UTTAR PRADESH JOURNAL OF ZOOLOGY

42(24): 50-56, 2021
ISSN: 0256-971X (P)

HRCT IN PARA-NASAL SINUSES STUDIES

TAMBOLI ASIF [a], LUHANA MANISHA [a*], SHAHA PRAMOD [a], BHOITE AMOL [a] AND GAUTAM AMOL [a]

[a] Department of Radiology, Krishna Institute of Medical Sciences, KIMSDU, Karad, India.

AUTHORS' CONTRIBUTIONS

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

Article Information

Editor(s):
(1) Dr. Moses Okpeku, University of Swaziland, Swaziland.
Reviewers:
(1) Swati Tandon, Delhi University, India.
(2) Dibyajyoti Talukdar, Central Agricultural University, India.
(3) Huynh Tan Hoi, FPT University, Vietnam.

Received: 25 September 2021
Accepted: 01 December 2021
Published: 06 December 2021

Original Research Article

ABSTRACT

Para-nasal sinuses cover many situations which may range from inflammatory to neoplasms. The sinuses that we are mentioning here are in closely anatomically connected with the orbit and the cranial fossa too. Therefore, early participation of these sectors is an important feature. Since the clinical evaluation is deprivation of the surrounding bone structures, clinical radiology is of vital importance.

Objective: To evaluate role of Computed Tomography in correlation with clinical finding in assessing the severity of nasal and para-nasal diseases.

Materials and Methods: The study was conducted in the department of Radio Diagnosis, Krishna Institute of Medical Sciences and Hospital. All the patients referred to the department of Radio diagnosis with suspected or diagnosed with pathologies of para-nasal sinus was first evaluated with plain film followed by Computed Tomography evaluation.

Results: Maximum number of patients had sinonasal polyposis pattern 31 (70.45%) followed by infundibular6 (13.63%), osteomeatal unit 3 (6.81%),sporadic 3 (6.81%)and least was spheno ethmoid recess pattern1 (2.27%) of patients.

Conclusion: the correlation of anatomical computed tomographic CT abnormalities such as concha bullosa and Deviated nasal septum DNS in the causation of Para- Nasal Sinus PNS disease cannot be emphasized without the control group.

Keywords: Nasal cavity; para-nasal disease; pathology; para-nasal sinuses; computed tomography.

1. INTRODUCTION

Pathological lesions the para-nasal sinuses cover a wide range of conditions going from fiery to neoplasms, including both amiable and dangerous [1–2]. These sinuses are in close physical association with the circle and the cranial fossa. The early contribution of these districts is accordingly a

**Corresponding author: Email: luhanamanisha@outlook.com;*

significant element [3–4]. Since clinical assessment is decisive of encompassing hard designs, indicative radiology is of most extreme significance. Though customary plain radiography exhibits maxillary and front facing sinus illness, they give restricted perception of the foremost ethmoid cells, the upper 66% of the nasal cavity, and the front facing break [5–6]. CT imaging gives nitty gritty data of the para-nasal sinus and is currently grounded as an option in contrast to standard radiographs [7]. Direct coronal examining and sagittal reproduction imaging space-involved injuries have been upset presently with one of a kind capacity of CT to picture the two bones and delicate tissues. Exact portrayal of illness and infinitesimal anatomic status gives a solid preoperative guide for endoscopic sinus medical procedure. CT is hence of most extreme significance and gives standard imaging of para-nasal sinus infections [8–9]. Samuel (1963) stated that radio-logically, opaque maxillary sinus is to be regarded as the sign and not as definitive diagnosis, as an opacity in the region of maxillary sinus could be of anatomical, technical or pathological nature. He further described the occipito-mental projection as the best suited one for the evaluation of the state of maxillary sinus. Hounsfield and Ambrose devised computerized tomography in 1960's [10].

Hippocrates in the 5th century BC said "one who has a headache, a severe headache, pus or fluid flowing from the nose carries away the disease", referred to as describing sinusitis. can go. Leonardo da Vinci (1452-1519) gave an accurate description and illustration of the antrum and frontal sinus [11].

In 1895, Wilhelm Konard Roentgen discovered X-rays. Scheer (1897) first diagnosed the presence of pus in the sinus by radiography and confirmed the diagnosis by lavage. Killen and Mosher (1929) published the radiological basis in the diagnosis of chronic maxillary sinusitis. They concluded that it is caused by the accumulation of an opaque antrum fluid on the X-ray film, which is immobilized in free or thickened mucosa [12].

Objective of the Study: To evaluate role of Computed Tomography in correlation with clinical finding in assessing the severity of nasal and para-nasal diseases.

2. METHODOLOGY

The study was conducted in the department of Radio Diagnosis, Krishna Institute of Medical Sciences and Hospital, Karad. All the patients referred to department of Radio diagnosis with suspected or diagnosed with pathologies of para-nasal sinus had been first evaluated with plain film followed by Computed Tomography evaluation. The patients had then be followed up with histopathological correlation.

2.1 Procedure

All the patients who fulfill the inclusion criteria had been advised to undertake computed tomography (CT) .

2.2 Selection Criteria

2.2.1 Inclusion criteria

-All the patients with clinically suspected para-nasal sinus diseases.

2.2.2 Exclusion criteria

- All other lesions mimicking para-nasal sinus diseases.
- Patient with contrast allergy.
- Patients with renal impairment in which contrast study is not possible.
- Patients with history of trauma.

2.3 Methods of Data Collection

- After obtaining clinical history relevant clinical examination was done.
- With relevance to clinical diagnosis laboratory investigations were asked for.
- Then patients underwent CT PNS.
- Contrast was given whenever required.

CT PNS

- Scans were performed with 16 slice MDCT scanner.

Technique

Patient Position: Supine Angulation was done in prone position only in case of CSF rhinorrhea.
Thickness: 0.75 mm for both coronal & axial sections. 5 mm are taken at osteomeatal unit on coronal sections.
Extent: Coronal – posterior margin of sphenoid sinus to anterior margin of frontal sinus Axial – hard palate to upper margin of frontal sinus

If necessary extended beyond above mentioned extent as required.

Exposure: 130 kVp , 80 mAs, scan time depends on area covered

It is to be noted that Kernel-H70 (sharp) is for bone window to visualize sinus and Kernel-H30 (medium/smooth) is for mucous.

Contrast agent: 60 mL of the iodinated contrast agent OMNIPAQUE (containing 350 mg iodinated non-ionic water-soluble) was used when estimation of the serum creatinine level followed by a single intravenous bolus injection of 300 mg/kg of weight calculated . Data is analyzed using statistical software R version 4.0.2 and Microsoft Excel. There were 44 subjects in the sample. Categorical variables are given in the form of frequency table. Diagnosing capacity of Clinical and CT diagnosis over histopathological diagnosis compared with sensitivity, specificity, NPR and PPR. P-value less than or equal to 0.05 indicates statistical significance.

3. RESULTS

Table 1 represents the distribution of age and gender of the population taken for study.

Maximum patients were in the age group of 21-30 years. Average of age in the study observed as 45.65±19.19 years. There were 21 (47.72%) females and 23 (52.27%) males in the study. Following plots summarizes the above table.

In the present study, a total of 2 cases are seen arising from the structures adjacent to the PNS. 1 case of Juvenile nasopharyngeal angiofibroma originating from the Right nasopharynx was seen extending into the Right Maxillary sinus, Sphenoid and post Ethmoid sinus. One case of Inverted papilloma arising from the Left nasal cavity was seen extending into left maxillary sinus.

From above Tables (11 a & b), it was observed that diagnostic accuracy of CT diagnosis was good compared to clinical diagnosis. Accuracy, Kappa coefficient was significantly more for CT diagnosis compared to clinical diagnosis. CT diagnosis had perfect agreement with final diagnosis.

4. DISCUSSION

Recently CT has become the best diagnostic method for the evaluation of the nasal cavity, para-nasal sinuses and for the performance of various sinonasal diseases [13]. Acute sinus infection is diagnosed by clinical evaluation, whereas, sinus disease refractory to medical therapy is diagnosed by CT [14]. Previous studies showed poor correspondence of plain X-rays with CT. Plain films are no longer routinely indicated for the evaluation of para-nasal sinus disease. CT

Table 1. Distribution of age and gender in the study

Variables		Number of subjects (%)
Age (in years)	≤ 20	2 (4.54%)
	21-30	13 (29.54%)
	31-40	6 (13.63%)
	41-50	4 (9.09%)
	51-60	8 (18.18%)
	≥ 61	11 (25%)
Gender	Female	21 (47.72%)
	Male	23 (52.27%)

Table 2. Distribution of complaints in the study

Variables	Number of subjects (%)
Nasal obstruction	13(28.88%)
Headache	10 (22.22%)
Nasal blockage	9 (20%)
Nasal discharge	3 (6.66%)
Nasal discharge and headache	2 (4.44%)
Epistaxis	1 (2.22%)
Swelling	1 (2.22%)
Swelling and nasal discharge	1 (2.22%)
Headache and pain	1 (2.22%)
Nasal blocking and sneezing	1 (2.22%)
Nasal obstruction and headache	1 (2.22%)
Pain and swelling	1(2.22%)

Most of the patients had Nasal obstruction (28.88%) followed in decreasing order Headache (22.22%) and nasal blockage (20%)

Table 3. Distribution of CT findings in the study

Investigations		Number of subjects (%)
DNS	Left	8 (18.18%)
	Right	13 (29.54%)
	Center	23 (52.27%)
	Total	21 (47.7%)
Concha Bullosa	Bilateral	4 (9.09%)
	Left	4 (9.09%)
	Right	5 (11.36%)
	Total	13 (29.54%)
Osteomeatal unit	Normal	16 (36.36%)
	Blocked	28 (63.63%)
	Total	28 (63.63%)

DNS was seen in 21 (47.72%) patients. Concha bullosa was noted in 13 (29.54%) patients with unilateral right predominance. OMU obstruction was observed in 28 (63.63%) patients.

Table 4. Distribution of sinus diseased in the study

SINUS		Number of subjects (%)
Maxillary	Normal	3 (6.81%)
	Right	6 (13.63%)
	Left	8 (18.18%)
	Bilateral	27 (61.36%)
	Total	41 (23.16%)
Anterior ethmoid	Normal	3 (6.81%)
	Right	7 (15.91%)
	Left	10 (22.72%)
	Bilateral	24 (54.54%)
	Total	41 (23.16%)
Posterior ethmoid	Right	6 (13.63%)
	Normal	9 (20.45%)
	Left	10 (22.72%)
	Bilateral	19 (43.18%)
	Total	35 (18.64%)
Frontal	Right	6 (13.63%)
	Left	9 (20.45%)
	Normal	13 (29.54%)
	Bilateral	16 (36.36%)
	Total	31(17.51%)
Sphenoid sinus	Right	6 (13.63%)
	Left	10 (22.72%)
	Normal	13 (29.54%)
	Bilateral	15 (34.09%)
	Total	31 (17.51%)

Most common diseased sinus was maxillary sinus and Anterior ethmoid, followed in decreasing order were posterior ethmoid, frontal and sphenoid sinuses

Table 5. Distribution of CT severity grading in the study

CT Severity	Number of subjects (%)
Grade 1	22 (50%)
Grade 2	8 (18%)
Grade 3	5 (11%)
Grade 4	9 (21%)

CT severity was assessed in 44 patients who had inflammatory diseases. Maximum number 22 (50%) of patients had grade 1 severity and grade 4 severity was found in number 9 (21%) of patients

Table 6. Distribution of bone involvement in the study

BI	Number of subjects (%)
No	19 (43.18%)
Yes	25 (56.81%)

Out of 44 patients, Bone involvement was seen in 25 (56.815) patients in the form of thinning, erosion or destruction

Table 7. Distribution of pattern in the study

Pattern	Number of subjects (%)
Spheno ethmoid recess	1 (2.27%)
Sporadic	3 (6.81%)
Osteomeatal unit	3 (6.81%)
Infundibular	6 (13.63%)
Sino nasal polyposis	31 (70.45%)

Maximum number of patients had sinonasal polyposis pattern 31 (70.45%) followed by infundibular6 (13.63%),osteomeatal unit 3 (6.81%),sporadic 3 (6.81%)and least was spheno ethmoid recess pattern1 (2.27%) of patients

Table 8. Distribution of Lundmackay scores in the study

LMKS	Number of subjects (%)
≤ 5	10 (22.72%)
6-10	14 (31.81%)
11-15	8 (18.18%)
16-20	8 (18.18%)
≥ 21	4 (9.09%)
Mean ± SD	10.95±6.07

Maximum number 14 (31.815%) of patients had Lund-Mackey scores between 6-10 and minimum number 4 (9.09%) of patients had scores between ≥ 21

Table 9. Neoplastic Diseases arising from adjacent structures with extension to PNS (n= 05)

	Type of tumor	Sinus Extension		Number
		From	To	
1	Inverted Papilloma	Lt Nasal cavity	Lt Maxillary sinus.	1
4	Juvenile nasopharyngeal angiofibroma	Rt nasopharynx	Rt Maxillary sinus Rt Sphenoid Rt post Ethmoid	1

Table 10. Comparison of findings of Clinical, CT and final diagnosis

	Number of Clinical Diagnosis(%)	Number of CT Diagnosis (%)	Number of Final Diagnosis(%)
Chronic sinusitis	34 (77.27%)	12 (27.27%)	12 (27.27%)
Polyp	5 (11.36%)	10 (22.73%)	10 (22.73%)
Fungal sinusitis	2 (4.55%)	9 (20.45%)	9 (20.45%)
Others	3 (6.82%)	13 (29.55%)	13 (29.55%)

Table 11a. Correlation between clinical and CT diagnosis

Parameters	True positive	False positive	False negative	True negative
Chronic Sinusitis	12	22	0	10
Polyp	4	1	6	33
Fungal sinusitis	2	0	7	35
Others	2	1	11	30

Table 11b. Correlation between clinical and CT diagnosis

Parameters	Sensitivity	Specificity	PPR	NPR	Accuracy	Kappa	p-value
Chronic Sinusitis	100	31	35	100	50	0.24	0.04479
Polyp	40	97	80	85	84.09	0.45	0.02844
Fungal sinusitis	22	100	100	83	84.09	0.31	0.1277
Others	15	97	67	73	72.72	0.18	0.2192

Abbreviations: PPR: Positive predictive value; NPR: Negative predictive value

This study was performed to evaluate pathological lesions of the para-nasal sinuses by CT. 44 patients were evaluated with CT who were referred after clinical examination and then some of them with HPE findings. The age of patients in the present study was between 16–78 years which was consistent with the study conducted by Glicklich RE et al. The maximum number of patients was between 21–30 years old. The mean age in the study was observed to be 45.65 ± 19.19 years.

Patients presenting with symptoms were recorded during clinical examination. The most common symptom was nasal obstruction in 13 patients consisting of 28.8 %, followed by headache and nasal blockage. The least common symptom was nasal discharge and swelling in face .The other symptoms with which they presented were epistaxis, facial pain, and sneezing [15].

5. CONCLUSION

This study evaluated only symptomatic patients and, therefore, there is no association between symptomatic and asymptomatic patients. Furthermore, the correlation of anatomical CT abnormalities such as concha bullosa and DNS in the causation of PNS disease cannot be emphasized without the control group. This study proved the superiority of CT evaluation over clinical evaluation of symptomatic patients for diagnosis and planning of management in para-nasal sinus diseases. Its importance lies in its ability to detect bone erosion. It is now increasingly used as a complement to sinus endoscopy to evaluate areas that are ophthalmic tondoscopy.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

1. Garg D, Mathur K. Clinico-pathological study of space occupying lesions of nasal cavity, para-nasal sinuses and nasopharynx. Journal of clinical and diagnostic research: JCDR. 2014;8(11):FC04.
2. Batsakis JG. The pathology of head and neck tumors: nasal cavity and para-nasal sinuses, part 5. Head & neck surgery. 1980;2(5): 410-9.
3. Parajuli S, Tuladhar A. Histomorphological spectrum of masses of the nasal cavity, para-nasal sinuses and nasopharynx. Journal of Pathology of Nepal. 2013;3(5):351-5.
4. Sutar, H. B. (2015). Clinicopathological Study of Nasal Polypoidal Masses.
5. Zafar U, Khan N, Afroz N, Hasan SA. Clinicopathological study of non-neoplastic lesions of nasal cavity and para-nasal sinuses. Indian journal of pathology and microbiology. 2008;51(1):26.
6. Swami SV, Birare SD, Dalve KT, Korade S. Clinicopathological study of non-neoplastic and neoplastic sinonasal lesions. Journal of Diagnostic Pathology and Oncology. 2017;2(2):40-3.
7. Rawat DS, Chadha V, Grover M, Ojha T, Verma PC. Clinico-pathological Profile and management of sino-nasal masses: A prospective study. Indian Journal of Otolaryngology and Head & Neck Surgery. 2013;65(2):388-93.
8. Miłoński J, Pietkiewicz P, Urbaniak J, Olszewski J. Unilateral pathological lesions of para-nasal sinuses removed by endoscopic surgery. Otolaryngologia Polska. 2014;68(2):83-8.
9. Zafar U, Khan N, Afroz N, Hasan SA. Clinicopathological study of non-neoplastic lesions of nasal cavity and para-nasal sinuses. Indian journal of pathology and microbiology. 2008;51(1):26.
10. Bassiouny A, Newlands WJ, Ali H, Zaki Y. Maxillary sinus hypoplasia and superior orbital fissure asymmetry. The Laryngoscope. 1982;92(4):441-8.
11. Gerrits PO, Veening JG. Leonardo da Vinci's A Skull Sectioned": Skull and dental formula revisited. Clinical Anatomy. 2013;26(4): 430-5.
12. Rosenbusch GE, VAN EEKELEN AD. Wilhelm Conrad Röntgen. Springer International Publishing; 2019.

13. Hussein AO, Ahmed BH, Omer MAA, Manafal MF, Elhaj AB. Assessment of clinical, X-Ray and CT in diagnosis of paranasal sinus diseases. Int J of Sci Res. 2014;3:7-11.
14. Cady RK., Dodick DW, Levine HL, Schreiber CP, Eross EJ, Setzen M, Durham PL. Sinus headache: a neurology, otolaryngology, allergy, and primary care consensus on diagnosis and treatment. In Mayo Clinic Proceedings. 2005;80(7):908-916. Elsevier.
15. Kacha S, Guillemin F, Jankowski R. Development and validity of the DyNaChron questionnaire for chronic nasal dysfunction. European Archives of Oto-Rhino-Laryngology. 2012;269(1):143-153.