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Research Article

A correlative study of preoperative computed tomography of paranasal sinuses with intraoperative findings in functional endoscopic sinus surgery in chronic rhinosinusitis

ChandaralekhaJ[1], Anandasegarane P. [2], Shanmuganathan R.[3], SamjeeSmile[4],Stalin Sivagurunathan[5]
[1]Senior Resident, Department of ENT, Indira Gandhi Medical College & Research Institute (IGMC&RI), Puducherry, India.
[2]Chief Medical Officer, SAG, Department of ENT, Indira Gandhi Government General Hospital & Postgraduate Institute (IGGGH & PGI), Puducherry, India.
[3]Senior Medical Officer, Indira Gandhi Government General Hospital & Postgraduate Institute (IGGGH & PGI), Puducherry, India.
[4]Head, Department of Radiology, Indira Gandhi Government General Hospital & Postgraduate Institute (IGGGH & PGI), Puducherry, India.
[5]HOD IGGGH & PGI Indira Gandhi Government General Hospital and Post Graduate Institute, Puducherry, India.

*Corresponding Author
Dr. Chandaralekha J
Email: jlekhapdy@gmail.com

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Abstract: ***Introduction:*** Chronic rhinosinusitis (CRS) is a persistent inflammatory disorder of the nasal and paranasal sinus mucosa lasting more than 12 weeks. Computed tomography (CT) of the paranasal sinuses provides detailed evaluation of sinonasal anatomy, disease extent, and anatomical variations, and is essential for preoperative assessment before functional endoscopic sinus surgery (FESS). To correlate preoperative CT findings with intraoperative observations in CRS patients undergoing FESS and to document anatomical variations. **Methods:** This cross-sectional study included 60 patients with CRS at a tertiary care hospital between September 2019 and March 2021. Patients underwent clinical evaluation, diagnostic nasal endoscopy, and relevant haematological and radiological investigations. CT of the paranasal sinuses was performed, and the findings were used to plan FESS based on disease extent and anatomical variations. **Results:** Most patients were aged 51-70 years (31.7%) and were female (53.3%). Nasal obstruction (85%), discharge (65%), and postnasal drip (60%) were the most common symptoms. The maxillary and anterior ethmoid sinuses showed the highest incidence of polyposis on CT and intraoperatively. Concha bullosa (53.3% on CT, 51.6% intraoperatively) and Type I uncinate process attachment (41.7% on CT, 38.4% intraoperatively) were the most frequent anatomical variations. CT demonstrated high diagnostic accuracy for the nasopharynx (100%), maxillary sinus (100% sensitivity), and osteomeatal complex (96.7% accuracy). There was a strong correlation between CT and intraoperative findings for most anatomical structures, with sensitivity and specificity exceeding 90% for the maxillary sinus, osteomeatal complex, and uncinate process attachment. **Conclusion:** The maxillary and anterior ethmoid sinuses were the most frequently involved in CRS. Concha bullosa and agger nasi were common anatomical variations. CT findings demonstrated high concordance with intraoperative observations, especially for the osteomeatal complex and maxillary sinus, confirming its reliability for preoperative anatomical assessment in FESS.

Keywords: Chronic rhinosinusitis, Computed tomography, Functional endoscopic sinus surgery, Anatomical variations, Diagnostic accuracy

INTRODUCTION

Chronic rhinosinusitis (CRS) is a prevalent and persistent inflammatory condition affecting the mucosa of the nose and paranasal sinuses, typically lasting at least 12 consecutive weeks [1]. It has a significant impact on the quality of life of patients, leading to symptoms that can cause substantial morbidity, loss of productivity, and healthcare burden. Epidemiological studies estimate that CRS affects approximately 15% of the population, with a notable prevalence in India [2,3].

The paranasal sinuses are paired, with air-filled cavities lined with ciliated pseudostratified columnar respiratory epithelium. Anatomically, these sinuses are grouped into anterior (frontal, maxillary, and anterior ethmoid) and posterior (posterior ethmoid and sphenoid) units based on their drainage pathways. The anterior sinuses drain through the osteomeatal complex into the middle meatus, whereas the posterior ethmoid and sphenoid sinuses drain into the superior meatus and sphenoethmoidal recess. Anatomical variations in these regions are common and can influence both the development and management of CRS [4].

CRS is broadly classified into two categories: CRS with nasal polyps (CRSwNP) and CRS without nasal polyps (CRSsNP) [5]. CRSwNP is characterised by an eosinophilic, Th2-dominated inflammatory response, whereas CRSsNP typically demonstrates a Th1-dominated milieu with features such as fibrosis and goblet cell hyperplasia. The variations in clinical presentation and underlying pathophysiology highlight

the complexity of CRS and the need for individualised diagnostic and therapeutic approaches [6].

Accurate diagnosis and effective management of CRS rely on a combination of clinical evaluation and imaging techniques. The American Academy of Otolaryngology-Head and Neck Surgery recommends the use of a combination of major and minor clinical criteria for diagnosis. However, imaging, particularly computed tomography (CT), plays a crucial role in assessing the extent of disease, identifying anatomical variations, and planning surgical intervention [7].

CT scans provide detailed visualisation of sinus anatomy and pathology, surpassing the capabilities of plain radiography, and are essential for preoperative evaluation in patients considered for functional endoscopic sinus surgery (FESS) [8]. FESS, introduced by Messerklinger in 1978, revolutionised the surgical management of CRS by allowing targeted, minimally invasive intervention with the preservation of normal structures [9]. The success of FESS depends heavily on a thorough understanding of sinonasal anatomy and its variations, which are best appreciated on preoperative CT. Accurate correlation between CT findings and intraoperative observations is vital for optimising surgical outcomes and minimising complications [9,10].

Despite advances in imaging techniques, inconsistencies exist between preoperative radiological assessments and intraoperative findings of the same. This study evaluated the correlation between preoperative CT findings and intraoperative observations during FESS in patients with CRS and documented anatomical variations to improve surgical planning. This study systematically compared radiological and operative findings to enhance diagnostic accuracy and surgical safety in CRS management.

Aim of the study

This study aimed to correlate preoperative CT findings with intraoperative findings in patients with CRS undergoing FESS and to observe the anatomical variations encountered during the procedure.

MATERIALS AND METHODS

This retrospective cross-sectional study was conducted on 60 patients who presented to the ENT Department of Indira Gandhi Government General Hospital and Post Graduate Institute, Puducherry, from September 2019 to March 2021. The Institutional Ethics Committee (IEC Nos: GHSAC/2019) approved this study, and informed consent was obtained from all patients before the initiation of the study.

Inclusion criteria

Patients aged ≥18 years with clinically and radiologically confirmed CRS (symptoms ≥12 weeks) who underwent CT evaluation and FESS and provided informed consent were included.

Exclusion criteria

Patients with acute rhinosinusitis, prior sinonasal surgery, sinonasal tumours, fungal or granulomatous sinus disease, immunocompromised status, pregnancy or lactation, or incomplete records were excluded.

Detailed histories were obtained regarding symptoms of nasal obstruction, rhinorrhea, postnasal discharge, headache, facial pain/pressure, olfactory disturbances, and CRS-related symptoms, such as cough and asthma. The patients were subjected to investigations of haematological parameters and radiological evaluation. Blood samples were collected and sent for baseline haemoglobin estimation, blood grouping and typing, and cross-matching when indicated. Other relevant investigations were ordered based on clinical suspicion of a particular aetiology. The diagnosis of CRS was based on clinical history, physical findings, and diagnostic nasal endoscopy findings.

Once the patient's diagnosis was confirmed and all other comorbidities were ruled out, CT of the paranasal sinus was performed 2 weeks prior, and FESS was planned. The investigations included complete haemogram, bleeding time, clotting time, urine analysis, blood grouping and Rh typing, random blood sugar, HIV, HBsAg, HCV, diagnostic nasal endoscopy, X-ray paranasal sinus, and CT paranasal sinus(axial/coronal/sagittal) 1 mm cut with bone and soft tissue window. Intraoperative findings were documented immediately after surgery using a standardized proforma by the operating surgeon. To minimize interobserver variability, all findings were cross-verified by a second experienced ENT surgeon, and any discrepancies were resolved through consensus.

Statistical analysis

Data are presented as frequencies and percentages, and categorical variables were compared using the Pearson chi-square test. Cross tabs were created to determine sensitivity and specificity. Significance was defined by P values < 0.05 using a two-tailed test. Data analysis was performed using IBM SPSS version 21.0.

RESULTS

Table 1: Demographic, clinical, and surgical profile

		N (%)
Age (in years)	19-30	10(16.7%)

	31-40	17(28.3%)
	41-50	14(23.3%)
	51-70	19(31.7%)
Gender	Male	28(46.7%)
	Female	32(53.3%)
Symptoms	Nasal obstruction	51(85%)
	Nasal discharge	39(65%)
	Post nasal drip	36(60%)
	Anosmia/ hyposmia	15(25%)
	Headache	15(25%)
	Epistaxis	14(23.3%)
	Snoring	10(16.7%)
	Earache/ear fullness	10(16.7%)
	Facial pain	9(15%)
	Dental pain	6(10%)
	Swelling	5(8.3%)
Type of surgery	FESS	39(65%)
	SEPTO-FESS	21(35%)

FESS, Functional Endoscopic Sinus Surgery; SEPTO-FESS, Septoplasty with Functional Endoscopic Sinus Surgery.

In nasal floor evaluation, normal findings were predominant on CT-PNS (53.3%) and intraoperatively (55%), while polyps were observed in 46.7% of cases on CT and 45% intraoperatively, with a significant difference (p=0.03). The nasal septum was in the midline position in 65% of patients on CT and 61.7% during surgery, with deviation in 35% of patients. Septal perforation was absent on CT but noted in 3.3% of cases intraoperatively, showing a significant difference (p=0.05). The inferior meatus showed oedema commonly on CT (51.7%) and intraoperatively (61.7%), with mucopus in 28.3% and 25% of cases, respectively, with a significant difference (p=0.05).

The inferior turbinate appeared normal most frequently (55% on CT, 58.3% intraoperatively), followed by hypertrophy and polypoidal changes. Nasopharynx assessment showed normal appearance in 86.7% of patients and polyps in 13.3% of patients, both on CT and intraoperatively. The middle turbinate appeared normal more on CT (53.3%) than intraoperatively (45%), with polypoidal changes and hypertrophy noted in varying percentages. The osteomeatal complex showed partial occlusion most commonly (40% on CT, 43.3% intraoperatively), followed by total occlusion and normal widening. The middle meatus predominantly showed oedema on CT (63.3%) and intraoperatively (53.3%), with varying frequencies of mucopus and normal findings. The maxillary sinus showed predominant polyposis (63.3% on CT and 61.7% intraoperatively), followed by mucosal thickening and normal findings, with significant differences among all parameters (p<0.0001) (Table 2).

Table 2: Comparison of surgical findings between CT-PNS and intra-operative

		N (%)		**P-value**
		CT PNS findings	**Intra-operative findings**	
Floor of the nose	Normal	32(53.3%)	33(55%)	0.03
	Polyp	28(46.7%)	27(45%)	
Septum	Midline	39(65%)	37(61.7%)	0.05
	Deviated	21(35%)	21(35%)	
	Perforation	0	2(3.3%)	
Inferior meatus	Normal	12(20%)	8(13.3%)	0.05
	Edematous	31(51.7%)	37(61.7%)	
	Mucopus	17(28.3%)	15(25%)	
Inferior turbinate	Normal	33(55%)	35(58.3%)	<0.0001
	Hypertrophied	18(30%)	15(25%)	
	Polypoidal	9(15%)	10(16.7%)	
Nasopharynx	Normal	52(86.7%)	52(86.7%)	<0.0001
	Polyp	8(13.3%)	8(13.3%)	
Middle turbinate	Normal	32(53.3%)	27(45%)	<0.0001
	Hypertrophied	10(16.7%)	12(20%)	
	Polypoidal	18(30%)	21(35%)	
	Normal widening	15(25%)	15(25%)	<0.0001

Osteomeatal complex	Partial occlusion	24(40%)	26(43.3%)	
	Total occlusion	21(35%)	19(31.6%)	
Middle meatus	Normal	10(16.7%)	12(20%)	<0.0001
	Edematous	38(63.3%)	32(53.3%)	
	Mucopus	12(20%)	16(26.6%)	
Maxillary sinus	Normal	7(11.7%)	5(8.3%)	<0.0001
	Mucosal thickening	15(25%)	18(30%)	
	Polyposis	38(63.3%)	37(61.7%)	

CT-PNS, Computed Tomography of Paranasal Sinus. Statistical test: Pearson's chi-square test.

In the anterior ethmoidal sinus, polyposis was most common on CT (63.3%) and intraoperatively (65%). Mucosal thickening was observed in 20% of CT scans and 23.3% of intraoperative examinations, while a normal appearance was reported in 16.7% of CT scans and 11.7% of intraoperative examinations. The posterior ethmoidal sinus showed normal findings in 50% of patients on CT and 53.3% intraoperatively, with polyposis in 30% of patients on CT and 26.7% during surgery, and mucosal thickening at 20% during surgery. The spheno-ethmoid recess was normal in most patients (56.7% on CT and 53.3% intraoperatively), with mucosal thickening in 25% on CT and 30% intraoperatively, and polyposis in 18.3% on CT and 16.7% intraoperatively.

The superior turbinate was normal in 53.3% of CT and 50% of intraoperative cases, with hypertrophy in 28.4% of CT and 25% of surgical cases, and polypoidal changes in 18.3% of CT and 25% of surgical cases. The superior meatus showed normal findings in 58.3% of CT and 53.3% of surgical cases, with oedema at 28.4% in both, and mucopus at 18.3% intraoperatively versus 13.3% on CT. The sphenoid sinus was mostly normal (78.3% on CT and 80% intraoperatively). The frontal recess and sinus showed predominantly normal findings, with varying degrees of mucosal thickening and polyposis between CT and intraoperative observations, with significant differences across all findings ($p<0.0001$) (Table 3).

A strong concordance was observed between CT and intraoperative findings for key anatomical structures, with significant agreement for the floor of the nose ($p=0.03$), septum ($p=0.05$), inferior meatus ($p=0.05$), and multiple sinus regions ($p<0.0001$). Structures such as the maxillary sinus, osteomeatal complex, and anterior ethmoid sinus demonstrated both high sensitivity and specificity (≥95%) when CT findings were compared with intraoperative observations, confirming CT's reliability as a predictor of intraoperative anatomy.

Table 3: Comparison of anatomical structures between CT PNS and intraoperative findings

		N (%)		P-value
		CT PNS findings	**Intra-operative findings**	
Anterior ethmoidal sinus	Normal	10(16.7%)	7(11.7%)	< 0.0001
	Mucosal thickening	12(20%)	14(23.3%)	
	Polyposis	38(63.3%)	39(65%)	
Posterior ethmoidal sinus	Normal	30(50%)	32(53.3%)	< 0.0001
	Mucosal thickening	12(20%)	12(20%)	
	Polyposis	18(30%)	16(26.7%)	
Spheno-ethmoid recess,	Normal	34(56.7%)	32(53.3%)	< 0.0001
	Mucosal thickening	15(25%)	18(30%)	
	Polyposis	11(18.3%)	10(16.7%)	
Superior turbinate	Normal	32(53.3%)	30(50%)	< 0.0001
	Hypertrophied	17(28.4%)	15(25%)	
	Polypoidal	11(18.3%)	15(25%)	
Superior meatus	Normal	35(58.3%)	32(53.3%)	< 0.0001
	Edematous	17(28.4%)	17(28.4%)	
	Mucopus	8(13.3%)	11(18.3%)	
Sphenoid sinus	Normal	47(78.3%)	48(80%)	< 0.0001
	Mucosal thickening	6(10%)	8(13.3%)	
	Polyposis	7(11.6%)	4(6.7%)	
Frontal recess	Normal	36(60%)	35(58.3%)	< 0.0001
	Mucosal thickening	18(30%)	17(28.4%)	
	Polyposis	6(10%)	8(3.3%)	
Frontal sinus	Normal	33(55%)	30(50%)	< 0.0001

	Mucosal thickening	12(20%)	15(25%)	
	Polyposis	15(25%)	15(25%)	

CT-PNS, Computed Tomography of Paranasal Sinus. Statistical test: Pearson's chi-square test.

Concha bullosa was the most common middle turbinate variation, seen in 53.3% on CT and 51.6% intraoperatively. Paradoxical middle turbinate was found in 10% of patients on CT and 13.3% during surgery. Double middle turbinate was observed in 3.3% of patients on CT and 6.7% intraoperatively, while normal appearance was observed in 33.3% of patients on CT and 28.3% during surgery.

For uncinate process attachment, Type I was the most common (41.7% on CT, 38.4% intraoperatively), followed by Type II (20% in both). Type III was rare (3.3% CT, 5% surgery), Type IV showed 11.7% CT and 13.3% surgery, Type V appeared in 15% and 13.3%, and Type VI was the least common (8.3% CT, 10% surgery).

In frontal cells, Type I predominated (48.3% CT, 51.7% surgery), Type II was 36.7% and 33.3%, Type III was 11.7% and 13.3%, while Type IV was the rarest (3.33% CT, 1.67% surgery). Agger nasi cells were present in 41.6% of CT and 46.7% of surgically. Haller cells appeared in 10% of CT and 8.3% of surgical cases. Onodi cells were found in 15% of CT and 10% of surgical cases (Table 4).

Table 4: Comparative assessment of anatomical variants on CT-PNS and intraoperative findings

Anatomical Variants		**N (%)**		**P-value**
		CT PNS findings	**Intra-operative findings**	
Middle turbinate	Concha bullosa	32(53.3%)	31(51.6%)	< 0.0001
	Paradoxical MT	6(10%)	8(13.3%)	
	Double MT	2(3.3%)	4(6.7%)	
	Normal	20(33.3%)	17(28.3%)	
Uncinate Attachment	Type I	25(41.7%)	23(38.4%)	< 0.0001
	Type II	12(20%)	12(20%)	
	Type III	2(3.3%)	3(5%)	
	Type IV	7(11.7%)	8(13.3%)	
	Type V	9(15%)	8(13.3%)	
	Type VI	5(8.3%)	6(10%)	
Frontal Cells	Type I	29(48.3%)	31(51.7%)	< 0.0001
	Type II	22(36.7%)	20(33.3%)	
	Type III	7(11.7%)	8(13.3%)	
	Type IV	2(3.33%)	1(1.67%)	
Agger Nasi	Present	25(41.6%)	28(46.7%)	< 0.0001
	Absent	35(58.4%)	32(53.3%)	
Haller Cells	Present	6(10%)	5(8.3%)	< 0.0001
	Absent	54(90%)	55(91.7%)	
Onodi Cells	Present	9(15%)	6(10%)	< 0.0001
	Absent	51(85%)	54(90%)	

CT-PNS, Computed Tomography of Paranasal Sinus; MT, Middle Turbinate. Statistical test: Pearson's chi-square test.

Regarding the diagnostic accuracy of CT-PNS in evaluating the sinonasal anatomy and variants, the nasopharynx achieved 100% accuracy for all diagnostic indices. The maxillary sinus and Haller cells showed 100% sensitivity, NPV, and near-perfect accuracy (100% and 98.3%, respectively). The osteomeatal complex, sphenoid sinus, and frontal recess had accuracies of 96.7% to 98.3%, with sensitivity and specificity above 95%, suggesting excellent CT reliability. For the frontal sinus, the accuracy (85%) and specificity (80%) were lower, although the sensitivity remained high at 90%.

In assessing anatomical variants, uncinate process attachment showed excellent diagnostic agreement, with 96.7% accuracy, 100% sensitivity, and 94.6% specificity. Frontal cells and agger nasi performed well, with accuracy values of 96.7% and 86.7%, respectively. The Onodi cells demonstrated high specificity (100%) and NPV (98.2%), despite a lower sensitivity of 80%. Two evaluations were performed for the middle turbinate. One showed an accuracy of 91.7%, sensitivity of 100%, and specificity of 84.8%, while the other showed lower values (accuracy 86.7%, sensitivity 83.3%, specificity 88.1%) (Table 5).

Table 5: Diagnostic performance of CT-PNS compared to Intraoperative findings

	Accuracy (%)	**Sensitivity (%)**	**Specificity (%)**	**PPV (%)**	**NPV (%)**
Floor of the nose	98.3	97	96.4	100	100

Septum	96	100	91.3	94.9	100
Inferior meatus	93.3	100	92.3	66.7	100
Inferior turbinate	96.7	94.3	100	100	92.6
Nasopharynx	100	100	100	100	100
Middle turbinate	91.7	100	84.8	84.8	100
Osteomeatal complex	96.7	100	95.1	90.5	100
Middle meatus	96.7	83.3	100	83.3	96
Maxillary sinus	100	100	96.4	71.4	100
Anterior ethmoid sinus	95	100	94.3	70	100
Posterior ethmoid Sinus	96.7	93.8	100	100	93.3
Spheno ethmoidal recess	96.7	100	92.9	94.1	100
Superior turbinate	96.7	100	93.3.	93.8	100
Superior meatus	95	100	89.3	91.4	100
Sphenoid sinus	98.3	97.9	100	100	92.3
Frontal recess	98.3	100	96	97.2	100
Frontal sinus	85	90	80	81.8	88.9
Middle turbinate	86.7	83.3	88.1	75	92.5
Uncinate attachment	96.7	100	94.6	92	100
Agger nasi	86.7	89.3	100	100	91.4
Haller cell	98.3	100	98.2	83.3	100
Frontal cells	96.7	93.5	100	100	93.5
Onodi cell	98.3	80	100	100	98.2

CT-PNS, Computed Tomography of Paranasal Sinus; PPV, Positive Predictive Value; NPV, Negative Predictive Value. Diagnostic indices calculated using standard cross-tabulation.

DISCUSSION

In our study, the majority of patients were females (53.3%), and most were in the 51-70 years age group. The most common presenting symptom was nasal obstruction (85%), followed by nasal discharge (65%) and postnasal drip (60%). This aligns with the studies by Mandke et al. and Baradaranfar et al., both of which reported a female predominance and a similar age distribution [11,12]. The symptom profile described by Wani et al. and Kumarii et al. also found nasal obstruction to be the predominant complaint in CRS [13,14].

In our study, the septal deviation was observed in 35% of patients, which is similar to the 36% reported by Mandke et al. and lower than that reported by Baradaranfar et al. (45%) and Venkateswaran (62%) [11,12,15]. The strong correlation between CT and intraoperative findings in detecting septal deviation in our study supports the reliability of CT imaging, as also noted by Dua et al. (44%) [16].

In our study, inferior turbinate involvement was found in 45% of patients, which aligns with Mandke et al. (41%) but is higher than that reported by Kumari et al. (16%) [11,14]. Zojaji et al. reported a much higher involvement (66%), suggesting possible regional or population-based anatomical variations [17]. In our study, middle turbinate involvement was found in 55% of patients, similar to the study by Venkateswaran (52%) and higher than that by Zojaji et al. (14%) and Kumari et al. (20%) [14,15,17]. These results highlight the variability in turbinate pathology across different populations but confirm that CT is a sensitive modality for detecting such changes in the nasal cavity.

In our study, osteomeatal complex occlusion was observed in 75% of patients, which is comparable to that reported by Kaku et al. (70%) but higher than that reported by Firoze et al. (44%) [3,18]. This high prevalence highlights the central role of osteomeatal complex obstruction in CRS and the accuracy of CT in its detection.

In our study, maxillary sinus involvement was reported in 88% of patients, and the specificity (100%) of CT for maxillary sinus pathology was similar to that reported by Mandke et al. (85%) but lower than that reported by Firoze et al. (93%) [11,18]. This aligns with findings from Kumari et al. (80%) and supports the use of CT as a gold standard for maxillary sinus evaluation [14]. Anterior ethmoid sinus involvement was noted in 83% of cases, similar to Tandon et al. (80%), but was higher than that reported by Kumari et al. (45%) [19,14]. Posterior ethmoid sinus involvement (50%) was similar to that of Prasanth et al. (50%) but lower than that of Firoze et al. (79%) [20,18]. Sphenoid sinus involvement was the least common (21.6%), consistent with the findings of Mandke et al. (25.5%) [11].

In our study, frontal sinus involvement was observed in 45% of patients, which was higher than that reported by Mandke et al. (33.3%) [11]. The sensitivity (90%) and specificity (80%) for frontal sinus pathology in our study indicate good agreement between CT and intraoperative findings. Concha bullosa was the most common

anatomical variant, reported in 53.3% of patients, which aligns with the findings of Mandke et al. (71.11%) [11]. A paradoxical middle turbinate was observed in 13.3% of patients, similar to the findings of Prasanth et al. (26.6%) and Venkateswaran (28%) [20,15]. Agger nasi cells were present in 41.6% of patients, aligning with Dua K et al. (40%) and Baradaranfar et al. (36%) [16,12]. Haller cells were found in 10% of patients, comparable to Wani AA et al. (8.66%) and Zinreich et al. (7%) [13,21].

Our study demonstrated the high sensitivity, specificity, and accuracy of CT-PNS in evaluating sinonasal anatomy and pathology, particularly for the maxillary sinus, osteomeatal complex, and anatomical variants. These findings are consistent with those of previous studies, confirming CT-PNS as a reliable preoperative tool.

CONCLUSION

Our study concluded that the maxillary sinus was the most frequently involved paranasal sinus, followed by the anterior ethmoid sinus. Concha bullosa was the most common anatomical variation on CT PNS, with agger nasi being the second most frequent. Type I was the most common uncinate process attachment based on the Landsberg and Friedman classification. The high correlation between CT and intraoperative findings in this study confirms CT's value as a precise preoperative mapping tool for FESS, enabling accurate identification of sinonasal anatomy and disease extent while potentially reducing complications. Both endoscopy and CT scans complement each other in evaluating osteomeatal complex anatomy and sinus pathology, improving surgical outcomes, and minimising complications.

Conflict of interest: The authors declare that they have no conflict of interest.

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