CT scan of the nose and paransasl sinuses :Anatomical and Pathological findings

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Abstract

Objectives: To find out the occurrence of anatomical anomalies and pathological changes in patients subjected to CT scanning.
Materials and Methods: The CT of 584 patients were studied. Age,sex, anatomical nomalies and pathological changes were recorded .
Results: Eighty seven patients had anatomical anomalies and 177 had pathological changes with 296 having combined anatomical and pathological findings. Of the anatomical anomalies , deviated septum was the most common and Haller's cells were the least common. Pathological changes included mucosal thickening, nasal polypi and hypertrophy of the turbinates.
Conclusion: CT scan is a useful diagnostic method in the diagnosis of sinus disease. Deviated nasal septum and mucosal thickening were the common findings seen by this modality of imaging in this series.
Key words: Deviated nasal septum, concha bullosa, Haller's cell, paradoxical middle turbinate, mucosal thickening, hypertrophied turbinate, chronic sinusitis, CT scan.

Introduction

Currently we have four main diagnostic examination methods to assess the paranasal sinuses. These are : plain x-rays, computing tomography (CT), magnetic resonance imaging (MRI) and ultrasound. CT offers a better definition and less radiation exposure than polytomography. The tremendous advances seen in mucociliary transport activity and pathophysiology of the nose and paranasal sinuses has revolutionized the management of sinus diseases. Nasal endoscopy coupled with meticulous radiological identification of the structures of the region provides detailed information that helps in the surgical management of these tissues. The ostiomeatal complex (OMC) has come to be identified as a vital area that affects the health of sinuses. Chronic inflammation , nasal polyposis, mucosal hypertrophy or anatomical variants may block the area leading to chronic sinus disease.

The anatomical complexity of the nasal passages and paranasal sinus system makes direct examination of this area not a very satisfactory procedure. Although nasal endoscopy can be used to define the nasal cavity and middle meatal structures it can not directly visualized all the OMC or deeper ethmoidal labyrinth.

It is now agreed that plain x-rays are of little use in the imaging of the paranasal sinuses. Pfleiderer et al [1] demonstrated only 44% correlation between plain maxillary sinus x-ray and subsequent sinoscopic findings. Discrepancies are sometimes noted between a sinus series and a CT scan.

[2] The CT examination in the coronal plane is the optimal imaging modality to evaluate the nasal cavity and the paranasal sinuses specially for evaluating chronic inflammatory disease. [3] However, axial views may be necessary at times to visualize the relationship of the optic nerve to the posterior ethmoid cells.

The role of CT scan is to provide information about mucosal changes and anatomical variants not readily evaluated endoscopically.

No information is available about anatomical variants and pathological changes in the nose and sinuses in Saudi Arabia. Hence, this study aims to find out the occurrence of anatomical anomalies and pathological changes seen in patients subjected to CT scanning.

Materials and Methods

The CT scans of 584 patients scanned for various sinus diseases were examined for the period 1997-1999. This data was collected from King Abudlaziz University Hospital and Erfan & Bagedo General Hospital in Jeddah, Saudi Arabia. All CT scans were taken in the coronal plane with 3mm thickness cuts. Age and sex of patient was entered.

The data related to abnormalities was divided into :

Anatomical variants.
Pathological changes.

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Deviated Nasal septum

	Right	Left	Right	Left	
Deviated nasal septum	92	118	65	56	33 56%

(N=584)

Figer -I

Anomalies of the Turbinates

Turbintaes	Right	Left	Bilateral	Total %
Concha Bullosa	30	23	48	101 (17%)
Paradoxical	5	9	14	28 (4%)

(N=584)

Figer -II

Distrbution of Disease

Sinus	Number (%)
Maxillary	291 (49.8%)
Ethmoid	212 (36.3%)
Frontal	181 (30.9%)
Sphenoid	130 (22.2%)

(N=584)

Figer -III

Hypertrophy of the Turbinates

Turbinate	Mail			Total
	Right	Left	Bilateral	
Inferior	42	80	156	278
Middle	30	21	50	101

(N=584)

Figer -IV

Mucosal Thickening

Sinus	Right	Left	Bilateral	Total (%)
Maxillary	36	40	170	246 (42%)
Ethmoid	25	24	175	224 (38%)
Fronatal	21	22	99	142 (24%)
Sphenoid	19	10	83	112 (19%)

(N=584)

Figer -V

Fluid levels in the different sinuses

Sinus	Right	Left	Bilateral	Total (%)
Maxillary	18	17	25	60 (10%))
Ethmoid	17	1	5	23 (3.9%)
Fronatal	8	3	7	18 (3%)
Sphenoid	1	2	9	12 (2%)

(N=584)

Figer -VI

Polyposis

Sinus	Right	Left	Bilateral	Total (%)
Maxillary	17	11	33	61 (10%)
Fronatal	2	3	16	21 (3.5%)
Ethmoid	6	-	8	14 (2.4%)
Sphenoid	-	-	6	6 (1%)

(N=584)

Figer -VII

The anatomical anomalies recorded consisted of deviated nasal septum, anomalies of the uncinate process, concha bullosa, paradoxical middle turbinte, Haller's cells, Onodi cells, and hypoplsia or atresia of sinuses.
The pathological changes recorded consisted of hypertrophy of the inferior and middle turbinates, occlusion of the OMC, mucosal thickening, fluid levels, polypi, mucoceles and miscellaneous findings.

Results

During the period 1997-1999 five hundred and eighty four consecutive coronal CT scans of the paranasal sinuses performed in King Abdulaziz University Hospital and Erfan & Bagedo General Hospital for various condition were included in this study. CT scans were done in the coronal plane with 3mm thickness cuts. There were 354 males and 230 females. The age range was between 4 and 84 years with a mean age of 32.5 years.
Eighty seven (14%) patients had anatomical anomalies with no pathological changes and 177 (30.3%) had pathological changes while 296 (50.7%) had a combined anatomical variants and pathological changes. Five per cent of the CT scans showed no anomalies or changes.
The results were divided into anatomical anomalies and pathological changes.
The anatomical anomalies are shown in Tables I & II. Deviated nasal septum constituted the majority of findings followed by concha bullosa and paradoxical middle turbinates. Anomalies of the uncinate process were seen in 25 patients (4%) and Haller's cells in 22 patients (3%). No Onodi cells were seen in this series. Hypoplasia was seen in 20 of the frontal sinuses and 3 of the maxillary sinuses while complete aplasia of the frontal sinus was seen in eight patients.
The pathological changes seen in the different sites are shown in Tables III, IV, V, VI & VII. Mucosal thickening took the major share of the pathological changes seen with a total of 724 sites. The maxillary sinus was the most commonly involved sinus. Sixty four per cent of the turbinates were hypertrophied with the inferior turbinate being the most commonly affected. The majority of fluid levels and polypi were again seen in the maxillary sinuses. One hundred and ninety five (33.3%) middle meati were occluded. Of these 7 were not associated with sinus disease while the remaining 188 (32%) were associated with mucosal thickening or poplypi. Sixty nine (11.8%) of the concha bullosa were associated with sinus disease while 32 (5.5%) were associated with disease free sinuses.
Ten osteomas were seen in the frontal sinuses, two in the maxillary sinus and one in the ethmoid sinus. Only one dentigerous cyst was seen. No cases of bony destruction indicating neoplasia were seen in this series. One case of rhinolith was also seen.

Discussion

In 1966 Proctor stated that the ethmoid sinuses are the likely key to infectious sinuses.[4] Messerklinger in 1978 [5] concluded that in the majority of patients infection spreads from the ethmoids to the maxillary antra and frontal sinuses via the middle meatus, infandibulum and frontal recess. Anatomical variations in the middle meatus are said to contribute to middle meatal blockage e.g. concha bollusa. It is now accepted that CT is the optimum imaging method of demonstrating diseases in the sinuses.[6] Pfleiderer et al in 1983 [1] and Laranne et al in 1992 [7] demonstrated poor correlation between plain x-rays and subsequent sinoscopic findings and the high percentage of false positive and negative results. According to Lazar and Younis CT scanning has become the "gold standard" in imaging the paranasal sinuses.[8]. The present study was aimed at finding out the CT scan appearances in a Saudi population attending two general hospitals in Jeddah, Saudi Arabia. This, we believe, is the first such study to come out of Saudi Arabia.
Five percent of the scans showed no anatomical variations or pathological changes. Battacharya et al reported a 34% normal scans in their series. [9] Anatomical variations alone were seen in 14% of our patients. Scribeno et al reported 69 (N=130) anatomical variations seen in their series.[10] On the other hand 30.3% of scans in our series showed pathological changes alone while 50% showed a combined anatomical variants and pathological changes. The overall total is 80.3% which is almost similar to other series.[11]
The incidence in our series of DNS was 56%, concha bullosa in 17%, paradoxical middle turbinate in 4%, Haller's cells in 8% and abnormal uncinate process in 4%. Kennedy and Zinreich [12] reported concha bullosa in 36%, septal deformity in 21% and Haller's cells in 10% .Bogler et al [13] reported concha bullosa in 17%, Haller's cells in 46% and paradoxical middle turbinates in 27%. Another study [14] reported septal deformity in 40%, concha bullosa in 29% and paradoxical middle turbinates in 12%. Yet another report gives the incidence as concha bullosa 13%,Haller's cells 11%,paradoxical turbinates 15%.[15] The following frequency was described by Lloyd [16]: concha bullosa 14%, paradoxical turbinate 17%, bent uncinate process 16% and Haller's cells 2%.
Not a single case of Onodi cell was seen in our series. Gross anatomic studies place the prevalence of Onodi cells at 1-39% [17,18] while CT scan

studies report a prevalence of 1-8%. [17,19,20]
Hypoplasia of the frontal sinus was seen in 20 (3.4%) of our cases and 3 of the maxillary sinus. Complete aplasia of the frontal sinus was seen in 8 patients.
No dehiscence of the lamina paparyacea was seen in our series. The incidence seems to be between 2% to 32%. [15,21]
In this series, the maxillary sinuses was the most involved sinus (49.8%) followed by the ethmoids (36.4%), the frontals (30.9%) and the sphenoids (22.2%). Battacharya et al [9] report the involvement of the maxillary sinus to be 43% while Zinreich et al [22] report the involvement of the maxillary sinus to be 65%, the ethmoids 72%, the frontals 34% and the sphenoids 29%.Others give a similar figures.[23]
Mucosal thickening was the most common pathological finding in our series. The maxillary sinus was the most commonly involved sinus (42%) and the sphenoids were the least affected (19%).Tonai and Baba [24] report the mucosal thickening to be 86%. The most common combination was the maxillary and ethmoidal sinuses. It is already known that most sinus disease starts in the middle meatus which may then spread to the adjacent sinuses. In this series the occlusion of the middle meatus occurred in 33.3% of the cases. Out of these only 1.2% were not associated with sinus disease. Kamal [25]demonstrated the presence of anatomical or pathological changes on the ostiomeatal area in all of the 100 patients in his study who were suffering from maxillary sinusitis. Calhoun et al [14] identified a high incidence of disease in the ostiomeatal complex in patients with sinusitis compared with control group.
Sinus disease was also associated with concha bullosa in 11.8% of the cases. Lloyd [16] reported that 11 out of 14 patients showing concha bullosa were associated with CT evidence of sinus infection. East and Annis [23] reported a 30% incidence of concha bullosa. However, they postulate that the extent of pneumatization in the middle turbinate and therefore the size had no correlation with the presence or absence of disease in the anterior ethmoids.

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