Pediatric Maxillary Sinus Growth Pattern

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Background
- Surgical management of pediatric sinus disease is generally considered after exhausting medical management.
- Obtaining detailed radiographic images, most commonly computed tomography, is considered the standard of care prior to any sinus surgery for the pediatric population.
- CT scans help with confirming a diagnosis and with surgical planning.
- Though prior studies have documented development of the pediatric paranasal sinuses, they have had limitations, such as smaller age range, limited technology, and lack of absolute size measurements.
- Knowledge of the dimensions of the pediatric sinus would help with decision making for timing of surgery and with surgical planning.
- The most frequent sinus that requires surgical management is the maxillary sinus in the pediatric population.

Objectives
- Describe the growth pattern of the maxillary sinus in the pediatric population.
- Identify periods of an increased growth rate, or growth spurts.

Materials & Methods
- Retrospective chart review of 163 consecutive patients that were newborn to age 18 and received a sinus CT scan at a single institution between Jan 2006 and June 2009.
- Exclusion Criteria: poor quality CT scan, prior sinus surgery, choanal atresia, cystic fibrosis, other anatomic abnormality.
- Indications for CT scans included: allergic rhinitis, anosmia, trauma, chronic rhinosinusitis, nasal polyps, orbital abscess, and Wegener’s granulomatosis.
- Recorded the largest measurement in the anterior-posterior (depth), cephalocaudal (height), and mediolateral (width) directions of the maxillary sinus on the left and right side of each CT scan.
- Determined a growth curve for each dimension of the maxillary sinus.
- Determined the growth speed (1st derivative) for each dimension of the maxillary sinus.
- Determined the change in growth speed (2nd derivative) for each dimension to identify growth spurts.

Results
- 139 of 163 CT scans reviewed met inclusion criteria.
- Gender distribution: 68 (49%) females, 71 (51%) males.
- Age range 6 months – 18 years.
- The maxillary height, depth, and width all grew at an increased rate from newborn to age 6. The rate decreased after age 6 until 18.
- The following tables provide the growth rates for each dimension of the maxillary sinus.

<table>
<thead>
<tr>
<th>Age Range</th>
<th>Maxillary Height Growth Rate (mm/year)</th>
</tr>
</thead>
<tbody>
<tr>
<td>newborn – 6</td>
<td>2.6</td>
</tr>
<tr>
<td>6-18</td>
<td>1.3</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Age Range</th>
<th>Maxillary Height Growth Rate (mm²/year)</th>
</tr>
</thead>
<tbody>
<tr>
<td>newborn – 6</td>
<td>3.0</td>
</tr>
<tr>
<td>6-18</td>
<td>0.5</td>
</tr>
</tbody>
</table>

Conclusions
- Initially there is increase in growth until age 6. The growth continues to increase until age 18.
- The maxillary width grows at the most rapid rate from newborn to age 6.

Future Direction
- Compare maxillary sinus growth by gender.
- Compare growth by side (i.e. left versus right).
- Measure and analyze ethmoid, frontal, and sphenoid sinuses.