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Bioscience Research

Print ISSN: 1811-9506 Online ISSN: 2218-3973

Journal by Innovative Scientific Information & Services Network

RESEARCH ARTICLE BIOSCIENCE RESEARCH, 2020 17(2): 1308-1314. **OPEN ACCESS**

Assessment of Paranasal Sinuses Diseases using Multi-Detector Computed Tomography Scanning in Hail city, Saudi Arabia

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Diseases of the paranasal sinuses (PNS) associated with various anatomical and inflammatory changes. Computerized tomography (CT) plays effective role for assessment and characterization of PNS pathologies. The aim of this study is to characterize PNS diseases using computed tomography(CT) in Saudi patients. A retrospective study included 65 patients diagnosed clinically with nasal cavity disorders and PNS diseases that referred to the radiology department at the university medical center (UMC), University of Hail. They were examined with 64-slice MDCT using CT protocol of paranasal sinuses. The study was conducted at the period of August 2017 to October 2019.The majority of PNS pathologies affected patients in the 2nd decade (41.5%). Maxillary sinuses were the most affected sinuses. The most common findings were 86.15% nasal septal deviation, enlarged nasal conchae were 47.69%, mucosal thickening was 40%, retention cysts were 10.76%, and 3.07% polyps. CT had 98.41% sensitivity and 97.01% accuracy in characterizing PNS pathologies .CT is an accurate and sensitive imaging modality for evaluating the PNS diseases. Nasal septal deviation, enlarged nasal conchae, and mucosal thickening were the most common findings associated with PNS diseases.

Keywords: Pathologies, Paranasal Sinus Diseases, Computed Tomography.

INTRODUCTION

Recent advances in CT and magnetic resonance imaging (MRI) methods have increased the importance of imaging examinations in the assessment of abnormalities affecting the head and neck (Wolosker, 2018; Cintra , 2018; Campos, 2018; Caldana, 2018 and Cunha, 2017). Recently, CT was the main imaging modality to assess lesions in the nasal cavity and paranasal sinuses (PNS). It is the investigation of choice for proper treatment and relevant pre-operative evaluation of the nasal cavity and PNS diseases. It is considered the gold standard for differential diagnosis between inflammatory PNS pathologies and neoplasms (Kanwar, 2017). Hence, CT was sensitive and accurate and provided standard imaging of PNS diseases (Mukherji, 2015;Chaitanya, 2015).

CT scan has become the investigation of choice for radiological diagnosis of nasal and PNS diseases as CT produces high-resolution images demonstrating the air spaces, opacified sinuses, and fine structural architecture of bony anatomy (Shay, 2019). Multidetector CT (MDCT) is very

effective for evaluating the patency of sinonasal passages, showing the effect of anatomic variants inflammatory disease, and other abnormalities (Miller, 2009).

CT plays an important diagnostic role in determining the distribution and extent of paranasal disease and detecting those anatomic variations (such as sepal deviation, and concha bullosa). These morphological changes may place the patients at increased risk for intra- and post-operative FESS complications and thereby reduces the morbidity and mortality of patients. It aids in the diagnosis and management of recurrent PNS diseases by determining the distribution and extent of the lesion.

Saudi Arabia reported a high incidence of acute and chronic PNS pathologies (Hamdi, 2020). In one study conducted in the Kingdom of Saudi Arabia, it was reported half of the Saudi participants had had chronic sinusitis (Abualnasr, 2017). It was observed increased patients with symptomatic sinusitis in Hail city. However, according to our knowledge, no previous studies concerning assessment of PNS in Hail city. Thus, this study aims to evaluate PNS pathologies using CT.

MATERIALS AND METHODS

This is a retrospective study conducted at the radiology department of (UMC) of the University of Hail, KSA, during the period of August 2017 to October 2019. A total of 65 patients were retrospectively studied with ages ranged between (20-59) years. The study's target population was patients with clinically suspected PNS pathologies who referred for paranasal sinuses CT scans. Informed consent was received from the patients. Data collection sheet was designed to include demographic and clinical data such as age, gender, clinical history, and CT findings.

CT imaging procedure

The CT scans were done using GE medical system 64 Slice MDCT, and images were acquired in the axial plane and make post-processing multi planner reconstruction (MPR). The exposure factors were 120 kvp and 60 mAs. Soft tissue window level and width (50/200) and width (350/2500) and bone window were applied to enhance optimal contrast resolution.

CT imaging protocol was performed on multi-channel helical scanners that allowed the retrospective reconstruction of image data into data sets of different spatial quality and image characteristics. CT acquisition parameters were based on a standard protocol of paranasal sinuses. A slice thickness of 3mm with 1.25 mm scan interspaces was used for acquiring the image. The scan range started from the bottom of the maxillary sinus and endpoint through the frontal sinus. Examinations were considered acceptable if all CT images of the paranasal sinuses were intact and available with soft tissue and bony window settings (Figures 2-3).

Statistical analysis:

The data were analyzed using excel program and software SPSS version 23 for significances of tests was used. Categorical data were presented as frequencies and percentages. A Chi-square test was used to compare qualitative variables such as gender and CT findings of PNS pathologies. P-value < 0.05 was considered as significant.

RESULTS

The study showed that the majority of patients were male 37(56.9%), whereas females 28(43,1%). Frequency distribution of patient ages affected by paranasal sinuses disease, the majority of patients ages in 2nd decade (23.7%); mean age was 33±9.10 years, as shown in table 1.

The prevalence of PNS pathologies was distributed between males and females (table 2). Nasal septal deviation, enlarged conchae, mucosal thickening, and retention cysts were more frequent findings, and they were more prevalent in males than females. The PNS had no association with gender since there was no significant difference between males and females (p-values < 0.05), as shown in table 2.

The maxillary sinuses were the most affected (49.23%), as summarized in figure 1. Coronal and axial CT images revealed mucosal thickening in maxillary and ethmoidal sinuses, which indicate acute sinusitis, as shown in figure 2 and figure 3.

The distribution of PNS pathologies, according to age groups, as summarized in table 3. The majority of PNS pathologies were most common in the age group of 20-29 years old. Enlarged conchae 48.4%, septal deviation (44.6%), and mucosal thickening were common in the age group of 20-29 years. The findings were less frequent in the age group of 50-59 years. There were no anatomical variants detected in the study sample.

The performance of CT scanning for the detection of various findings of PNS pathologies revealed.

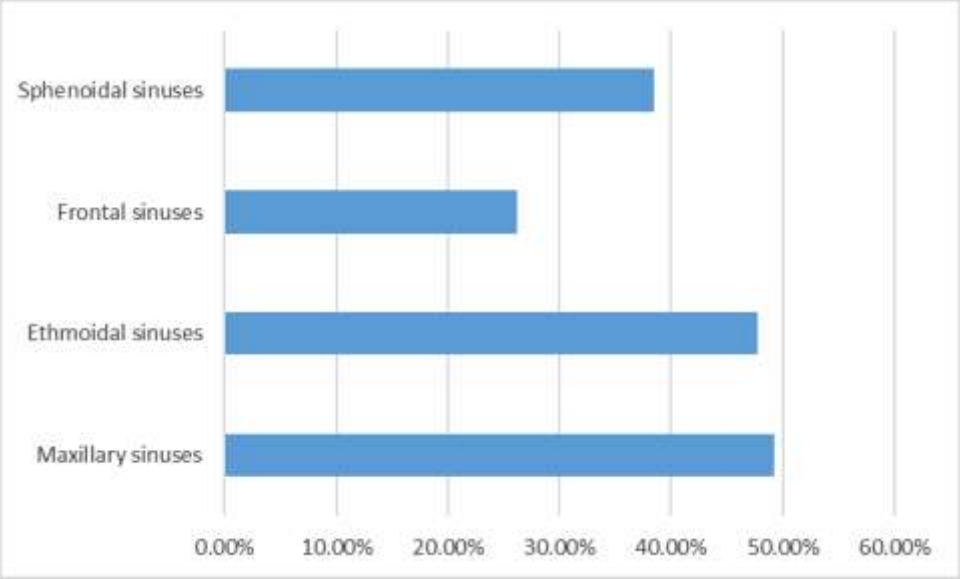

Figure 1: Distribution of the affected paranasal sinuses

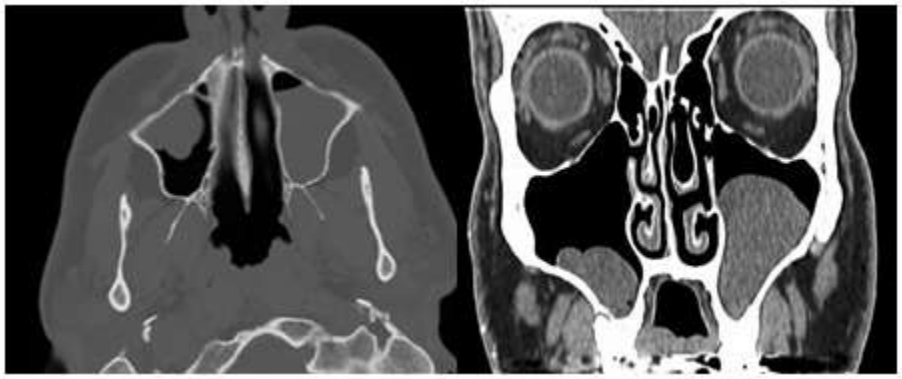

Figure 2: MDCT (axial and coronal) of paranasal sinuses for a 36-years' male show bilateral maxillary sinus with mucosal thickening

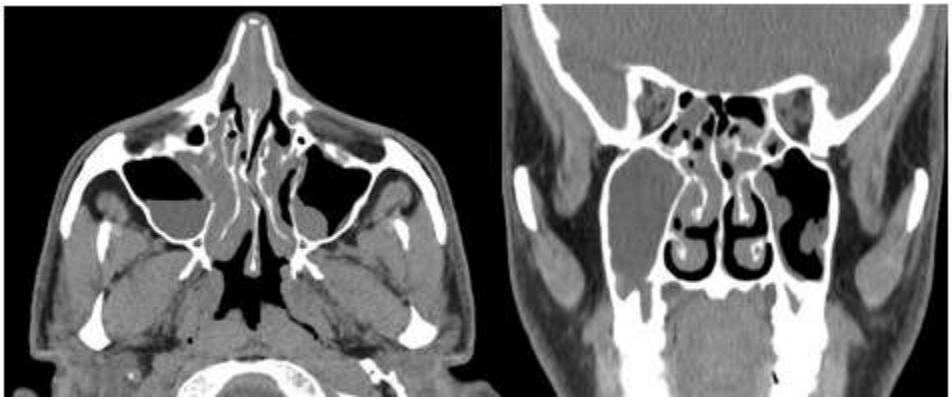

Figure 3: MSCT image (axial and coronal) of paranasal sinuses for a 51-years' male show both maxillary and ethmoid air sinuses lined with mucosal thickening, more intensive in the right than the left

Table 1: demographic characteristics of patients with PNS pathologies

variable	Frequency	Percent %
Gender		
Males	36	31.6
Females	29	25.4
Age groups (years		
20-29	27	23.7
30-39	24	21.1
40-49	12	10.5
50-59	2	1.8
Mean age = 33±9.10 years		

Table 2: Association of PNS pathologies with gender

CT findings of PNS pathologies	Males No.(%)	Females No. (%)	Total No. (%)	P-values
Enlarged nasal conchae	15 (23.07 %)	16 (24.61%)	31 (47.69%)	0.202
Septal deviation	31 (47.69%)	25 (38.46%)	56 (86.15%)	0.639
Retention cysts	5(7.69%)	2 (3.07)	7 (10.76%)	0.313
Mucosal thickening	16 (24.61%)	10 (15.38%)	26 (40%)	0.288
Retention cysts and mucosal thickening	4 (6.15%)	2 (3.07%)	6 (9.23%)	0.445
polyps	1 (1.53%)	1(1.53%)	2 (3.07%)	0.697

Table 3: Distribution of PNS pathologies according to age groups

CT findings of PNS pathologies	20-29 years	30-39 years	40-49 years	50-59 years
Enlarged nasal conchae	15 (48.4%)	10 (32.3%)	5 (16.1%)	1 (3.2%)
Septal deviation	25(44.6%)	20 (35.7%)	9 (16.1%)	2 (3.6%)
Retension cysts	1 (14.3%)	4 (57.1%)	2 (28.6%)	0 (0.0%)
Mucosal thickening	10 (38.5%)	10 (38.5%)	6 (23.1%)	0 (0.0%)
Retension cysts and mucosal thickening	2 (33.3%)	3 (50.0%)	1(16.7%)	0 (0.0%)
polyps	1(1.53%)	1(1.53%)	0	0

Table 4: Performance of CT in diagnosis of PNS diseases in the study sample (65 patients)

Presence or absence of PNS pathologies	Values
True positive	62
True negative	3
False positive	1
False negative	1
Performance of CT in characterization PNS pathologies	Values %
Sensitivity %	98.41.60%
Specificity %	75%
Accuracy %	97.01%
Positive predictive value (PPV %)	98.41%
Negative predictive value (NPV %)	75%

98.41.60% sensitivity, 75% specificity, 97.01% accuracy, 98.41% positive predictive value (PPV%), and 75% negative predictive value (NPV %) as shown in table 4.

DISCUSSION

Recently CT has become the best diagnostic modality for evaluation of nasal cavity, paranasal sinuses, and for demonstrating various sinonasal diseases (Joshua, 2013; Maillet, 2011). The present study evaluated the spectrum of PNS diseases in Saudi patients using CT.

The present study showed that PNS pathologies were more prevalent in the second decade and third decade; this is higher in males and females with a mean age of 33±9.10 years. These epidemiological data were similar to previous studies conducted in Saudi patients (lbalwi, 2019; Maillet, 2011).

The findings of the study revealed that the maxillary sinuses were more affected than other sinuses. In agreement, Yousef et al., and Afolabi et al., reported the same findings. Similarly, Singh et al., (2018), reported that the majority of PNS lesions were located in the maxillary antrum

In this study, there was no significant difference between the male and female incidence of PNS pathologies concerning gender-wise. Similarly, Drumond et al., evaluated the prevalence of PNS abnormalities and reported no significant difference between males and females. Hommod et al., (2017) reported a prevalence of 26.4% males and 22.4% females of chronic sinusitis in Saudi patients who lived in the Jazan region. Therefore, gender was not a significant factor for PNS pathologies.

In the current study, it was found that enlarged nasal conchae, septal deviation, and mucosal thickening were the most common findings in PNS pathologies. Taghiloo et al., (2019) reported that nasal septal deviation was found in 75% of the cases, while mucosa thickening was found in 31.76 % of males and 56.67% of females. Similarly, it was found that the nasal septum deviation was 86.15%, which is the most common finding. In contrast, Smith (2010) reported studied the prevalence of nasal septal deviation and concha bullosa and found 19.4% of the cases had nasal septal deviation. The mucosal thickening was found in 40% of the cases in this study, which is approximate to that reported by Hansen et al., who reported 49% mucosal thickening in their study. It was observed that polyps were less frequent. Similarly, Hamdi (2020) reported less prevalence of polyps compared to other PNS pathologies in Saudi patients. Therefore, a spectrum of findings with different incidence was associated with PNS pathologies.

Patel et al., evaluated the role of CT in the characterization of non-neoplastic PNS diseases and reported that CT has 100% sensitivity and specificity in detecting the PNS diseases correctly. [24] Furthermore, Hamdi et al., reported that CT has high sensitivity, specificity, positive predictive Value (PPV), and negative predictive Value (NPV) for characterization the PNS pathologies. [11] These results agreed with our findings that CT has high 98.41.60% sensitivity,75% specificity, 97.01% accuracy, 98.41% PPV, and 75% NPV. Therefore, the performance of CT is very high for the diagnosis and characterization of PNS diseases.

This study is limited to only one center in which the research was conducted, which may affect the limited number of cases, and the limitation of the number of patients is since we are receiving patients with PNS diseases from or UMC ENT department in most of the cases. Although it is the first study of its type in this city regarding sinus diseases, especially the people of this region suffer from sinuses diseases due to their nature.

CONCLUSION

CT is very accurate and sensitive in diagnosis and characterization of various abnormalities affecting the nasal cavity and PNS. A nasal septal defect is the most common finding associated with PNS pathologies. PNS diseases were most common in the second decade; and more frequent in maxillary antrum that other sinuses.

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CONFLICT OF INTEREST

The authors declared that present study was performed in absence of any conflict of interest.

ACKNOWLEGEMENT

We would like to thank the clinical staff and Radiologists at the radiology department of (UMC) of the University of Hail for their great help.

AUTHOR CONTRIBUTIONS

Qurain Turki Alshammari contributed to study design and literature search. Mohammed Salih: definition of intellectual content, Bushra Abdel Malik: edited and reviewed the manuscript

Mohamed Yousef prepared the manuscript, Elfadil Elnour: manuscript preparation and data acquisition. Elgeili Yousif: data acquisition.

Moawia Gameraddin: statistical analysis. All authors contributed to the study and did the same efforts equally.

REFERENCES

Abualnasr D., Alattas D., Abualnasr D., Alsrisri D., Aljeraisi D., 2017. Prevalence Of Chronic Rhino Sinusitis And Its Recurrent After Treatment Compare To Its Recurrent After Surgery At Saudi Arabia. International Journal of Advanced Research. 5: 2310–18.

Afolabi O.A., Alabi B.S., Omokanye H.K. et al, 2017. Management and Outcome of Rhinosinusitis in Nigeria. OTO Open. 1(1):2473974X16685545.

Caldana W.C., Kodaira S.K., Cavalcanti C.F.A., et al., 2018. Value of ultrasound in the anatomical evaluation of the brachial plexus: correlation with magnetic resonance imaging. Radiol Bras. 51:358-65.

Campos H.G., Altemani A.M., Altemani J, et al., 2018. Poorly differentiated large-cell neuroendocrine carcinoma of the paranasal sinus. Radiol Bras. 51:269-70.

Chaitanya C.S., Raviteja A., 2015. Computed tomographic evaluation of diseases of paranasal sinuses. International Journal of Recent Scientific Research. 6:5081–86.

Cintra M.B., Ricz H., Mafee M.F., et al., 2018. Magnetic resonance imaging: dynamic contrast enhancement and diffusion-weighted imaging to identify malignant cervical lymph nodes. Radiol Bras 51:71-5.

Cunha B.M.R., Martin M.F., Indiani J.M.C. et al., 2017. Giant cell tumor of the frontal sinus: a typical finding in an unlikely location. Radiol Bras 50:414-5.

Drumond J.P., Allegro B.B., Novo N.F., de Miranda S.L., Sendyk W.R., 2017. Evaluation of the Prevalence of Maxillary Sinuses Abnormalities through Spiral Computed Tomography (CT). Int Arch Otorhinolaryngol 21:126-33.

Hamdi A.A., Mohtasib R., Mahmoud M.Z., 2020. Role of Computed Tomography in Determining the Spectrum of Paranasal Sinuses Pathologies in Saudi patients. Pakistan Journal of Biological Sciences 23: 339-344.

Hansen A.G., Helvik A.S., Nordgård S, et al, 2014. Incidental findings in MRI of the paranasal sinuses in adults: a population-based study (HUNT MRI). BMC Ear Nose Throat Disord 14:13.

Homood M.A., Alkhayrat S.M., Kulaybi K.M., Mohajer A.A., Majrashi A.S., Salawi A.A et al, 2017. Prevalence and Risk Factors of Chronic Sinusitis among People in Jazan Region' KSA. The Egyptian Journal of Hospital Medicine 69: 2463-2468.

Joshua B.Z., Sachs O., Shelef I., Vardy-Sion N., Novack L., Vaiman M, et al, 2013. Comparison of clinical data, CT, and bone histopathology in unilateral chronic maxillary sinusitis. Otolaryngol Head Neck Surg 148:145-50.

Kanwar S.S., Mital M., Gupta P.K., Saran S., Parashar N., Singh A., 2017. Evaluation of paranasal sinus diseases by computed tomography and its histopathological correlation. J Oral Maxillofac Radiol 5: 46-52.

Ibalwi Y., Alroqi A., Alharethy S., 2019. Anatomical variations in Computerized Tomography of paranasal sinuses in a Saudi population. Saudi J Otorhinolaryngol Head Neck Surg 21:1-5

Maillet M., Bowles W.R., McClanahan S.L., John M.T., Ahmad M., 2011. Cone-beam computed tomography evaluation of maxillary sinusitis. J Endod 37:753-57.

Miller J.C., 2009. Imaging for Sinusitis. Radiology Rounds. A Newsletter for Referring Physicians Massachusetts General Hospital Department of Radiology. 7(8).

Mukherji S.K., 2015. Imaging of Paranasal Sinuses. Neuroimaging Clinics of North America. 25: xi.

Patel R.B., Nair N.R., Contractor J.A., Patel J.A., Vasani A.M., 2019. Role of CT-PNS in non-neoplastic sino-nasal diseases: an observational study at tertiary care center in South Gujarat. International Journal of Otorhinolaryngology and Head and Neck Surgery. 5: 345.

Shay A., Tajudeen B., 2019. Histopathologic analysis in the diagnosis and management of chronic rhinosinusitis. Current Opinion in

Otolaryngology & Head and Neck Surgery 27: 20-24.

Singh S.G., Qureshi S., Jain L., Jadia S., Sharma S., 2018. Presentation of Lesions of Nose and Paranasal Sinuses at a Tertiary Care Center in Central India. Indian J Otolaryngol Head Neck Surg 70:284-89.

Smith K.D., Edwards P.C., Saini T.S., Norton N.S., 2010. The Prevalence of Concha Bullosa and Nasal Septal Deviation and Their Relationship to Maxillary Sinusitis by Volumetric Tomography. International Journal of Dentistry. 1–5.

Taghiloo H., Halimi Z., 2019. The frequencies of different types of nasal septum deviation and their effect on increasing the thickness of maxillary sinus mucosa. J Dent Res Dent Clin Dent Prospects. 13:208-14.

Wolosker A.M.B., 2018. Contribution of dynamic contrast enhancement and diffusion-weighted magnetic resonance imaging to the diagnosis of malignant cervical lymph nodes. Radiol Bras. 51(3): ix. 25.

Yousef M., Sulieman A., Hassan H., Ayad C., Bushara L., Saeed A., Gamerddin M., Ahmed B., 2014. Computed tomography evaluation of paranasal sinuses lesions, Sudan Med. Monit 9: 123-