Concha Bullosa: A Shield Against Allergens?
Douglas M. Worrall BS, Raewyn G. Campbell MD, James N. Palmer MD, David W. Kennedy MD, Nithin D. Adappa MD
Department of Otorhinolaryngology Head and Neck Surgery, University of Pennsylvania Health System

Abstract
Introduction: Concha bullosa (CB) is a pneumatization of the nasal turbinates, which alters intranasal anatomy and may influence the inflammatory microenvironment central to chronic rhinosinusitis (CRS) and allergic rhinitis (AR) pathophysiology. It remains unclear whether CB is part of an adaptive process, buffering against inhalant allergens, or a pathologic one, impairing sinus drainage and predisposing to inflammation. Investigating the link between allergies and CB can examine the theoretical benefit of this enigmatic anatomic variant, which has implications on the extent of resection in endoscopic sinus surgery.

Methods: A retrospective review of adults with chronic sinonasal symptoms evaluated by skin prick testing and maxillofacial computed tomography (CT) scan between 2010 and March 2014 was performed. Allergy status was blinded prior to CT scan analysis by two independent reviewers. Chi-squared test was used to examine the relationship between CB and allergy status.

Results: Forty-three adults were divided into thirty positive cases and thirteen negative (70%) and negative (69.2%) allergy tests (p=0.93). Overall, 83.3% of CB were located in the middle turbinate, 16.7% in the superior turbinate, and 20% occurred in the middle turbinate bilaterally.

Conclusions: Although an enlarged, pneumatized turbinate could function as a physical barrier to inhalant allergens, documented allergies showed no association with concha bullosa formation. No physiologic benefit of CB was identified in this study. The causality behind CB driving CRS is controversial, but the high prevalence of CB among patients with chronic sinonasal symptoms suggests a possible association with sinonasal quality of life.

Background

- Concha bullosa (Figure 1) is an air filled cavity within the nasal turbinates, most commonly occurring in the middle turbinate.

Is CB part of an adaptive response to atopy, increasing the buffering capacity of the nasal turbinates against inhalant allergens?

- Nasal turbinates function to humidify, filter, and warm inhaled air.

- Other species exhibit adaptive physiology of the turbinate; Camels have highly pneumatized and complex nasal turbinates, presumably to maximize surface area for humidification and optimize airflow into filtered inhaled dust and sand.

- It is unclear when or how CB form. Current hypothesis range from excessive sinus pneumatization in utero to conchal microfractures in late puberty.

Is CB pathologic, contributing to sinonasal obstruction and predisposing to CRS?

- Some studies found an association between CB and CRS.

- Others have only observed a correlation when CB were bilateral.

The relationship between CB and CRS remains controversial.

- However, endoscopic resection of the lateral portion of CB can provide significant sinonasal symptom improvement compared to medical management alone.

Question:

Is CB part of an adaptive response to atopy, increasing the buffering capacity of the nasal turbinates against inhalant allergens?

Figure 1 - LEFT: CT scan showing right middle turbinate concha bullosa (yellow arrow). RIGHT: Endoscopic view of same right middle turbinate concha bullosa.

Results

- Of the 43 subjects evaluated, 13 tested negative to all 29 intradermal allergens. The remaining 30 subjects tested positive with varying degrees of atopy, with a median of 6 positive responses and a range from 2-17 positive wheals.

- Blinded CT scans were reviewed for the presence of CB, and were divided based on relative size (small, moderate, large) and location.

Methodology

- Retrospective case-control study dividing 43 subjects with chronic sinonasal symptoms seen at rhinology clinic between 2010 and March 2014 by allergy status into cases with positive allergies and controls with no allergies in skin prick testing. CT scans then evaluated for the presence of concha bullosa.

- Skin-prick allergy testing done by standard protocol with commercial test solutions and measurement of wheal size. Negative allergy defined as <3mm wheal, positive allergy defined by wheal size greater than or equal to positive Histamine control. Screened for sensitivity to 29 common allergens.

- Moderate atopy was defined as 2-9 positive intradermal allergies and severe atopy was defined as ≥10.

Chi-squared analysis of differences in CB prevalence based on allergy results.

Conclusions

Proposed it may play a protective role, blocking inhalant allergens in allergic rhinitis.

No association found between CB on CT scan and atopy on skin-prick testing.

Allergies seem to play no role in the formation or growth of pneumatized cavities in the turbinates. The notion that CB is an adaptive response in allergic rhinitis is unlikely.

Unclear whether concha bullosa affords any physiologic benefit in humans.

Massive enlargement of a CB could be detrimental to the sinuses, impairing mucus drainage and potentially predisposing to CRS, its high frequency among chronic sinonasal patients may support this, but the putative role of CB in CRS remains highly controversial.

References

1. Zinreich S, Kaykusuz I, Alsafy 0. 13 - 15

2. Several other studies examining CB among patients with and without CRS have found no association

3. The relationship between CB and CRS remains controversial.

4. However, endoscopic resection of the lateral portion of CB can provide significant sinonasal symptom improvement compared to medical management alone.

Table & Statistical Analysis

Table 1 – Summary of CT scan results for CB across various subgroups.

- Concha bullosa alters intranasal anatomy.

Figure 2 – Qualitative division of concha bullosa on maxillofacial CT scans on bone (A, B, D) or soft tissue (C, E) windows. A - Large CB in L middle turbinate. B - Moderate CB in middle turbinates bilaterally. C - Small CB in R middle turbinate. D - Small CB in roots of middle turbinate bilaterally. E - No CB present for comparison.