Frequency and Predictors of Incidental Sinonasal Abnormalities Diagnosed on Brain Computed Tomography Scans

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ABSTRACT

Background: CT scan of nasal sinus is the gold standard test in diagnosing Sino-nasal abnormalities[3] which has the advantage of being able to show fine anatomic detail in serial tomographic sections. Indeed, CT scan of sinuses reinforces the clinical diagnosis in suspected Sino-nasal diseases. It presents as a confirmatory method to plan systematic medical and surgical treatment.

Objective: The purpose of the study is to determine the frequency of incidental Sino-nasal abnormalities on brain computed tomography scans and to determine the predictors of incidental Sino-nasal abnormalities on brain CT scans.

Methodology: This case control study was conducted at Department of Radiology, Teaching Hospital, University of Lahore, Lahore. The sample size of 374 was estimated by using 95% confidence level with 5% margin of error and taking an expected percentage of incidental Sino-nasal abnormalities as 59.97%. Frontal, maxillary, sphenoidal and ethmoidal sinuses were focused. Coronal and sagittal reconstructed images were reviewed where necessary. Presence of air‑fluid levels or mucosal thickening was regarded as positive findings.

Results: The data consisted of 374 patients. The data was gathered from both males and females, 47% (176 patients) population was male whereas 52.9% (198 patients) was female. Mean age $\pm$ S.D of the participants was 48.25$\pm$ 21.28. Out of 374 participants 31.6% (118 participants) population had Sino-nasal abnormality whereas remaining 68.4% (256 participants) population had no Sino-nasal abnormality.

Conclusion: Incidental Sino-nasal abnormalities were infrequent. The participants of all ages showed presence of Sino-nasal abnormalities, maxillary sinusitis being the commonest of all.

Keywords: Sinusitis, Incidental, Prevalence, Maxillary

INTRODUCTION

Sino-nasal abnormalities included a wide range of abnormalities. A wide range of abnormalities account for Sino-nasal abnormalities including acute and chronic and fungal sinusitis, polyps, neoplasm and neoplasm like masses, rhinitis, rhinosinusitis (chronic, allergic and vasomotor). Sino-nasal abnormalities are one of the most common incidental findings on Computed Tomography (CT) scans i.e. 30.9%.[1] In Pakistan the prevalence of sinusitis among patients with ear nose and throat (ENT) complaint is 65%.[2]Radiological imaging plays an important role in diagnosis, treatment choice, follow-up, and surgical planning of different paranasal sinus abnormalities.[3] Though plain X-ray is often used to investigate Sino-nasal abnormalities, Computed tomography (CT) and Magnetic Resonance Imaging (MRI) are more sensitive to diagnose different Sino nasal abnormalities.[4, 5]CT scan of nasal sinus is the gold standard test in diagnosing Sino-nasal abnormalities[3] which has the advantage of being able to show fine anatomic detail in serial tomographic sections. Indeed, CT scan of sinuses reinforces the clinical diagnosis in suspected Sino-nasal diseases. It presents as a confirmatory method to plan systematic medical and surgical treatment.[6] The purpose of the study is to determine the frequency of incidental Sino-nasal abnormalities on brain computed tomography scans so that Sino-nasal findings could be added to the regular reporting of brain CT scan. The study was further extended to determine the predictors of incidental Sino-nasal abnormalities on brain CT scans so that the radiologists have raised awareness about possible incidental Sino nasal findings.

MATERIAL AND METHODS

This case control study was conducted at Department of Radiology, Teaching Hospital University of Lahore, during from the period 4/3/2020 to 4/11/2020. The sample size of 374 was estimated by using 95% confidence level with 5% margin of error and taking an expected percentage of incidental Sino-nasal abnormalities as 59.97%[7]. The non-probability consecutive sampling was used to collect sample. Inclusion criteria for the study were as follows; Patients both male and female, Patients of any age, Patients visiting radiology department of University of Lahore undergoing CT scan brain. The exclusion criteria for the study were as follows; Patients with brain lesion, Motion artifacts, Post-op status, Head injury[2]. Toshiba AquilionCXL 128 slice CT scanner machine with multi-planar reconstruction was used to perform CT scans for Sino-nasal abnormalities. The sinuses were inspected using window setting of 1200 with a level of 200 HU. To conduct the scan of patient in coronal plane the patient was positioned face-down with the chin elevated. After obtaining the scout projection, the area of scanning was defined to include the region from anterior wall of frontal sinus up to posterior wall of sphenoid sinus. The 3mm thickness

sections were obtained. The scanning parameters were 120 kVp and 400 mAs. No contrast material was used.[8] The rules and regulations set by the ethical committee of University of Lahore were followed while conducting the research and the rights of the research participants were respected.

Written informed consent (attached) was taken from all the participants. All information and data collection were kept confidential. Participants remained anonymous throughout the study. The subjects were informed that there are no disadvantages or risks of the procedure of the study. Participants were also informed that they were free to withdraw at any time during the process of the study. Data in laptop was kept under password. This was an observational study and it was done in routine. After obtaining the informed consent patients were enrolled in the study. Demographic data was recorded. All the examinations were done using Toshiba Aquilion CXL 128 slice MDCT scanner. The scanned images were saved on Magnetic optic discs and external hard drives. Serial axial images from the base of the skull to the vertex were examined in each patient focusing on the paranasal sinuses (frontal, maxillary, sphenoidal and ethmoidal). Coronal and sagittal reconstructed images were reviewed where necessary. Presence of air‑fluid levels or mucosal thickening was regarded as positive findings. Each scan was evaluated for presence of sinonasal abnormalities. All scans were interpreted in bone window settings. The data was analyzed using SPSS 21. Quantitative data was described in terms of mean $\pm$ S.D. The qualitative variables were described in form of frequency tables and percentage. Chi square test was applied to measure relationship between age, gender and sinonasal abnormalities and to find the relationship between the sinonasal abnormalities and predictors. P-value≤0.05was taken as significant.

RESULTS

The data consisted of 374 patients. The data was gathered from both males and females, 47% (176 patients) population was male whereas 52.9% (198 patients) was female. Mean age $\pm$ S.D of the participants was 48.25$\pm$21.28. The youngest participant of the study was 1 year old and the eldest participant was 94 years old. Out of 374 participants 31.6% (118 participants) population had Sino nasal abnormality whereas remaining 68.4% (256 participants) population had no Sino nasal abnormality the deviated nasal septum was seen in 8% population (30 participants), whereas 92% population (344 participants) presented without deviated nasal septum. Concha bullosa was present only in 1.1% population (4 patients) whereas remaining 98.9% population (370 participants) presented without concha bullosa. Spur was present in 7.21% population (27 participants). Whereas 92.8% population (347 participants) presented with no spur. Amongst 7.21% population 4.5% presented with right spur and 2.7% presented with left spur. Onodi cells were also observed but no participant presented with onodi cells. Sino-mucosal hypertrophy was absent in 75.9% (284 participants) and was present in 24.1% population (90 participants) (chart: 1).Maxillary sinuses were examined on CT scan. The results showed that 82.1% patients did not have maxillary sinusitis whereas 17.9% participants had maxillary

sinusitis. Amongst these 17.9% patients 9.1% presented with right maxillary sinusitis and 8.8% presented with bilateral maxillary sinusitis. The sphenoidal sinusitis was present in 10.5% participants whereas it was absent in 89.6%. 1.9% population presented with right sphenoidal sinusitis, 6.7% presented with bilateral sphenoidal sinusitis and 1.9% presented with left sphenoidal sinusitis (chart: 1).

Ethmoid sinusitis was found absent in 86.9% population whereas 13.1% presented with ethmoid sinusitis. Out of 13.1% ethmoid sinusitis patients 1.9% presented with right side ethmoidal sinusitis and majority i.e., 11.2% presented with bilateral sinusitis. 96% population did not present with frontal sinusitis and only 4% presented with frontal sinusitis. Among these 3% 2.9% cases were of bilateral frontal sinus pathology and remaining 1.1% of right frontal sinus pathology (chart: 1). Polyp was also seen using CT scans and no patient was found presenting with polyp. Presence of mass wasalso not seen in any case. And all the patients included in the study showed absence of any mass (chart: 1). Chi square test was applied to find out the relation between gender and occurrence of sinusitis. The data summary showed that 43 males presented with sinusitis whereas sinusitis was present in 48 females. The chi square test indicated no significant relationship between gender and sinusitis. P value 0.966 (P≥0.05) indicated there is no significant relationship between gender and presence of sinusitis. Both males and females were equally affected by the disease. The degree of freedom for the test was 1. Chi square test was applied to find out the association between age and sinusitis. The data summary showed that 11 patients age between 0-20 presented with sinusitis. Patients between age 21-40; positive cases for sinusitis were 21. Patients between ages 41-60; the number of positive sinusitis cases was 29. For patients between age 61-80; 22 patients presented with sinusitis. And for patients between ages 81-100 the number of positive cases was 8 (Table:1). square test showed no significant relationship between age and the presence of sinusitis. P value 0.806 (P≥0.05) indicates no significant association between presence of sinusitis and age. Individuals of all ages were equally affected by the condition (Table:2)

DISCUSSION

In present study the prevalence of incidental sino-nasal abnormality was 31.6% the prevalence found in this study is similar to the prevalence quoted by Mohammad Nazri et al. in 2013. They mentioned the prevalence of incidental sinonasal abnormalities between 14-37% on CT.[9]Nasal septum deviation was studied and the prevalence of nasal septum deviation in current study was 8%, which is lesser than the prevalence concluded in previous studies. According to smit et al the prevalence of nasal septum deviation was 19.4%.[10] Whereas the number was even higher in a study conducted by Jae-Cheul Ahn et al, they mentioned the prevalence of nasal septum deviation to be 48% which is much higher than the prevalence found in current study[11].

The prevalence of incidental concha bullosa in present study was 1.1%, which is lesser than the prevalence mentioned by Fatma Çağlayan. According to her study the prevalence of incidental concha bullosa was

3.9%[12] which is higher than the results mentioned in this study. Stephen Rheem also worked on the incidental prevalence of sinonasal abnormalities. The prevalence of concha bullosa according to their study was lesser than the prevalence of Fatma Caglayan i.e. 2.72%[13] but still higher than the current study.Presence of incidental onodi cells was also evaluated in current study, however no participant presented with onodi cells. The results were in contrast to the study conducted by Hakan Avseve, who mentioned the prevalence of incidental onodi cells to be 4.6%[14]. In current study no participant was found presenting with incidental haller's cells. The results were in contrast to the study conducted by Neha Koshal, who conducted study to find out the prevalence of haller's cells to be 30.39%[15] in patients with maxillary sinusitis. This could be for the reason that haller's cells are responsible for ventilation and drainage of paranasal sinuses and hence are less affected in normal individuals but are severely affected in patients presenting with prior sinusitis[15].

In current study maxillary sinusitis was present in 17.9% population. The results were lesser in comparison to the study conducted by Ogolodom who concluded the prevalence of maxillary sinusitis to be 35.52%. [16]. However the results of current study were close to the study conducted by CC Ani, who mentioned the prevalence of maxillary sinusitis to be 23.2%[17]. Ethmoidal sinusitis was another Sino-nasal abnormality evaluated using CT scan. The results indicated the prevalence of 13.1%. The prevalence was less than half of the prevalence concluded by Ogolodom. Ogologom concluded the prevalence of ethmoidal sinusitis to be 29.08%[16]. The prevalence was even higher according to the study conducted by Jagram Verma who mentioned the prevalence of ethmoidal sinusitis to be 77%[18]. Frontal sinusitis was also evaluated using CT scan and the results indicated that only 4% population presented with frontal sinusitis and remaining 96% did not show frontal sinusitis. According to Jagram Verma the prevalence of frontal sinusitis is 80%[18] whereas ogolodom reported the prevalence of frontal sinusitis to be 22.77%[16]. In the current study the prevalence of sphenoidal sinusitis was 10.5% whereas the prevalence of sphenoidal sinusitis according to the study conducted by Micheal was 26.42% which was more than double the prevalence deduced in current study[19]. Incidental presence of Polyp and mass was also evaluated in CT but no participant in current study was found with incidental polyp and mass. The absence of polyp was not supported by Drumond et al who concluded the polypoid leision prevalence of 10.76%[20]. The commonest sinusitis according to the present study was maxillary (17.9%) followed by ethmoidal (13.1%), sphenoidal (10.5%) and the least common frontal;4% ofthe results were similar to the previous studies in which the maxillary sinusitis is the commonest sino-nasal pathology[16].

In current study the prevalence for all sinonasal abnormalities were much lesser than previously conducted studies. One cause behind this difference in the incidental values might be the season in which the present study was conducted. According to MeltemÖzdemir sinonasal pathologies are more common in winters[21] and current study was performed in summers which resulted in lesser number of patients presenting with incidental pathologies.

Chi square test was applied to check any association between gender and prevalence of sinonasal abnormalities. The current study showed no association between the gender and presence of sinonasal abnormalities. 43% males and 48% females were affected by the condition. Pearson chi square value of 0.002 and P value 0.966 indicated that there was no association between gender and the presence of sinonasal abnormalities. The results of current study were similar to the study conducted by Raghav who also reported no significant relation between gender and sinonasal abnormalities[22]. However Rege et al conducted a study in which they mentioned a significant difference between both genders and mentioned that males in comparison to females were more positive for sinonasal pathologies[23].

Chi square test was also used to find out the association between age and sinonasal abnormalities. The P value 0.806 indicated that there is no significant association between age and the presence of sinonasal abnormalities. The results of current study were similar to the study conducted by Rege and Ragave who also mentioned no association between age and the prevalence of sinonasal abnormalities. [22, 23]The study was conducted in summers which might correspond to the lesser prevalence of incidental sinonasal abnormalities. It is recommended to conduct the study in summer season.It is also recommended to find out the relation between BMI and the prevalence of sinonasal abnormalities.

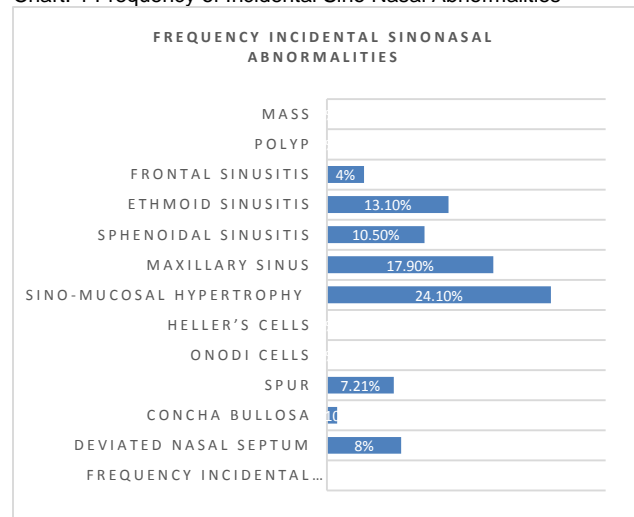Chart: 1 Frequency of Incidental Sino Nasal Abnormalities

Table: 1 Chi Square Test: Gender and Sinusitis

Chi square test			
	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	.002[a]	1	.966
Continuity Correction[b]	.000	1	1.000
Likelihood Ratio	.002	1	.966
Fisher's Exact Test			
Linear-by-Linear Association	.002	1	.966
N of Valid Cases	374		

a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 42.82.
b. Computed only for a 2x2 table

Table: 2 Chi-Square Test: Age and SinusitisChi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	68.964[a]	80	.806
Likelihood Ratio	79.323	80	.500
Linear-by-Linear Association	1.957	1	.162
N of Valid Cases	374		

a. 145 cells (89.5%) have expected count less than 5. The minimum expected count is .24.

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