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Research Article

Prospective Study on Anatomical Variation of Paranasal Sinus and Nasal Cavity in CT Scans and Literature Review

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Abstract

Purpose: To estimate anatomic variation of paranasal sinus in Bahrain population and to compare their prevalence in different studies.

Materials and Methods: It is a prospective study of 100 ct scans of paranasal sinus with no significant sinus pathology. We determined prevalence of variations of paranasal sinuses and compared it with other studies.

Result: Our study showed similar results in anatomic variation to that found in the literature with some differences in parameters like most common type of keros classification and type of uncinated process.

Conclusion: These variations could be due to different facial configuration in study population. And such difference need to be considered in surgical decision making and management of paranasal sinuses in order to avoid untoward complications.

Keywords: Paranasal Sinus; CT Scan Sinuses; Frontal Sinus; Ethmoid Sinus; Maxillary Sinus

Introduction and Aim

Most common sinus anatomic variation found in the literature [1] included septal deviation, concha bullosa and agger nasi cell. The aim of this study is to describe the most common anatomic variation of the paranasal sinuses in Bahrain population in comparison to other studies.

Materials and Methods

This is a prospective cross-sectional study in which 100 CT scans of paranasal sinuses obtained from January 2018 to December 2020. Inclusion criteria included normal sinuses on CT scans of adult patients. Exclusion criteria included CT scans with abnormal paranasal sinus findings including sinusitis, tumors and previous surgery. The prevalence of different anatomic variations was recorded and compared to other studies. The descriptive data were expressed as frequencies and percentages, continuous data were expressed as mean and SD. Statistical analysis was done using chi-square test or Fisher's exact was test used for the comparison between discrete variables. A Student's t test was used for comparison of continuous variables. A p-value < 0.05 considered as statistically significant.

Results

Of the 100 CT scans collected 93% of patients were of Bahraini nationality. 7% were of different ethnic origins, including Indian,

Pakistani, Syrian and Yemeni. 35% were male and 65% were female. The mean age was 38.8 years with 14.3 SD. 83% had septal deviation, 2% had bilateral absent frontal sinuses, 1% had unilateral absent frontal sinus and 90.9% had asymmetric frontal sinuses. Frontal sinus cells type-1 was found in 41%, type-2 cells were found in 40%, type-3 cells were found in 16% and type-4 cells were found in 11%. Maxillary sinus was present bilaterally in all reviewed CT sinuses. Agger nasi cell was present in 98%. Onodi cell was found in 23% and was unilateral in 14%. Haller cells were found in 34 of 200 sites, making up 17%. The most common type of uncinate process found in our study was type-2 making up 66%, followed by type-1 (14%), type-3 (11%), type-5 (6%), type-6 (2%) and type-4 (1%). Paradoxical middle turbinate was found on right in 12% and on the left in 11%. Concha bullosa was present in 27%, lamellar concha in 29% and secondary middle turbinate in 3%. Keros type-1 was found to be more common in our study making up 63%. 64% of osteomeatal compexes - Google Search were type-2 and 58% of sphenoid sinuses were sellar type. Sphenoid sinus extension were classified as Type 1 -Lateral Pterygoid, Type 2- Lateral full lateral, Type 3- Lesser wing, Type 4- Anterior, Type 5 - Clival subdorsum, Type 6- Clival dorsum and Type 7-Clival occipital Type-5 being the most commonly found, making up 47%. Optic nerve canal type-1 was found in 68%.

Discussion

Several studies mention septal deviation as the most common anatomical variation found on CT scans of the paranasal sinuses. Our study shows 83% of patients with nasal septal deviation. According to Katya A Shpilberg., *et al*. [1] 98.4% had nasal septal deviation. According to our study among 83 patients with septal deviation, 41 had left deviation, 32 right deviation and one patient had deviation both sides. 4 patients showed s-shaped deviation and 6 patients had spur.

Frontal sinus in our study was bilaterally present in 95 patients (95%), bilaterally absent in 3% and bilaterally rudimentary in 1 patient. Absent unilateral sinus was found in one patient (1%). The majority of patients had asymmetric sinuses (90.9%). In comparison one study [2] found bilateral and unilateral absent frontal sinuses in 0.73% and 1.22% of cases, respectively. In another study [3] a total of 109 PA skull radiographs were taken and absent frontal sinuses was found in 5.5% and unilateral sinus was found in 2.75%.

41% patient had type I frontal cell which was the most common type of frontal cell found in our study. In one study [4] type I frontal cells were found in 21.429%, type II in 26.429%, type III in 22.143% and type IV in 8.571%.

In our study the maxillary sinus was present in all patient. Absent maxillary sinus has been reported in literature [5,6] but none of our patients had absent maxillary sinus.

In our study Agger nasi cell was present in 98% of patients compared to other studies, in which Agger nasi cell was found in 98.7% [7].

In our study 23 out of 100 patients had onodi cell, out of these 14 of them had bilateral onodi cell. In one study 260 (24.07%) of cases out of 1080 displayed onodi cell [8].

In one study [9] Haller cells prevalence was in 49.5% (99 of 200). In our study total of 34 of 200 sites had Haller cells, making up 17%.

The most common type of uncinate attachment according to Landsberg and Friedman classification in the literature [10] is type-2 (52%). Our study showed similar findings in which the most common type of uncinate attachment was type-2 (66%).

One study [11] showed the prevalence of aerated uncinate process to be 6.26% compared to our study in which aerated uncinate process was found in 4%. In the literature [12] the prevalence of horizontal and vertical uncinate processes was 56% and 44% respectively compared to 15% and 84% prevalence found in our study. The prevalence of hypertrophied uncinate process in our study was 6% compared to 2.3% found in the literature [13].

In our study right paradoxical middle turbinate was seen in 12% and left paradoxical middle turbinate was seen in 11%, compared to the literature in which right paradoxical middle turbinate was found in 5% and left paradoxical middle turbinate was found in 3%, Sharma., *et al* [14].

In one study [15], of the 202 scans the prevalence of concha bullosa was 31.7% compared to 27% prevalence in our study. Secondary middle turbinate was reported in 0.8% to 6.8% of cases by Lin., *et al*. [16], compared to 3% prevalence in our study.

Type 2 keros is the most common type as stated in literature [17], making up approximately 71% in comparison our study showed type 1 keros to be more common (63%).

In a study done by John Earwaker [18], osteomeatal complex type 2 is the most common in agreement with our study in which type 2 osteomeatal complex was found in 64%.

In a recent study [19], of 500 CT scans 98.8% has sellar type of sphenoid sinus, 1.2% presellar and 0% conchal. However, in our study 58% patients had sellar type with 33% presellar and 9% conchal.

Sphenoid sinus extension was classified as Type 1 -Lateral Pterygoid, Type 2- Lateral full lateral, Type 3- Lesser wing, Type 4- Anterior, Type 5 - Clival subdorsum, Type 6- Clival dorsum and Type 7-Clival occipital. In 500 CT Scans [19], the prevalence of pterygoid type of sphenoid sinus extension, type 1 was (52.4%) compared to (19%) in our study, type 2 full lateral extension (45.7%) compared to (17%) in our study, lesser wing type 3 (20.4%) compared to (21%) in our study, type 4 anterior (20.4%) compared to (32%) in our study, type 5 clival subdorsal (84.8%) compared to (47%) in our study, type 6 clival dorsal (5.2%) compared to (6%) in our study and type 7 clival occipital (5%) compared to (0%) in our study.

The prevalence of optic canal types in one study [20] was as follows type 1- (60%) comparable to our study in which the prevalence of was (68%), type 2- (15%) compared to (18%) in our study, type-3 (14%) compared to (4%) in our study and type-4 (11%) compared to (10%) in our study.

Conclusion

Our study showed similar results in anatomic variation to that found in the literature with some differences in parameters like keros type 1 was more common in our study as compared to keros type 2 in other studies. And also vertical uncinate was more common than horizontal in our study. These variations need to be considered in surgical decision making and management of paranasal sinuses in order to avoid untoward surgical complications.

Author Contribution

S. Prabhu: Project development, data collection and manuscript writing.

A.F. Alabdullah: Project development, data collection.

M. R Abdulmaaboud: Data verification and analysis.

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Conflicts of Interest

No conflict of interest.

Ethics Approval

Ethical approval was obtained before commencement of research.

Consent for Publication

Received consent for publication from all authors.

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