Do Maxillary Sinus Retention Cysts Reflect Obstructive Sinus Phenomena?

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Objective: To determine the relation of maxillary sinus retention cysts (RCs) to ostiomeatal complex (OMC) obstruction and anatomic variation of the paranasal sinuses.

Methods: The results of 410 computed tomographic scans of the sinuses ordered by otolaryngologists in an academic center during a 1-year period were reviewed. Computed tomographic scans with maxillary sinus RCs were studied to determine cyst characteristics, the Lund score, OMC size and patency, and the presence of anatomic variations. Statistical analysis was conducted to determine the relation of RCs to these factors.

Results: The incidence of RCs was 12.4% (51 cases). The mean patient age was 41.3 years, with a female-to-male ratio of 2.4:1. Solitary cysts were found in 45 (88%) involved sinuses. Nine cases (18%) demonstrated bilateral cysts, allowing 42 unilateral cases to be analyzed with the non-diseased side as a control. The mean cyst size was 1.56 cm, and cysts were most commonly located inferiorly (30 [50%]) and were solitary (45 [88%]). The RC side had a higher mean Lund score than the control side (2.62 vs 1.93; \( P = .008 \), Wilcoxon signed rank test). Of the cyst sides, 18 (43%) demonstrated OMC occlusion, vs 15 (36%) for the control side (\( P = .55 \), McNemar test). The mean OMC size was smaller for the cyst side vs the control side (0.77 vs 1.35 mm; \( P = .13 \)). No association was found between RCs and concha bullosa or Haller cells (\( P = .45 \) and \( P = .39 \), respectively).

Conclusions: Maxillary sinus RCs do not reflect persistent obstructive pathology of the OMC, and are not associated with potentially obstructive anatomic sinus variations. Consideration should be given to not scoring RCs as positive disease during Lund staging.

Arch Otolaryngol Head Neck Surg. 2000;126:1369-1371

The maxillary sinuses are the largest of the paranasal sinuses, and may become involved with several types of disease, including chronic rhinosinusitis, malignant neoplasms of the paranasal sinuses, or dental disorders. Of the paranasal sinuses, they are also the most commonly found to harbor retention cysts (RCs). These maxillary sinus RCs are usually asymptomatic, but may become clinically important when they cause obstruction of the maxillary sinus outflow tract, when they occur in the setting of symptoms compatible with chronic rhinosinusitis, or when the diagnosis is in doubt. High-resolution computed tomographic (CT) scanning of the paranasal sinuses has become the accepted standard in the radiographic assessment of chronic rhinosinusitis. Because of its high image quality, the CT scan is usually able to distinguish maxillary sinus RCs from other forms of mucosal disease, and in many cases allows patients to avoid diagnostic biopsy when the cyst is asymptomatic.

However, it is not clear whether maxillary sinus RCs are a completely incidental finding, or whether they represent true sinus pathology. While some believe that RCs rarely cause symptoms, and should not be considered disease in terms of chronic rhinosinusitis, others have reported symptomatic cysts and recommend surgical therapy in certain cases. Furthermore, with the widespread use of the CT scan for staging of chronic rhinosinusitis, the question arises as to whether the finding of a maxillary sinus RC should be staged as positive disease (opacification) in the Lund scoring system. This study was undertaken to determine the incidence of maxillary sinus RCs in a population undergoing evaluation for chronic rhinosinusitis and to determine whether such RCs reflect obstructive sinus phenomena.

RESULTS

From the aggregate 410 sinus CT scans, 51 cases of RCs were identified, for an overall incidence of 12.4%. The mean patient age was 41.3 years, with a female-to-male ratio of 2.4:1. Solitary cysts were found in 45 (88%) involved sinuses. Nine cases (18%) demonstrated bilateral cysts, allowing 42 unilateral cases to be analyzed, with the non-diseased (noncyst) side as a control. Cases with bilateral RCs were eliminated from the remaining analysis. The mean cyst size was 1.56 cm (range, 0.5-4.4 cm), and cysts were
PATIENTS AND METHODS

The results of 410 CT scans of the sinuses ordered by otolaryngologists in an academic center during a 1-year period were reviewed. These coronal CT scans were ordered as part of the clinical evaluation of patients with chronic rhinosinusitis, when 1 or more of the criteria for the diagnosis of chronic rhinosinusitis were present according to the American Academy of Otolaryngology—Head and Neck Surgery guidelines. From this group, patients with maxillary sinus RCs were identified. For the purposes of classification, the following characteristics were required for the radiographic diagnosis of a maxillary sinus RC: (1) a homogeneous dome-shaped cyst with sharp demarcation of the lateral borders; (2) absence of bony destruction; (3) absence of communication with tooth roots (to exclude dentigerous cysts); and (4) a smooth, spherical outline along the free border of the cyst.

Patient demographics were recorded. The CT scans with maxillary sinus RCs were studied to determine characteristics of the cysts, including the location, number, and size of the cysts. The size of the cyst was measured in its longest dimension. In patients with multiple cysts in a single maxillary sinus, location and size were evaluated for the largest cyst. For each patient, the size and patency of the maxillary sinus infundibulum (ostiomeatal complex [OMC]) were recorded for both sides. The type of radiographic disease in each maxillary sinus was subclassified as mucosal thickening alone, RC alone, mucosal thickening and RC, or normal. The presence or absence of Haller cells, concha bullosa, or other anatomic variations was noted.

Statistical analysis was conducted using the Statistical Package for Social Sciences system, version 9.0 (SPSS Inc, Chicago, Ill). Descriptive statistics were computed for all cases. Next, cases with bilateral RCs were excluded, and the remaining unilateral cases were examined, with the nondiseased (noncyst) side as a control. The Lund scores and the sizes of the OMC for the cyst side and the control side were compared with the Wilcoxon signed rank test. The McNemar test was used to determine the association between the presence of OMC occlusion and the presence of a cyst. Similarly, the McNemar test was used to determine the association between RCs and Haller cells and concha bullosa.

In only 1 case was the cyst itself found to be obstructing the maxillary infundibulum. The RC side had a higher mean Lund score than the control side (P = .008, Wilcoxon signed rank test). Occlusion of the OMC was found in more of the cyst sides than the control sides (P = .55, McNemar test). The mean OMC size was smaller for the cyst side vs the control side, but this was not statistically significant (P = .13, Wilcoxon signed rank test). No association was found between the presence of RCs and concha bullosa or Haller cells (P = .45 and P = .39, respectively; McNemar test). These data are summarized in the Table. Based on these data, a corrected Lund score was computed for the disease side. The corrected Lund score was computed by treating maxillary sinus RCs as “no disease” in scoring; if there was mucosal disease within the sinus in addition to the RC, that sinus was scored as diseased. This resulted in a corrected mean Lund score of 1.86 for the diseased side, which was not statistically different from the control side (Lund score, 1.93; P = .93, Wilcoxon signed rank test).

Maxillary sinus RCs are classically described as dome-shaped lesions originating from the mucosa within the maxillary sinus. These cysts make up one of the most common incidental findings within the paranasal sinuses. Several studies have documented incidences ranging from 4.3% to 8.7% by plain radiography in the general patient population. This percentage may approach 10% or greater if more sensitive sinus imaging modalities such as CT or magnetic resonance imaging are used. This study found an incidence of maxillary sinus RCs of 12.4% in a group of patients seeking care for presumed sinonasal disease. This compares with an incidence of 16.4% found by Scribano et al in a similar patient population. It would appear that maxillary sinus RCs occur somewhat more frequently in patients with symptoms of chronic rhinosinusitis than in asymptomatic patients.

Because of the relatively high incidence of maxillary sinus RCs in the normal population, it is important to determine if these should be considered pathological. Especially in patients who present with clinical symptoms compatible with a diagnosis of chronic rhinosinusitis, whether to consider such cysts as manifestations of inflammatory or obstructive sinus disease becomes clinically important. In addition, with the continued emphasis on CT scan stag-

### Summary of Control and Diseased Side Data

<table>
<thead>
<tr>
<th>Variable</th>
<th>RC Side (n = 42)</th>
<th>Control Side (n = 42)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lund score, mean (SD)</td>
<td>2.62 (1.65)</td>
<td>1.93 (1.99)</td>
</tr>
<tr>
<td>OMC size, mean (SD), mm</td>
<td>0.77 (0.80)</td>
<td>1.35 (1.98)</td>
</tr>
<tr>
<td>OMC obstruction</td>
<td>18 (43)</td>
<td>15 (36)</td>
</tr>
<tr>
<td>Haller cell</td>
<td>8 (19)</td>
<td>5 (12)</td>
</tr>
<tr>
<td>Concha bullosa</td>
<td>10 (24)</td>
<td>14 (33)</td>
</tr>
<tr>
<td>Disease type</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mucosal disease alone</td>
<td></td>
<td>14 (33)</td>
</tr>
<tr>
<td>Cyst alone</td>
<td>32 (76)</td>
<td></td>
</tr>
<tr>
<td>Disease and cyst</td>
<td>10 (24)</td>
<td></td>
</tr>
<tr>
<td>No pathological features</td>
<td></td>
<td>28 (67)</td>
</tr>
</tbody>
</table>

*Data are given as the number (percentage) in each side, unless otherwise indicated. RC indicates retention cyst; OMC, ostiomeatal complex; and ellipses, data not applicable.
ing of chronic rhinosinusitis, maxillary sinus RCs, if considered true pathological features, will tend to increase patients’ CT scan stage. For these reasons, this study sought to determine if maxillary sinus RCs were related to obstruction of the OMC, to the size of the OMC, and to other anatomic variations, which might link these cysts to a potentially correctable pathophysiological cause.

Obstruction of the OMC is believed to be a critical step in the development of chronic rhinosinusitis. Much of the endoscopic treatment of chronic rhinosinusitis is mainly directed at addressing disease involving the OMC. Obstruction of the OMC may result in mucosal thickening, air fluid levels, complete opacification, or other pathological findings within the maxillary sinus. Similarly, obstruction may also promote the formation of mucosal RCs, although such a relation has been difficult to demonstrate.  

The pathogenesis of maxillary sinus RCs remains unclear. Some studies propose a postobstructive or allergic cause for these cysts. There is some evidence that these cysts may progressively enlarge and culminate in the form of an antrochoanal polyp. Other reports have implicated barotrauma in the genesis of these cysts. If indeed obstruction was a causal factor in the cysts, one would expect a higher incidence of OMC obstruction or narrowing in maxillary sinuses with cysts when compared with a control side without cyst involvement. This study did not find this to be the case. In fact, no statistical difference was found between the rates of OMC obstruction in control and cyst sides. This is further reinforced by the fact that the size of the maxillary sinus infundibulum was not statistically significantly different between the maxillary sinus that contained the RC and the control maxillary sinus. This argues against maxillary sinus RCs resulting from postobstructive phenomena.

It is possible that the initial event leading to the formation of a maxillary sinus RC is OMC obstruction. After the initial formation of the cyst, the OMC may subsequently become patent, while the cyst may persist. Therefore, it is possible that OMC obstruction may yet be implicated in the formation of RC. Only a longitudinal study on the evolution of these cysts would be able to completely exclude this possibility. Interestingly, this study did find cases in which RCs arose in sinuses with accessory or surgically augmented maxillary ostia, further suggesting that OMC obstruction is not linked to cyst formation.

This study also failed to find an association between maxillary sinus RCs and concha bullosa or Haller cells. Other studies have also failed to find an association between these anatomic variations and inflammatory disease of the maxillary sinuses. In a study by Scribano and associates, the existence of anatomic variations alone did not result in a higher incidence of maxillary sinus disease. Only the presence of obstruction caused by mucosal contact from these variations was statistically related to maxillary sinus disease, including maxillary sinus RCs. Based on our data, it seems unlikely that maxillary sinus RCs are causally related to these anatomic variations of the OMC.

Despite demonstrating symptoms suggesting the diagnosis of chronic rhinosinusitis, which therefore prompted CT evaluation of the sinuses, most of our patients had relatively low overall Lund scores. It is clear from the data that when the RC is considered radiographically abnormal, the Lund score will be increased. When the overall Lund score is small, this percentage increase in the Lund score may be significant. When the RC was not considered radiographically abnormal, the Lund scores for the control side and cyst side were no longer statistically significantly different. In light of the lack of concordance between OMC obstruction and the presence of a cyst, this "normalization" of the Lund score suggests that the finding of an RC in the absence of associated mucosal thickening should not be scored as positive maxillary sinus disease during CT scan staging.

Chronic rhinosinusitis is a clinical diagnosis, confirmed and staged with the sinus CT scan. Often, the CT scan is used to plan the extent of surgery for disease that fails to respond to medical management. In the functional concept, surgical relief of obstruction at the OMC region is a critical element in the ventilation of the paranasal sinuses. Some researchers have reported series of symptomatic maxillary sinus RCs and improved patient symptom scores after marsupialization or excision of these cysts alone. However, as most of these cysts are asymptomatic, and given that they are not likely related to obstructive sinus phenomena, we prefer generally not to consider these patients as candidates for surgical therapy. The major exception would be a maxillary sinus RC arising from the medial wall of the maxillary sinus causing OMC obstruction by virtue of its location. Medial wall cysts only occurred in 13.3% of our cases, and in only 1 case (2.0%) was the cyst itself obstructing maxillary sinus outflow. Of course, in the setting of atypical radiological findings such as bony destruction, diagnostic intervention is warranted.

The following conclusions may be drawn:
1. Maxillary sinus RCs are not related to anatomic variations of the OMC, and do not reflect persistent obstruction of the maxillary sinus outflow tract.
2. Consideration should be given to not scoring maxillary sinus RCs as positive radiographic disease in the Lund scoring system.

Accepted for publication May 18, 2000.
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REFERENCES