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Role Of Computed Tomography In The Evaluation Of Paranasal Sinuses Pathologies

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ABSTRACT

Background: Paranasal sinuses are hollow spaces around the nasal bones, categorized into frontal, maxillary, ethmoid, and sphenoid sinuses. Computed tomography (CT) plays a significant role in diagnosing paranasal sinus pathologies. Imaging techniques like NCCT, CECT, and HRCT offer detailed anatomical visualization, aiding in detecting lesions and physiological abnormalities.

Objective:

- To identify paranasal sinus pathologies using computed tomography.
- To assess the diagnostic accuracy of CT imaging in detecting anatomical variations and pathological lesions in the paranasal sinuses.
- To identify the spectrum of paranasal sinus pathologies prevalent in a specific population using CT.
- To evaluate the correlation between clinical symptoms and CT findings in patients with paranasal sinus complaints.
- To determine the most commonly affected age group and gender in cases of paranasal sinus pathologies based on CT findings.

Method: A prospective study was conducted in the Department of Radio-Diagnosis, SGT Hospital, Gurugram, from October 2022 to March 2023. Thirty-nine patients of all age groups presenting with paranasal sinus complaints underwent radiological evaluation using CT.

Results: Among the 39 patients studied, 21 distinct pathologies were identified. The age group 21–40 years was the most affected (56.4%). Maxillary sinusitis was the most common pathology (38%), followed by anatomical variations like deviated nasal septum (57.1%).

Conclusion: The correlation between clinical symptoms and CT findings highlights the utility of CT scans in understanding patient complaints and diagnosing underlying conditions. CT provides superior visualization of bony structures, making it an essential diagnostic tool for evaluating paranasal sinus pathologies.

Keywords: Paranasal sinuses, Computed tomography, Maxillary sinus, Pathologies.

INTRODUCTION

Paranasal sinuses are air-filled cavities surrounding the nasal cavity. These include the frontal, maxillary, ethmoid, and sphenoid sinuses. Anatomically, the sinuses are located within the bones of the face and skull, each serving specific physiological functions such as reducing skull weight, resonance of voice, and immune response. Sinusitis, characterized by inflammation or infection of these cavities, presents symptoms such as headache, facial discomfort, and nasal obstruction. General radiography is often used for diagnosing sinus pathologies due to its availability and cost-effectiveness but lacks detailed three-dimensional visualization. Computed tomography (CT) has emerged as the gold standard for evaluating paranasal sinus diseases. CT provides high-resolution images, allowing precise assessment of anatomical variations, sinus opacifications, and osseous abnormalities. The present study aims to evaluate paranasal sinus pathologies using CT imaging, correlating clinical symptoms with radiological findings.

MATERIAL & METHODS

Study Design: Prospective study
Duration: October 2022 – March 2023
Setting: Department of Radio-Diagnosis, SGT Hospital, Gurugram
Sample Size: 39 patients of all age groups presenting with paranasal sinus complaints

All patients underwent NCCT, CECT, or HRCT scans for evaluation. Demographic data, clinical symptoms, and radiological findings were recorded and analysed.

RESULT

1. Age Distribution

The majority of patients (56.4%) were aged 21–40 years, followed by 1–20 years (33.3%). The remaining participants were aged 41–60 years and 61–80 years (5.1% each).

Age Group (Years)	Number (N)	Percentage (%)
1–20	13	33.3
21–40	22	56.4
41–60	2	5.1
61–80	2	5.1
Total	**39**	**100%**

2. Gender Distribution

Male participants constituted 66.6% (26 patients), with a male-to-female ratio of 2:1.

Gender	Number (N)	Percentage (%)
Male	26	66.6
Female	13	33.3
Total	**39**	**100%**

3. Clinical Complaints

Patients presented with various symptoms, including nasal obstruction (23%), nasal blockage (28.2%), and nasal bleed (10.2%).

Complaint	Number (N)	Percentage (%)
Nasal Obstruction	9	23
Nasal Blockage	11	28.2
Shortness of Breath	2	5.1
Nasal Bleed	4	10.2
Headache	2	5.1
RTA	1	2.5
Others	10	25.6

4. Pathologies Detected

A total of 21 pathologies were identified. The most common findings included deviated nasal septum (57.1%), maxillary sinusitis (38%), and hypertrophy of the inferior turbinate (33.3%).

Pathology	Number (N)	Percentage (%)
Deviated Nasal Septum (DNS)	13	57.1
Maxillary Sinusitis	8	38
Hypertrophy of Inferior Turbinate	7	33.3
Pansinusitis	5	23.8
Sinonasal Polyp	4	19
Sphenoid Sinusitis	4	19
Other Findings	21 pathologies in total	

DISCUSSION

Anatomical Considerations and Variations

The anatomy of the paranasal sinuses is complex, with significant variability among individuals. Stammberger and Kennedy (1995) emphasized the importance of standardized anatomical terminology for clinical and surgical applications, facilitating precise communication among specialists【6】. These sinuses, including the maxillary, frontal, sphenoid, and ethmoid, vary in size, shape, and pneumatization, as highlighted by Özer et al. (2018), who found differences based on age, gender, and cephalometric indices【3】.

Role of Computed Tomography in Evaluation

CT imaging has become the gold standard for evaluating paranasal sinus pathologies due to its high-resolution depiction of bony anatomy and soft tissue structures. Cashman et al. (2011) emphasized the preoperative importance of CT in functional endoscopic sinus surgery (FESS), noting its ability to identify anatomical variations and pathological changes【4】. Studies by Kanwar et al. (2017) and Usmani et al. (2022) further demonstrated the correlation between CT findings and histopathological results, validating its diagnostic accuracy in conditions such as chronic rhinosinusitis and sinonasal polyposis【7】【12】.

Advancements in Surgical Techniques

Advancements in surgical technology, such as the development of handheld flexible manipulators for frontal sinus surgery by Coemert et al. (2020), have improved access and precision during minimally invasive procedures【2】. The use of CT imaging for preoperative planning ensures the safe navigation of these devices in anatomically complex regions.

Clinical Implications and Pathological Insights

CT imaging not only aids in the diagnosis of sinus diseases but also plays a crucial role in understanding the pathophysiology of various conditions. For instance, Varshney et al. (2016) demonstrated the significance of CT in assessing anatomical variations in patients with sinonasal polyposis【9】. Similarly, Sharma et al. (2015) and Rudrawadi & Ragupathi (2021) highlighted the utility of CT in evaluating both inflammatory and neoplastic lesions, offering insights into disease progression and treatment outcomes【8】【11】.

Volume Assessment and Research Innovations

The study by Przystańska et al. (2018) introduced a simplified method for maxillary sinus volume assessment based on linear dimensions, paving the way for easier morphometric analyses【6】. These innovations contribute to more personalized treatment strategies, especially in surgical planning and reconstructive procedures.

CONCLUSION

CT imaging plays a pivotal role in the evaluation of paranasal sinus pathologies, offering precise and detailed visualization of anatomical structures. CT imaging remains an indispensable tool, offering detailed insights into sinus anatomy, pathology, and surgical planning. It significantly enhances the correlation between clinical symptoms and radiological findings, ensuring effective diagnosis and management of sinus-related disorders. Continued research and technological advancements promise to further refine our approach to these clinically significant structures.

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