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Prevalence of maxillary sinus abnormalities in asymptomatic Saudi adult population

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ABSTRACT

Objective: The aim of our work was to study the prevalence of maxillary sinus abnormalities in asymptomatic Saudi adult population using computed tomography. *Materials and methods*: It was retrospective study in King Khalid Hospital in Al-Kharj. It was designed to evaluate all patients who underwent brain CT scanning for any reason unrelated to maxillary sinuses abnormalities. 1442 patients underwent CT scans in past ten months from July 2020 to early May 2021 and evaluated by two examiners for identification of any abnormalities. All demographic data and radiological features related to maxillary sinuses were evaluated. *Results*: Retrospective CT scan analysis for incidental maxillary sinuses abnormalities revealed that about 495(34.33%) of the cases had positive findings, where the majority were males 517 (67.1% of the positive findings) while the females represented around 254 (32.9% of the positive findings). Of all these findings, the most frequently maxillary sinuses pathology found was Mucosal thickening 575 (39.88%) of all cases. *Conclusions*: Spread of incidental maxillary sinus abnormalities is more in the asymptomatic patients.

Keywords: Computed tomography; Maxillary sinus, Incidental findings, Diagnostic imaging

1. INTRODUCTION

Maxillary air sinuses are the biggest of all paranasal Sinuses. They are bilaterally located within the maxillary bone and fill the whole body of maxilla behind the cheek skin. The shape of each sinus is a pyramid. The orbit floor forms its roof. The roots of the premolars and molar teeth are related to the floor (Van & Miles, 1994). In spiral computed tomography (CT) scans maxillary sinus incidental abnormalities are common findings (Diament, 1987; Havas et al., 1988; Lesserson et al., 1994; Carmeli et al., 2011). Abnormalities of maxillary sinuses may arise primarily from within the sinus walls, impinge upon the sinuses, or infiltrate the sinuses from outside (Kumar et al., 2019).

These abnormalities can be classified into non-neoplastic, neoplastic, congenital or acquired according to their nature (Drumond et al., 2017).

Mucosal thickening, polypoid lesions, and inflammatory cysts are considered as non-neoplastic. Papilloma, adenocarcinoma are some types of neoplasm that affect the maxillary sinus (Stephens & Saleh, 2013). Mucosal thickening is hyperplasia with an inflammation of the lining mucosa of the maxillary sinus. It may result from infections, allergies, rhinitis or asthma (White & Pharoah, 2009). Chronic inflammation in the maxillary sinus mucosa due to continuous exposure to inhaled allergens, identified as mucosal thickening on Computed Tomography (Tezer et al., 2006). The rhinogenic sinusitis differs from odontogenicin terms of microbiology, pathophysiology, and treatment. The prevalence of odontogenic maxillary sinusitis is about 11% to 41% of all maxillary sinusitis in a previous study; in addition its occurrence may be increasing (Mehra & Murad, 2004).

There is one difference between chronic and acute sinusitis. There is a thickening in the sinus wall in chronic sinusitis but in acute sinusitis, fluid levels within the maxillary sinuses are sequestrated (Lana et al., 2012). Another common asymptomatic finding is mucosal cysts in previous studies, with prevalence ranging from 12.4 and 35.6% (Kanagalingam et al., 2009). On Computed Tomography, they appeared as globular opacities, and were not accompanied with chronic rhinosinusitis symptoms (Stephens & Saleh, 2013).

The aim of our work was to study the prevalence of abnormalities of maxillary sinus in asymptomatic Saudi adult population using computed tomography.

2. METHODS

It was retrospective study in King Khalid Hospital in Al-Kharj. It was designed to evaluateall patients who underwent brain CT scanning for any reason unrelated to maxillary sinuses abnormalities. Any patients with symptoms of acute or chronic sinusitis and those with headache and trauma in maxilla-facial region were excluded. Young patient under 19 years (to make sure full maxillary sinus development) and old ones above 90 also excluded. Low resolution images with artifacts that impair visualization of the sinus were also eliminated (Alsufyani & El-Hakim, 2021; Yilmaz, 2014; Ginat, 2015; Zeifer, 2002).

Our study obtained approval from the Health Research Ethics Board from Prince Sattam bin Abdul Aziz University (2020/04/17094). The privacy of the participants was secured. 1442 patients underwent CT scans in past ten months from July 2020 to early May 2021. All of them analyzed retrospectively from CT unit of radiology department by two independent radiologists. Imaging indications must not be sinus-related in order to meet the inclusion criteria.

All scans performed on the same 16-detector CT scanner, the Light speed 16. High-resolution axial images were acquired with the patient in the supine position. The CT images of patients who have had CT brain scan were collected by the radiologists then analyzed for any presence of maxillary sinuses abnormalities by the investigator and the advising senior radiologist. The features of maxillary sinuses abnormalities were mucosal wall thickening, inflammatory or odontogenic cysts and polypoid lesions. It also includes foreign bodies and neoplasm. All demographic data and radiological features related to maxillary sinuses were evaluated.

Data Entry & Analysis

Maxillary sinuses abnormalities identified were coded. Then the quantitative data was entered & analyzed using the latest version of Statistical Package Software (SPSS). By doing so, the frequency of each type of abnormality was calculated. It was also analyzed if there was any correlation between the variables. We will also use student t-test to achieve a comparison of the mean age of patients with incidental findings. Other statistical evidence of associations on categorical variables will be computed from Chisquare tests of contingency. A P-value of <0.05 will be considered as significant.

3. RESULTS

The study was conducted over 1442 patients; 495 (34.33%) were males and 947 (65.67%) were females. The patients' age ranged from 15 to 90 years with mean (44.9 ±18.98 SD). They were distributed in accordance with their age into three groups; young adults (15-30), middle-aged patients (31-50), and senior adults (>51), and the descriptive analysis showed that they were "406 (28.16%), 532 (36.89%), 504 (34.95%)" respectively (figure 1).

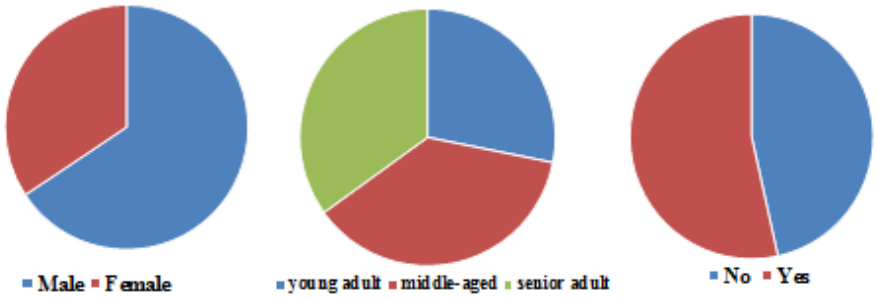

Figure 1 Shows the distribution of the gender, age groups incidental positive findings of the data.

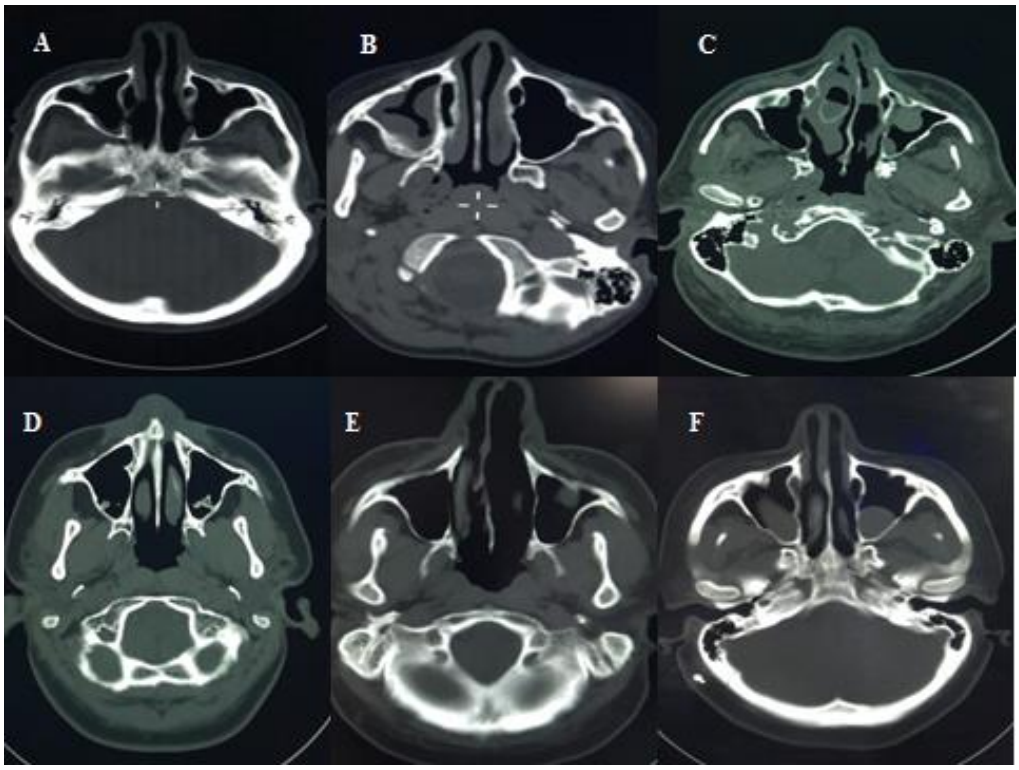

Figure 2 A) Axial Brain CT scan shows normal paranasal study. B) Right maxillary antrum mucosal thickening. C) Bilateral maxillary antrum polipoidal mucosal thickening and hypertrophied inferior turbinates. D) Peripheral inflammatory sinus calcification E) Bilateral maxillary antrum polipoidal mucosal thickening and hypertrophied inferior turbinates. F) Bilateral maxillary antrum polyp and retension cyst.

Retrospective CT scan analysis for incidental maxillary sinuses abnormalities revealed that about 495 (34.33%) of the cases had positive findings, where the majority were males 517 (67.1% of the positive findings) while the females represented around 254 (32.9% of the positive findings). Of all these findings, the most frequently maxillary sinuses pathology found was Mucosal thickening 575 (39.88%) of all cases. The others were seen but less frequently (Table 1, Fig. 2).

Table 1 shows the frequency and (%) of the maxillary sinuses' abnormality.

	Yes	No
Mucosal thickening	575 (39.88%)	867 (60.12%)
Polypoid Lesions	126 (8.74%)	1316 (91.26%)
Inflammatory cysts	110 (7.63%)	1332 (92.37%)
Odontogenic cysts	48 (3.33%)	1394 (96.67%)
Neoplasms	19 (1.32%)	1423 (98.68%)
Foreign Bodies	18 (1.25%)	1424 (98.75%)

As mentioned, testing the data for incidental maxillary sinuses abnormalities revealed that the male patients were more than females in all findings (Table 2) but with no significant association between both. The data also revealed that the senior adult patients were with the most incidental findings of all age groups 344 (23.86%), and to a lesser extend the middle-aged patients 238 (16.5%). Chi-square was conducted to test association between all three groups and their findings, and the results showed a highly significant association (P<0.001).

Table 2 The association between the gender and the types of maxillary sinuses abnormality

	Male		**Female**		**Chi-square Sig.**
	Yes	No	Yes	No	
Positive Findings	517 (35.85%)	430 (29.82%)	254 (17.61%)	241 (16.71%)	.236
Mucosal thickening	382 (26.49%)	565 (39.18%)	193 (13.38%)	302 (20.94%)	.620
Polypoid Lesions	85 (5.89%)	862 (59.78%)	41 (2.84%)	454 (31.48%)	.658
Inflammatory cysts	76 (5.27%)	871 (60.4%)	34 (2.36%)	461 (31.97%)	.432
Odontogenic cysts	33 (2.29%)	914 (63.38%)	15 (1.04%)	480 (33.29%)	.648
Neoplasms	12 (0.83%)	935 (64.84%)	7 (0.49%)	488 (33.84%)	.816
Foreign Bodies	15 (1.04%)	932 (64.63%)	3 (0.21%)	492 (34.12%)	.112

Testing individual incidental maxillary sinuses findings also have shown significant association between the age groups and foreign bodies (P=0.022), and highly significant association with mucosal thickening, inflammatory cysts, and neoplasms (P<0.001). No association was found between the age groups and polypoid Lesions (P value =0.498) and odontogenic cysts (P value = 0.081).

Table 3 The association between the age group and the types of maxillary sinuses abnormality

	young		**middle age**		**elderly**		**Chi-square Sig.**
	Yes	No	Yes	No	Yes	No	
Positive Findings	133 (9.22%)	273 (18.93%)	294 (20.39%)	238 (16.5%)	344 (23.86%)	160 (11.1%)	.000**
Mucosal thickening	101 (7%)	305 (21.15%)	222 (15.4%)	310 (21.5%)	252 (17.48%)	252 (17.48%)	.000**
Polypoid Lesions	38 (2.64%)	368 (25.52%)	50 (3.47%)	482 (33.43%)	38 (2.64%)	466 (32.32%)	.498
Inflammatory cysts	14 (0.97%)	392 (27.18%)	43 (2.98%)	489 (33.91%)	53 (3.68%)	451 (31.28%)	.000**
Odontogenic cysts	7 (0.49%)	399 (27.67%)	19 (1.32%)	513 (35.58%)	22 (1.53%)	482 (33.43%)	.081
Neoplasms	0 (0%)	406 (28.16%)	1 (0.07%)	531 (36.82%)	18 (1.25%)	486 (33.7%)	.000**
Foreign Bodies	0 (0%)	406 (28.16%)	8 (0.55%)	524 (36.34%)	10 (0.69%)	494 (34.26%)	.022*

**. The Chi-square statistic is significant at the .05 level.*

**. The Chi-square statistic is highly significant at the .001 level.*

4. DISCUSSION

In the present study scans of 1442 patients, the maxillary sinuses analysis for incidental maxillary sinuses abnormalities revealed that about 495 (34.33%) of the cases had positive findings, where the majority were males 517 (67.1% of the positive findings) while the females represented around 254 (32.9% of the positive findings). These results were nearly similar to some of the past studies (Elwakeel et al., 2017) that noted 73% of incidental abnormalities in maxillary sinus. Another study declared maxillary sinus abnormalities in 68.2% of 1113 cases in Brazil (Rege et al., 2012). On the other hand, there are few studies who reported a lower percentage of abnormalities of maxillary sinuses reported the prevalence of incidental pathologies in 43.54% of cases (Jangam et al.,

2016). A total of 110 patients, Raghav *et al*., (2014) observed incidental findings are 59.7% of maxillary sinus CBCT scans. Mucosal thickening was the most common findings. The latter found in 141cases (35.1%).

The work carried out by Ritter et al., (2011) using CBCT showed incidental findings in the maxillary sinus was 56.3%. Gracco *et al*., (2012) noted that 50% of the orthodontic patients revealed incidental findings in the maxillary antrum. Pazera *et al*., (2011) reported 46.8% incidental maxillary sinus pathologies in 134 Swiss patients. Al-Zoubi *et al*., (2017) study in Al Jouf University found scans of 412 patients, included of 824 maxillary sinuses. The percentage of pathological findings in maxillary sinuses was 30.1% (248 images).

A study of Drumond et al., (2017) found prevalence of pathological findings in 457 cases, which spread was about 60%. Detecting the total of maxillary sinuses, about 650 of cases had these abnormal findings, representing a prevalence of about 43%. A more recent study of Asif et al., (2021) out of total 2,411 radiographs taken, Abnormal findings were noted in 1,498 (64%). In addition other study of Kumar et al., (2019) scans of 150 patients found 58% pathologic findings. The most common findings were mucosal thickening about 29.2%.

5. CONCLUSION

Based on our study results, it can be revealed that the prevalence of incidental maxillary sinus abnormalities was more in the asymptomatic patients. For that reason, any physician should be familiar with of these incidental abnormalities discovered in the maxillary sinus. This will lead to early identification, management and follow up of sinus abnormalities.

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Authors' Contributions

All authors contributed to the research and/or preparation of the manuscript. Ali Hassan A. Ali and Omar O. Serhan participated in the study design and wrote the first draft of the manuscript. Ali Amer Hamdi, Fahad M Alotaibi, and Ahmed M. Also Mali collected and processed the samples. Abdulrahman S. Alshammari and Saeed M. Oraydah participated in the study design and performed the statistical analyses. All of the authors read and approved the final manuscript.

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Conflicts of Interest

The authors declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Ethics Approval

All series of steps that were implemented in this study that included animal models were in compliance with Ethics Committee of Prince Sattam bin Abdulaziz University Institutional Review Board (2020/03/17094).

Data and materials availability

The data are available upon request from the authors.

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