The Association Between Supraorbital Ethmoid Air Cells & Orbital Proptosis in Patients with Chronic Rhinosinusitis
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Abstract

Objectives
Orbital proptosis is a known possible complication in patients with chronic rhinosinusitis (CRS). This study is undertaken to determine the association of sinus anatomy and anatomic variants with the predisposition for such a complication.

Study design
Analysis of prospectively-collected data.

Methods
All adult patients with orbital proptosis were identified from a prospectively-collected database at a tertiary institution. These were compared with a series of randomly-selected patients diagnosed with chronic sinusitis that had undergone sinus computed tomography. The presence or absence of SOECs was noted and compared between the two groups. The primary sinus anatomy responsible for the proptosis was also identified. Statistical analysis was performed using the chi-squared test.

Results
Sixteen patients with orbital proptosis were identified, of which all but one had SOECs present, causing or contributing to the proptosis. Of the 36 patients with CRS but without proptosis, only 13 had SOECs present and 37 patients did not (chi squared=22.8, p=1.8x10^-10).

Conclusions
Supraorbital ethmoid cells appear to be highly associated with and most often are responsible for orbital proptosis in patients with CRS.

Methods
Patients with proptosis were identified from tertiary rhinology patient databases in Excel 2007 and Access 2007 (Microsoft Corp, Redmond, WA) by using the ICD-9 codes for orbital proptosis and chronic sinusitis. The preoperative CT scans of these patients were reviewed for the presence or absence of supraorbital ethmoid air cells (SOEC) and for the presence or absence of proptosis. In addition, the sinus anatomy responsible for orbital proptosis was identified. SOECs were defined as air cells lateral to the lamina papyracea, superior to the orbital plate of the frontal bone, and posterior to the frontal sinus, as determined by examination of both coronal and axial cuts of a standard sinus CT. Fifty additional patients in the database were then randomized selected and their CT scans were reviewed for the presence of SOECs. For both groups, if a patient was found to have had reconstructive surgery of the frontal sinus or anterior skull base area, he was excluded from the review. Patients with acute causes of proptosis such as periorbital cellulitis, orbital cellulitis, subperiosteal abscess, or orbital abscesses were also excluded. Finally, patients with benign or malignant tumor causes of proptosis were excluded. Demographics data, SOEC presence or absence, and proptosis presence or absence were recorded.

Results
A total of 16 patients were found to have orbital proptosis on CT sinus imaging between July 2003 and June 2011. Eleven of the sixteen (69%) were male, and the average age was 33 (range 7-76). Of the patients with proptosis, 15 (94%) had evidence of SOECs. The cause of proptosis was SOEC expansion in 15 patients; in the single patient without SOEC, orbital proptosis was secondary to frontal mucocle and expansion. Fourteen of the 15 patients (93%) with SOECs had bilateral SOECs. Of the fifty random patient CTs that were reviewed, 23 (46%) were male, the average age was 50 (range 15-86), and 13 (26%) had evidence of SOECs. Six of the thirteen (46%) with evidence of SOECs had evidence of bilateral SOECs in this group. The difference between the two groups, related to the presence of SOECs between proptotic and nonproptotic patients, is statistically significant (chi squared=22.8, p=1.8x10^-10).

Discussion
Our findings indicate a strong association between the presence of orbital proptosis and the presence of SOECs. In addition, the primary cause of orbital proptosis in our patient populations was involvement and expansion of SOECs. A comparison of the rates of SOEC among our groups and those in other studies deserves mention. First, our groups were derived from a tertiary referral practice, and thus a selection bias is inferred because CT scans of sinuses typically are not ordered for asymptomatic patients in this setting. Rates of SOECs in prior studies have varied widely based on cadavers or live subjects, and based on ethnicity. Van Alyea found rates of 6% and 15% on two cadaveric series,1,2 while Dixon found a 5% rate.3 Two studies on normal white populations showed rates of 62% and 65%,3,4 whereas Korean subjects were found to have SOECs just 2.6% of the time.5 A study of normal Chinese subjects showed a rate of 5.4%.6 Nouraei et al studied the CTs of patients with and without CRS, and found a 6% rate of SOECs.7 Our rate of 26% SOECs in random subjects lies within the aforementioned range. However, the 94% rate of SOECs in patients with proptosis deserves further mention, as this percentage is well beyond the findings of SOECs in other anatomic studies. The proptosis likely results from anterior displacement of the globe due to aeration of the orbit. Because of the confined space within the boney orbit, soft tissue is displaced in the direction of least resistance. In the case of the orbit, this results in anterior displacement of the globe. Because of the apparent association between proptosis and SOECs, the surgeon should pay special attention to this area of the dissection in order to fully open outflow tracts to restore mucociliary clearance as well as possible in proptotic patients. Improved dissection is associated with fewer intraoperative complications and less likelihood of revision surgery. In a time when healthcare expenditures are being closely monitored, this can be of paramount importance.

Conclusion
Rhinologic surgeons should have a heightened awareness for the presence of SOECs in patients who have proptosis. The proper identification and treatment of these cells can have implications for both avoiding surgical complications and for long-term successful treatment of chronic rhinosinusitis. SOECs appear to be highly associated with an increased risk of orbital proptosis in patients with CRS. Further anatomic studies are required to further delineate this association.

References
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