
- Discrepancies of CT findings with operative findings.
- To establish whether CT SCAN is absolutely necessary before FESS or not.

**METHODOLOGY:** This is a prospective study carried out over a period of 2 years among those patients suffering from sinonasal pathologies who underwent FESS . The patients were investigated with pre-operative CTSCAN of Nose and PNS and during operation we compared the CTscan findings with our endoscopic findings. The comparative results were then tabulated.

**RESULTS:** Deviated nasal septum was the most common bony variation(38%) followed by concha bullosa(20%). Maxillary sinus was the most commonly involved sinus in pathology(96%) and 70% of patients showed involvement of all four sinuses. Polypoidal changes were much noticed inside the sinuses(98%) than intranasally(88%). Among disease pathology most of the cases were sinonasal polypi(74%), followed by antrochoanal polyp(6%), inverted papilloma(6%) and fungus(2%) respectively. Accessory maxillary ostium was seen in 6% of patients, orbital erosion was seen in 4% of patients and 2% patients had cribriform plate erosion.

**CONCLUSION:** Based on preoperative CT scan, the surgeon can predict the anatomical variations and pathological changes. Therefore CT scan helps the operating surgeon to execute appropriate precautions during Endoscopic Sinus Surgery.

### KEYWORDS

CT scan , Functional endoscopic sinus surgery , maxillary sinus , frontal sinus , ethmoidal sinus

### INTRODUCTION

Surgical treatment of chronic sinusitis ,heretofore, has been based on the concept that the diseased sinus mucosa should be radically removed to enable new, healthy mucosa to grow in its place. The maxillary and frontal sinuses appear to be most commonly affected in chronic sinusitis, and the most popular sinus operation in the past ,has been the Caldwell-Luc's procedure. This however often fails to give the desired long term relief from symptoms. Messerklinger's work on sinus mucosa and mucociliary transport has shown us that the pathology is not primarily in the larger sinuses but is secondary to impaired drainage caused by disease in the ethmoidal air cells blocking their natural ostia in the middle meatus. It has now been clearly demonstrated that if the ostium of the diseased Sinus<sup>1</sup> is unblocked surgically by the removal of diseased ethmoidal air cells, normal drainage and ventilation of the sinus is re-established and the diseased mucosa reverts back to normal. There is no need to remove all the diseased mucosa as formerly believed.

The two cardinal factors in the maintainence of normal physiology of the paranasal sinuses and their mucous membranes are drainage and ventilation .Normal drainage of the paranasal sinuses depends on effective mucociliary clearance; this is dependent among other things, on the condition of sinus ostia.<sup>3</sup> Mucous transport from the sinuses into the nose is greatly enhanced by unipedal nasal airflow

creating negative pressure within the nasal cavity during inspiration. The secretions of the various sinuses donot reach their respective ostia randomly but by definite pathways which seems to be genetically predetermined.<sup>2</sup>

In the past two decades ,there has been a significant shift from external and headlight sinus surgery to endoscopic sinus surgery. This dramatic change was initiated by the pioneering studies of Messerklinger in which he demonstrated that each sinus has a predetermined mucociliary clearance pattern draining towards its natural ostium irrespective of additional openings that may have been created into the sinuses. This philosophy of opening the natural ostium of the diseased sinus was then popularized by Stammberger and Kennedy. Endoscopic sinus surgery is now considered the surgical management of choice for chronic sinusitis.

In a study conducted by Daniel F .Jiannetto and Michael F. Pratt(1989-1994), the hypothesis tested that the experienced otolaryngologist ,using computed tomographic (CT) scan interpretation along with clinical correlation, can best evaluate the extent of disease and need for functional endoscopic sinus surgery(FESS).<sup>5</sup>

Functional endoscopic sinus surgery does not imply "minimalistic" treatment of sinonasal disease with incomplete operations; rather it is a

technique to deal with all areas of disease. Even thin membranous bony partitions found in areas adjacent to chronic diseases, that becomes devitalized, can be removed and normal mucosa can be preserved, wherever possible. High-resolution CT imaging has added, to more accurate diagnosis and, hence, to surgical planning. Its advent in the delineation of the sinonasal pathology and anatomic variations has proven invaluable to the Otolaryngologist in the preoperative planning. This study was done to know the impact of anatomical and radiological findings on consideration of functional endoscopic sinus surgery.<sup>10</sup>

**METHODOLOGY**

This was a prospective study of 50 patients between the time period of 2014 to 2016.

**INCLUSION CRITERIA:**

Patients presenting with history of nasal blockage, headache, anosmia, nasal bleeding.

Patients undergoing Functional Endoscopic Sinus Surgery (FESS).

**STUDY AGE GROUP—7-70 years**

**EXCLUSION CRITERIA:**

1. Children less than 5 years
2. Pregnant women
3. Patients with maxillofacial/head trauma

**Method of collection of data:**

- The cases selected for the study were subjected to detailed history and evaluation.
- Routine investigations were carried out after admission.
- The patients underwent CT scan of Paranasal sinuses in coronal, axial & sagittal cuts in the RADIOLOGY department.
- Diagnostic nasal endoscopy was carried out in most cases.

**Procedure of Endoscopic Surgery:**

The surgical technique mostly used was the Messerklinger technique as described by Stammberger.

The extent of the procedure was dictated by the extent of the disease as determined by Ctscan and intraoperative nasal endoscopy. We performed our cases under general anaesthesia after proper nasal decongestion with 1:1000000 lignocaine and adrenaline mixture.

A typical complete procedure include the following:

1. uncinectomy
2. middle meatal antrostomy
3. clearance of frontal recess and sinus
4. opening of bulla and exenteration of anterior ethmoids
5. posterior ethmoid exenteration
6. sphenoid exenteration

Following the above procedures, the findings are recorded in the proforma and CT PNS findings compared with Endoscopic findings. The results were tabulated and the various variations were analysed as a percentage of the total and reported.

**OBSERVATION AND RESULTS**

According to our study, the total number of male patients affected was 60% whereas female patients were 40%.

According to the present study, the age group most affected was between 20 to 39 years which is 46%, followed by 40 to 59 years .i.e. 34%, and the least affected was 6-19 years which is 8%.

According to our study, the commonest anatomical variant related to middle turbinate was Concha bullosa, which was found 10% in CT scan while during surgery it was found in 20% patients.

In our present study, 70% of patients had all the four sinuses affected as seen by CTscan and also during surgery, and 14% of patients had one sinus affected as seen by CTscan and 18% as seen by surgery.

In our present study, the amount of polypoidal changes was maximum seen in Maxillary sinus which is 98% in CT scan and 96% during surgery. The least affected is the Frontal sinus which is 66% in CT scan and 70% in surgery.

As per our study, Polypoidal change was most commonly found in sinuses as compared to nasal cavities, which is 98% in both CTscan and surgery. It showed great correlation between CT scan and surgery.

As per our study, the most common bony defect was found to be Deviated nasal septum/spur, which was found to be 82% in CT scan and 38% in surgery and it also showed a great discrepancy between CT scan (82%) and intraoperative (38%) findings.

In our study, the most common pathology seen was sinonasal polypi, which was 64% in CT scan and 74% in intraop findings and final histopathology. It was followed by antrochoanal polyp, which was 18% seen in CT scan and 8% seen in intraoperative findings and histopathology. It was followed by fungal lesion which was seen to be of 6% as per CT PNS and 2% as per intraoperative findings. Lastly, inverted papilloma was found to be of 6% in intraoperative findings and 2% on CT scan.

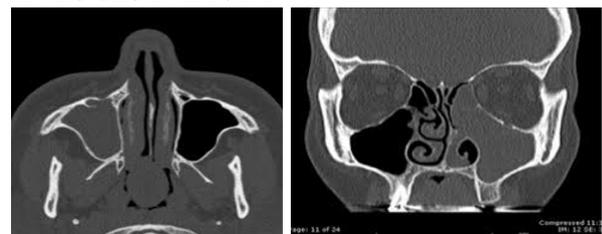
**Table: Distribution of sex and age group**

		NO. OF PATIENTS	% OF PATIENTS
Sex	Male	30	60
	Female	20	40
Age group	6-19 yr	4	8
	20-39yr	23	46
	40-59yr	17	34
	60-79yr	6	12

**Table: Distribution of middle turbinate, number of sinuses involved, polypoidal changes in sinuses, polypoidal changes, bony defects/abnormalities and type of disease**

		CT Scan	%	Fess	%
Middle turbinate	Concha bullosa	5	10	10	20
Number of sinuses involved	One	7	14	9	18
	Two	6	12	4	8
	Three	2	4	3	6
	Four	35	70	35	70
Polypoidal changes in sinuses	Maxillary	49	98	48	96
	Anterior ethmoid	41	82	41	82
	Posterior ethmoid	40	80	38	76
	Sphenoid	35	70	35	70
	Frontal	33	66	35	70
Polypoidal changes	Intranasal	46	92	44	88
	Sinuses	49	98	49	98
Bony defects/abnormalities	Deviated nasal septum/spur	41	82	19	38
	Orbital erosion	2	4	2	4
	Cribiform erosion	1	2	1	2
	Accessory maxillary ostium	1	2	3	6
Type of disease	Ethmoidal polyp	32	64	37	74
	Ac polyp	9	18	3	6
	Fungus	3	6	1	2
	Inverted papilloma	1	2	3	6

**ANTRO-CHOANAL POLYP**



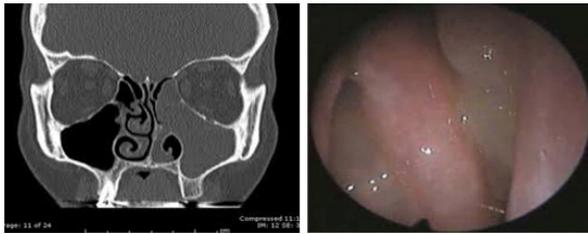
CT PNS (AXIAL VIEW)

CT PNS (CORONAL VIEW)



INTRA-OPERATIVE ENDOSCOPIC PICTURE

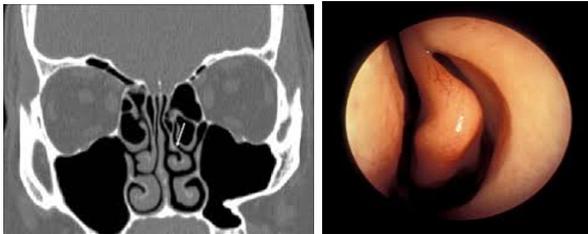
**ETHMOIDAL POLYP**



CT PNS

Intra-operative Endoscopic Picture

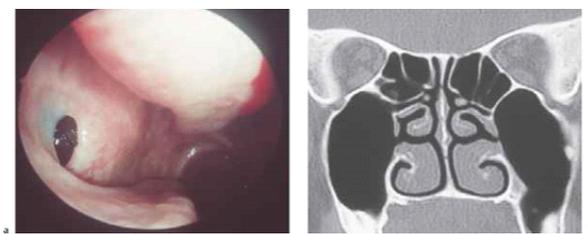
**PARADOXICAL MIDDLE TURBINATE**



CT PNS

Intra-operative Endoscopy

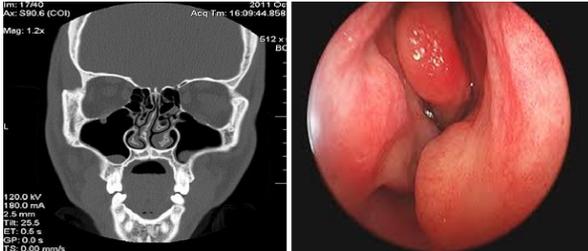
**ACCESSORY MAXILLARY OSTIUM**



Intraoperative Endoscopy

CT PNS

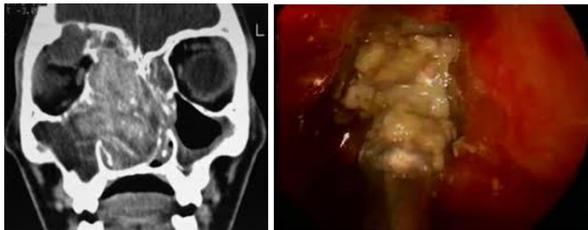
**DEVIATED NASAL SEPTUM**



CT PNS

Intra-operative Endoscopy

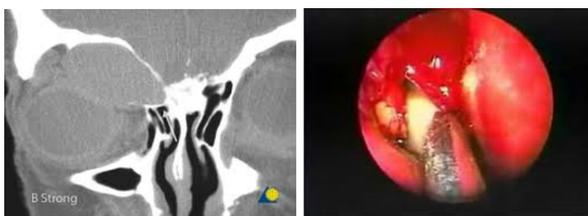
**FUNGAL SINUSITIS**



CT PNS

Intra-operative Endoscopy

**FRONTAL PYOCOELE DRAIN ENDOSCOPICALLY**



CT PNS

Intra-operative Endoscopy



**INTRA-OPFRONTAL SINUS ILLUMINATION**

**DISCUSSION**

Our observational study included 50 patients with chronic sinonasal diseases who underwent Functional Endoscopic Sinus Surgery after undergoing CT scan of the paranasal sinuses.

**AGE & SEX DISTRIBUTION**

According to Rasmi.P.R,Anil.S(2015)<sup>5</sup> prevalence of chronic sinonasal disease in males were 76.66% and females were 23.33%.In our study also males were more commonly affected and it was 60% and females were 40%.The age of the patients varied from 7-70 yrs.Common age group suffered from was 20-40yrs.

**ASSESSMENT OF CONCHA BULLOSA**

In our study,Concha bullosa was found in 20% of patients during endoscopic surgery & 10% of patients in CT scan. In a study done by Rashmi Prashant R & Anil S(2015)<sup>5</sup> concha bullosa was found to be 46.66% in CT scan & 53.33% during surgery showing a good correlation.

In a study done by Pawan Singhal & Nishi Sonkhya(2011)<sup>10</sup> concha bullosa was presumed in 54cases(18%) during endoscopy and it was observed in 48 cases(16%) during CTscan,showing a correlation of 88.88%. In a study conducted by Sheetal D ,et al<sup>7</sup> (2011) concha bullosa was seen in 35% and 42% of the patients on the right and left sides respectively in preoperative CTscan and 33% and 40% of patients on the right and left sides respectively in endoscopic surgery.

In another study done by Jones<sup>4</sup>(1995) there showed concha bullosa in 20% of patients.

As per a study conducted by J.Biswas et al(2013)<sup>8</sup> prevalence rate of Concha bullosa was 36%.As per Stammberger et al<sup>9</sup> ,the concha bullosa must be differentiated from an interlamellar cell,which arises from pneumatization of the vertical lamella of the middle turbinate from the superior meatus.Perhaps this is the reason for concha bullosa variation.

**ASSESSMENT OF POLYPOIDAL CHANGES**

In our study , polypoidal changes were more seen in the sinuses (98%),compared to nasal cavity changes(88%) intraoperatively.

According to study conducted by Rasmi.P.R,Anil.S<sup>5</sup>(2015) polypoidal changes were seen in 76.67% of patients undergoing surgery & 56.66% of patients in the preoperative CT scan in the sinuses,where as it is 46.66% during surgery & 40% in the preoperative CT scan in the nasal cavity,showing a good correlation.

According to a study conducted by Daniel F and Michael F(1995)<sup>6</sup> concurrent agreement between radiologist's CT scan findings and surgeon's operative findings for polypoidal thickening intranasally was 48.81%.

**POLYPOIDAL CHANGE IN MAXILLARY SINUS**

In our study it is found in 98% patients in CT scan and 96% during intraoperative.It showed a good correlation.

According to study conducted by Rasmi.P.R,Anil.S<sup>5</sup>(2015) they showed 50% involvement of maxillary sinus during FESS & 36.66% involvement in preoperative CT scan,but they only involved patients suffering from Chronic Sinusitis and hence might have shown difference with our present study.

According to a study conducted by Daniel F and Michael F(1995)<sup>6</sup> concurrent agreement between radiologist's CT scan findings and surgeon's operative findings for polypoidal change in maxillary sinus was 66.97%.Our study included all those patients undergoing FESS surgery and not to any particular disease process,and hence showed slight discrepancy with other studies ,but the correlation was good between CT findings and intraoperative findings.

#### POLYPOIDAL CHANGE IN FRONTAL SINUS

In our study it showed 70% patients having involvement of frontal sinus during FESS and 66% patients showing involvement in CT scan.

According to study conducted by Rasmi.P.R,Anil.S<sup>5</sup>(2015) it was found to 10% in preoperative CT scan and also in surgery showing 100% correlation.The discrepancy in results may be that our study included patients who had diffuse sinonasal polyposis in maximum patients who underwent FESS and not only Chronic sinusitis patient.

#### POLYPOIDAL CHANGE IN ANTERIOR ETHMOID

In our study it was found to be 82% of patients showing involvement during FESS and CT scan, showing a good correlation.

According to study conducted by Rasmi.P.R,Anil.S<sup>5</sup>(2015) it was found to be 40% during surgery & 43.33% in preoperative CT scan, showing a good correlation.

#### POLYPOIDAL CHANGE IN POSTERIOR ETHMOID

In our study it was found 76% patients showing involvement during FESS and 80% in preoperative CT scan.

According to study conducted by Rasmi.P.R,Anil.S<sup>5</sup>(2015) it was found in 50% patients both in preoperative CT scan & during surgery, showing a good correlation.

In a study conducted by GAS Lloyd(1991)<sup>1</sup> and William. E.Bolger (1988)<sup>3</sup> polypoidal change in posterior ethmoidal sinus was found in 28% and 32% patients respectively during surgery.

#### POLYPOIDAL CHANGE IN SPHENOID SINUS

In our study it showed involvement in 70% of patients both in CT scan and intraoperative surgery, showing a good correlation.

According to study conducted by Rasmi.P.R,Anil.S<sup>5</sup>(2015) it was found in 10% patients both in preoperative CT scan and during surgery, showing a good correlation.

In a study conducted by Sheetal D ,et al<sup>7</sup>(2011) ,in the assessment of mucosal disease through preop CT scan study,the maxillary sinus was the commonest affected (57% on right and 46% on the left),followed by the anterior ethmoid cells(40% on the right and 37% on the left),the posterior ethmoid cells(33% on the right and 28% on the left),the frontal sinus(28% on the right and 26% on the left)and, the sphenoid(20% on the right and 13% on the left) respectively. After endoscopic sinus surgery the same chronological involvement of sinuses were seen, which correlates well with our present study

Maxillary(96%),anterior ethmoid(82%),posterior ethmoid(76%),sphenoid & frontal (70%) respectively.

#### ACCESSORY MAXILLARY OSTIUM

In our study 6% of patients had accessory maxillary ostium as seen by intraoperative surgical findings & 2% of patients in preoperative CT scan.

In a study conducted by Sheetal D ,et al<sup>7</sup>(2011) the accessory maxillary ostium was found in 13% and 11% on the right and left sides respectively only during endoscopic surgery & not in preoperative CT scan.

#### NASAL SEPTAL ABNORMALITIES

Nasal septal deviation has an important role on causing sinusitis.Asymmetrical nasal septum can force nasal turbinates laterally and result in narrowing of the middle meatus and ultimately blocking drainage of the ipsilateral Maxillary,anterior ethmoid and frontal sinuses.<sup>12</sup> In a study done by Pawan Singhal & Nishi Sonkhya(2011)<sup>10</sup> 44% patients showed Deviated nasal septum/nasal spur in endoscopy whereas 50.66% patients showed Deviated nasal septum or spur in preoperative CT scan.

In a study done by J.Biswas et al<sup>8</sup>(2013) Deviated nasal septum was the most common anatomical variation with prevalence of 78%.

In our study 82% patients showed deviation or abnormality in preoperative CT scan findings whereas only 38% actually showed deviation during intra op FESS.This discrepancy might be occurred due to slight deflections seen by CT scaling whereas patient having asymptomatic minor negligible deflections or deviations seen during intra op FESS which are need not to be correctable. Moreover only correctable deviations or spurs or deflections are taken into consideration during Endoscopic surgery by surgeon.Also radiological and operative findings are not assessed by single-handed faculties hence might also be the cause of such discrepancy.

Different criteria applied to diagnose and consider septum to be deviated in different studies,accounted for variation in prevalence.

#### CONCLUSION

Computed tomography of the paranasal sinuses has improved the visualization of paranasal sinus anatomy and has allowed greater accuracy in evaluating paranasal sinus disease.Improvement in FESS and CT technology has concurrently increased interest in the paranasal region anatomy and its variations.Preoperative CT also can provide data for intraoperative stereotactic guidance systems,which are used to manage complex disease,and for revision surgery.

The radiologist must pay close attention to anatomical variants in the preoperative evaluation.It is important for surgeon to be aware of variations that may predispose patients to increased risk of intraoperative complications and help to avoid these to improve success of management strategies.

In the present study,the most frequent variation involved the nasal septum,followed by middle turbinate.Removal of the disease from Osteomeatal complex region is the basic principle of FESS which is best appreciated on CT scan.

There was good correlation between preoperative CT scan and intraoperative findings in FESS regarding involvement of different paranasal sinuses, CT diagnosis and clinical diagnosis, pneumatization of middle turbinate, polypoidal changes in the nose and sinuses,number of sinuses involved.While correlation was poor in septal variations.

To conclude,CT scan has emerged as the gold standard in preoperative diagnosis and allows for accurate patient selection for FESS.Based on preoperative CT scan,the surgeon can predict the anatomical variations and pathological changes.Therefore CT scan helps the operating surgeon to execute appropriate precautions during Endoscopic Sinus Surgery.

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