Etiopathogenesis of Rhinosinusitis in Relation to Ethmoid Anatomy

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Abstract
Introduction: Rhinosinusitis is one of the most common ENT disorders in the developed and developing world. The quest and identification of factors predisposing to chronic rhinosinusitis is the key for guiding appropriate management.

Objectives: The purpose of this study was to determine the prevalence of anatomical variations of the ethmoid sinus in patients with rhinosinusitis. This was done to assess and evaluate the significance of the anatomical variations of the ethmoid in the genesis of inflammatory sinus disease.

Material and methods: We reviewed 50 patients with rhinosinusitis, of which 38(76%) had anatomical variations of ethmoid and the extent of mucosal disease.

Results: Concha bullosa was found to be the most common anatomic variation and was seen in 25(50%) patients closely followed by variations in the uncinate process, paradoxically bend middle turbinate. The most commonly affected paranasal sinus was maxillary sinus (84%) followed by anterior ethmoidal sinus, posterior ethmoidal sinus, frontal sinus and sphenoid sinus in descending order.

Conclusion: Anatomical variations of the ethmoid sinuses are important etiological factors in the genesis of inflammatory sinus disease.

Keywords: Rhinosinusitis, concha bullosa, anatomical variations, FESS.

INTRODUCTION

Rhinosinusitis is an inflammatory process involving one or more of the paranasal sinuses that usually follows an allergic reaction or viral/bacterial upper respiratory infections. Rhinosinusitis, with its classical symptoms of nasal obstruction, nasal discharge, headache and allergic symptoms is the most common disease for which otorhinolaryngological consultation is sought.

The obstruction of the osteomeatal complex—the region of middle meatus in which all maxillary, anterior ethmoidal and frontal sinuses drainage orifices are located has been considered the most important in the pathophysiology of rhinosinusitis. 1,2

Anything which interferes with the normal functions of the mucus membrane predisposes to rhinosinusitis.

Anyone can get acute rhinosinusitis but some are more prone to it.

The approach to the evaluation of rhinosinusitis changed after Messerklinger and Stammberger 3 published the first comprehensive account of technique of nasal endoscopy and its application to the diagnosis of sinonasal disease. The same authors earlier gave the concept of mucociliary clearance of paranasal sinuses. Disruption of the mucociliary clearance due to anatomic variations is considered to be the prime factor for the continuation of symptoms and rhinosinusitis.

Computed tomography (CT scan) has proved to be an indispensable method for the diagnosis of paranasal sinuses afflictions, especially the coronal sections, in which we can clearly identify the important anatomical variations. 4,5

Environmental factors such as allergens, viruses or air pollutants have been considered to predispose to development of rhinosinusitis.

In this study we evaluated the role of anatomical variations of ethmoid in the causation of rhinosinusitis.
MATERIAL AND METHODS

The study was conducted at the Department of Otorhinolaryngology, Medical college and Sir Sayaji General Hospital, Baroda during the period between May 2007 and Nov 2009 which comprised 50 cases who underwent medical and surgical management for chronic rhinosinusitis and nasal polyposis.

The selection of the patients was done on the following basis:

- History of nasal obstruction nasal discharge, headache or allergic symptoms.
- All patients with clinical diagnosis of chronic sinusitis were included in the study. A detailed history and a thorough clinical examination was done. Routine hematological and serum investigations were performed. Nasal endoscopy and CT scan were performed in all cases.
- We excluded cases with Nose/PNS tumors, acute infective conditions and pediatric patients below 10 years of age.
- Endoscopic sinus surgery was performed on a majority of the patients.
- Septoplasty was performed in patients with severely deviated nasal septums beforehand to facilitate access during endoscopic sinus surgery. Patients were followed-up for symptomatic resolution by clinical assessment and routine endoscopic examinations.

RESULTS

Fifty patients who were diagnosed as having chronic sinusitis and underwent medical or surgical treatment, were studied in this series. Mean age of the patient was 36 years with the distribution ranging from 13 to 64 years. Males (76%) were found to be more commonly affected in this study (Table 1).

Most of the patients had history of nasal obstruction and nasal discharge.

In majority of patients, nasal obstruction was unilateral, intermittent and was relieved on medication but it was persistent and severe in patients who had nasal polypi. Nasal discharge was intermittent, mucoid or mucopurulent; more common in patients who had associated nasal polypi.

Headache was intermittent, associated with nasal obstruction. Anosmia/Parosmia were more commonly associated with nasal polypi. Sneezing was usually associated with allergic conditions (Fig. 1).
documentable abnormality. Another 8 patients had CT scan positive results and negative endoscopic ones. One patient presented with negative results for both CT scan and endoscopic examination.

More than 70% of the patients had bilateral disease. The maxillary sinus was the most common site of infection/inflammation followed by the anterior and posterior ethmoid, frontal sinus and sphenoid sinus (Fig. 2).

Functional endoscopic sinus surgery was performed in 39 (78%) of patients in this study. Septoplasty was usually performed as an adjunct to functional endoscopic sinus surgery to provide space for instrumentation.

DISCUSSION

The quest and identification of factors predisposing to chronic rhinosinusitis is the key for guiding appropriate management.

Sinusitis is one of the most common health care challenges in the developed and developing world.

Association between presence of concha bullosa and development of chronic rhinosinusitis was quite strong.\(^7\)\(^-\)\(^11\)

It is due to its negative influence on paranasal sinus ventilation and mucociliary clearance in the middle meatus region as quoted by Tonai\(^12\) (Figs 3A and B). The incidence of concha bullosa was 50% which is less as compared to the reported incidence of 53.6% by Bolger et al,\(^7\) 42.6% by Maru et al,\(^13\) 28% by Asruddin et al,\(^14\) 24% by Llyod.\(^15\)

Lloyd even suggested a possibility of complete blockage of the entrance to the middle meatus, if the concha bullosa were to grow to such a degree that the turbinate heads completely filled the space between the septum and lateral nasal wall\(^8\)\(^,\)\(^9\) (Table 3).

The middle turbinate may be paradoxically curved, i.e. bent in the reverse direction. This may lead to impingement of the middle meatus and thus to sinusitis. It was found in 11(22%) patients (Figs 4A and B). The incidence is higher to that of 12% by Asruddin et al\(^14\) and 15% by Llyod.\(^15\) It is less than that reported by Bolger et al\(^7\) (27%).

Zinreich first observed that the uncinate process may be curved or bent. It can impair sinus ventilation especially in the anterior ethmoid, frontal recess and infundibulum...
regions. The incidence of variation in uncinate process was found in 30% which is higher than that of 2.5% reported by Bolger and 2% by Asruddin and less than that of 9.8% by Maru et al (Figs 7A to C).

Unfortunately, the accuracy of reported rhinosinusitis cases is difficult to ascertain. The diagnosis on the basis of symptoms is common but can be very unreliable.

Endoscopic examination is a mandatory investigation in all patients of Rhinosinusitis and Sinonasal polyposis. It helps to know the site of origin of the polypi and the extent of disease.

Table 3: Association between concha bullosa and rhinosinusitis

<table>
<thead>
<tr>
<th>Concha bullosa</th>
<th>Rhinosinusitis/ nasal polypi</th>
<th>Nonrhinosinusitis/ nonnasal polypi</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Presence</td>
<td>24(48%)</td>
<td>1(2%)</td>
<td>25(50%)</td>
</tr>
<tr>
<td>Absence</td>
<td>21(42%)</td>
<td>4(8%)</td>
<td>25(50%)</td>
</tr>
<tr>
<td>Total</td>
<td>45(90%)</td>
<td>5(10%)</td>
<td>50(100%)</td>
</tr>
</tbody>
</table>

CT scan of paranasal sinuses is indispensable in identifying disease that may not be appreciated during routine clinical and endoscopic examination. In addition, CT examination of the paranasal sinuses will provide an anatomic road map of paranasal sinuses and identify the presence of significant anatomic abnormalities, the location and severity of disease. Coronal scans are preferred because anatomy and pathology are examined in a plane most identical to that approached by the endoscopic surgeon.

The osteomeatal complex is a region of key importance for the development of sinusitis. This is an area through which the maxillary, anterior ethmoid and frontal sinuses drain into the nasal cavity. Anatomic variations of the ethmoid which are extremely common sometimes block drainage from these three sinuses and lead to stagnation of secretions, creating a culture medium for infection to develop.

Successful management of rhinosinusitis by medical or surgical treatment is achieved in the majority of patients. Surgery is usually required in those patients having some anatomical abnormality obstructing the sinus drainage or
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those not responding to medical management. In some cases symptoms resolve spontaneously. Treatment of chronic rhinosinusitis is intended to reduce symptoms and signs, improve quality of life and prevent disease progression or recurrence.

CONCLUSION

Anatomical variations of the ethmoid sinuses are important etiological factors leading to the genesis of nasal pathology. Concha bullosa, variation in uncinate process and paradoxical middle turbinate which contribute to the narrowing of the osteomeatal complex are associated with mucosal disease.

REFERENCES