



ASSOCIATION OF ANATOMIC VARIANTS OF PARANASAL SINUSES AND CHRONIC SINUSITIS

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ABSTRACT A case-control study was carried out on 80 patients with a clinical diagnosis of chronic sinusitis who were referred by Department of ENT of tertiary care hospital. The control group (n= 40) were chosen from the same hospital patients with diagnoses other than sinusitis. The association between the anatomic variants (concha bullosa of inferior and middle turbinate, agger nasi cell, haller cell, giant ethmoidal bulla, septal deviation and inverted uncinate process) and existence of chronic sinusitis was shown with odds ratio (OR). Septal deviation and concha bullosa of middle turbinate were the anatomic variants significantly associated with chronic sinusitis (respectively OR= 2.08 and OR= 2.12). Normal anatomic variants of paranasal sinuses may be considered as predictors for the occurrence of chronic sinusitis.

KEYWORDS : Multislice computed tomography; Paranasal sinuses; Anatomical variations; sinusitis.

Multislice computed tomography is currently the imaging modality of choice for evaluating paranasal sinuses and adjacent structures.¹ Paranasal sinuses are a group of air-filled spaces developed as an expansion of the nasal cavities, eroding the adjacent bone structures. Some anatomical variations may predispose to chronic sinusitis by blocking normal sinus drainage. Chronic sinusitis is repeated bouts of acute infection or persistent inflammation of the sinuses.² The imaging signs suggestive of chronic sinusitis are: mucosal thickening, sinus opacity, retention cyst, and bone changes such as deformity or sclerosis that indicate osteitis and polyposis.³ Untreated chronic sinusitis can result in severe complications such as orbital cellulitis, osteomyelitis, subdural empyema, frontal lobe abscess, cavernous sinus thrombosis, and death.³ Identifying the predisposing factors for chronic sinusitis are therefore very important. Particularly, paranasal anatomical variants have been investigated by several studies, and concha bullosa has been shown to be a common predisposing factor for sinusitis.⁴

MATERIALS AND METHODS

From January 2016 to March 2017, 80 consecutive patients with the clinical diagnosis and positive CT scan findings of chronic sinusitis were chosen as cases in this case - control study. These patients were referred by Department of ENT of tertiary care hospital. The control group was selected from the patients of the same hospital with clinical diagnoses other than sinusitis and indication of CT scan imaging (n= 40). The information about age, gender, mode of CT scan (coronal or axial), imaging evidences of inflammatory disease for each sinus (only for the case group), and paranasal anatomic variants (for both cases and controls) was recorded. The anatomic types that were assessed included: septal deviation, concha bullosa of the middle and lower turbinates, the uncinate process, giant ethmoidal bullae, haller cells, giant agger nasi cells, and reverse uncinate process. The presence of each of these anatomic variants was diagnosed according to the imaging descriptions in the CT scan reference books. CT scan instrument was General Electric (GE) 16 slice CT. Paranasal sinus CT scans are generally performed by 2.5 mm for both coronal & axial sections, thin reconstruction of 1.25 mm for both axial and coronal sections. The association between chronic sinusitis and presence of anatomical variants of paranasal sinuses were measured by calculation of odds ratio (OR) with 95% confidence interval (CI).

RESULTS

Descriptive information of all participants is summarized in Table 1 and Table 2. The mean age (\pm SD) was 34.6 (\pm 12) years in the cases, and 33.5 (\pm 11) in controls. No significant difference was seen between these results. Also, male comprised 43 (53%) of the cases, and 18 (45%) of controls. No significant difference was seen (chi-square test, $p=0.08$). We found an association between presence of concha bullosa in middle turbinate and the septal deviation. The odds ratio (OR) and 95% confidence interval were 2.08 [1.12-3.94] and 2.12 [1.11-4.82], respectively. Data analysis in subgroups showed an association between the presence of anatomic variants and the occurrence of chronic sinusitis in any of the paranasal sinuses. This association was very strong in maxillary, frontal and sphenoidal sinusitis. Concha

bullosa of turbinates, septal deviation, and giant agger nasi cells were variants which showed significant associations in different types of sinusitis.

Table 1.

Sinusitis	No. of cases (%)
Ethmoid	33 (28)
Maxillary	74 (62)
Frontal	24 (20)
Sphenoid	27 (22)

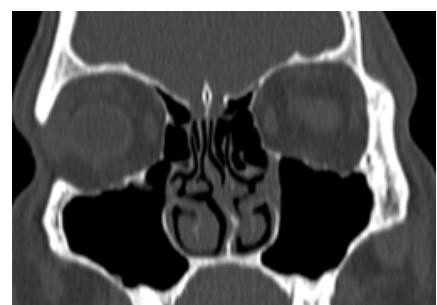
Table 2.

Anatomic Variants	No. of cases (%)
Nasal septum deviation	58 (48)
Concha bullosa	65 (54)
Haller cell	10 (8)
Giant agger nasi cell	14 (12)
Inverse uncinate process	7 (6)

Fig. 1 Coronal reformed image showing bilateral concha bullosa.



Fig.2 Coronal reformed image showing nasal septum deviated to left.



DISCUSSION

The current study revealed that among all the observed paranasal variants, concha bullosa of middle turbinate and septal deviation were associated with the occurrence of chronic sinusitis. Also, there was a significant association between presence of anatomic variants and occurrence of chronic sinusitis for each paranasal sinus. Except for ethmoidal sinusitis, this association was very strong. In a study by Scribano, 1997 Italy, 59% of their patients with chronic sinusitis had concha bullosa and 5% of them had large ethmoidal bulla. The remarkable difference between the prevalence of these variants among their patients as compared with the normal population lead to the conclusion that these anatomic changes probably increase the risk of sinus inflammatory diseases by bringing the mucosal lining of the osteomeatal unit in contact with the mucosal lining of the paranasal sinuses.⁵ Also in a Swiss study, S-Nadas reported that 35% of 151 patients with chronic sinusitis had middle turbinate concha bullosa, and after resecting the anterior third of the pneumatized turbinate, 80% of the patients showed improvement in their symptoms.⁶ Also another study by Lam on 100 patients with signs and symptoms of chronic sinusitis, spiral CT scan of the paranasal sinuses yielded 47 cases of concha bullosa and a significant relationship between this finding and chronic sinusitis was observed.⁷ However, a few studies like Tati's in 2001 and Unlu in 1994 found no relationship between the anatomic abnormalities and chronic sinusitis.^{8,9} Taking into account the normal anatomy of the paranasal sinuses and the osteomeatal unit (i.e. middle meatus, frontal recess and infundibulum), any anatomical abnormality that impedes sinus drainage can potentially cause (chronic) sinus inflammation. Among the anatomic variants, concha bullosa (especially the larger ones), and giant ethmoidal bulla occur in the vicinity of maxillary sinus infundibulum, and agger nasi cells are close to the frontal sinus recess. Therefore, they can compress these outlets.¹ It can be postulated that concha bullosa compresses semilunaris hiatus that is in continuity with maxillary sinus infundibulum, and the mucosal linings of these parts come into contact this sets the stage for mucosal inflammation, which persist as long as the anatomical abnormality is present, causing chronicity. In our study, the odds of presence of concha bullosa was 2.08 times as common among the individuals with chronic sinusitis as in the controls (95% CI: [1.12-3.94]).

Also, the odds of the presence of septal deviation in patients with chronic sinusitis was 2.12 times more than the odds in the controls (95% CI: [1.11-4.82]). This finding shows that the deviation of nasal septum may interfere with normal drainage of sinuses and cause chronic inflammation, with the abovementioned mechanisms. Another noticeable finding was the association of inverted uncinate process with frontal sinusitis. For other structural changes, like haller cells, normally we do not expect serious pressure effect or a higher prevalence of chronic sinusitis, since they occur away from the osteomeatal unit.

Conclusion

Untreated chronic sinusitis can have severe complications. Identifying the predisposing factors for these complications and eliminating them can prevent the inflammation from becoming chronic. Concha bullosa of the middle turbinate and deviated nasal septum are predisposing factors that can be successfully treated by surgeries; hence it is important to diagnose.

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