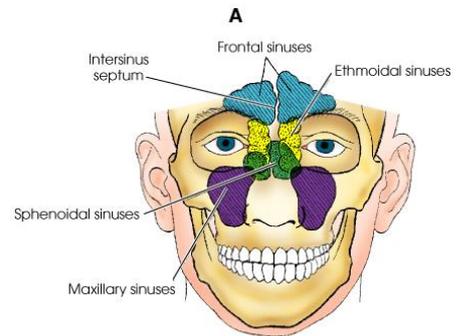


# Maxillary Sinus

## (Antrum of Hignore)

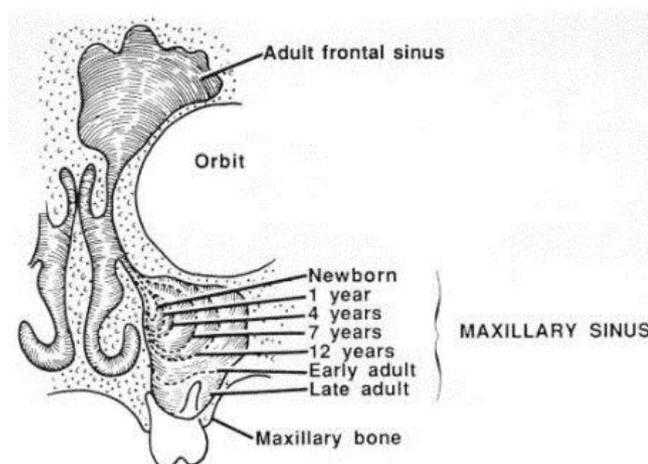
The maxillary sinus is a pneumatic space. It is the largest bilateral air sinus located in the body of the maxilla and opens in the middle nasal meatus of the nasal cavity with single or multiple openings.



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### Development:

- The maxillary sinuses are the only sizable sinuses present at birth.
- At birth they have the size of a small lima bean measuring about 8X4 mm, and are situated with their longer dimension directed anteriorly and posteriorly.
- They develop at the third month of intrauterine life, in the place existing between the oral cavity and the floor of the orbit.
- They develop as evagination of the mucous membrane of the lateral wall of the nasal cavity at the level of the middle nasal meatus forming a minute space that expands primarily in an inferior direction into the primordium of the maxilla.
- The maxillary sinus enlarges variably and greatly by pneumatization until it reaches the adult size by the eruption of the permanent teeth.
- Enlargement of the maxillary sinus is consequent to facial growth.
- Growth of the sinus slows down with decline of facial growth during puberty but continues throughout life.

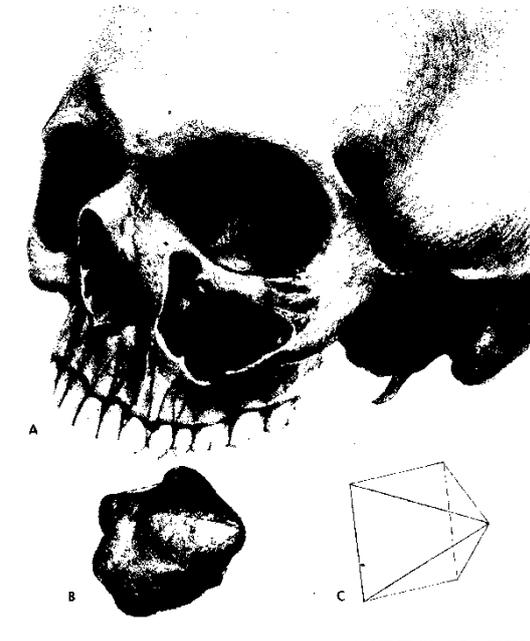


## Anatomy:

The maxillary sinus varies greatly in size, shape and position not only in different individuals but also in different sides of the same individual.

It is pyramidal in shape having a base, an apex and four walls:

- The base: lateral wall of the nasal cavity.
- The apex: directed laterally towards the zygomatic process of the maxilla.
- The four walls:
  - Anterior wall*: facial surface of the maxilla.
  - Posterior wall*: infratemporal surface of the maxilla.
  - Roof*: floor of the orbit.
  - Floor*: alveolar process of the maxilla.
- The opening through which the maxillary sinus communicates with the middle nasal meatus is termed **ostium maxillare**. It is about 3-6 mm in diameter and is found in a recess called **hiatus semilunaris**.
- The maxillary sinus may have septa that partially divide it into intercommunicating compartments with separate ostia may be found.
- The average capacity of the maxillary sinus is about 15 ml. and its average dimensions in centimeters are 2.3 transversely, 3.4 anteroposteriorly and 3.35 vertically.



## Enlargement of the maxillary sinus:

- Growth of the maxillary sinus is determined by a process of bone remodeling referred to as **pneumatization** which is carried out by

resorption of the internal walls (except the medial wall) at a rate that lightly exceeds growth of the maxilla.

- Fortunately the medial wall of the antrum is not resorptive (is depository) while its nasal wall is resorptive, if both were resorptive, total communication between the antrum and the nasal cavity may take place at one time.
- In young age, sinus growth by pneumatization is proportional to the growth of the maxilla. However with the advance of age pneumatization exceeds maxillary growth. Thus the antrum will expand at the expense of the maxillary process.
- Extension of the maxillary sinus in the processes of the maxilla leads to the formation of antral or sinus recesses which include:
  - Zygomatic recess*
  - Frontal recess*
  - Alveolar recess*
  - Tuberosity recess*
- Extension of the floor of the maxillary sinus in the alveolar process may occur not only between the roots of adjacent teeth, but also between the roots of individual teeth, leading to protrusion of the roots into the sinus cavity. At first protruding roots are covered with paper thin bone but later on such bone will get resorbed and the roots protrude extensively into the sinus cavity through openings, leaving the antral mucosa in direct contact with the periodontal ligament of the projecting root apices.
- In old age pneumatization becomes more pronounced, the floor of the sinus moves at more downward position particularly when the maxillary teeth are lost.

### **Histology of the maxillary sinus:**

The maxillary sinus is lined with a mucous membrane of the respiratory type. However it is somewhat thinner than that lining the nasal cavity. The antral mucous membrane is formed of:

- An epithelial layer resting on a basement membrane.

- A subepithelial connective tissue layer.

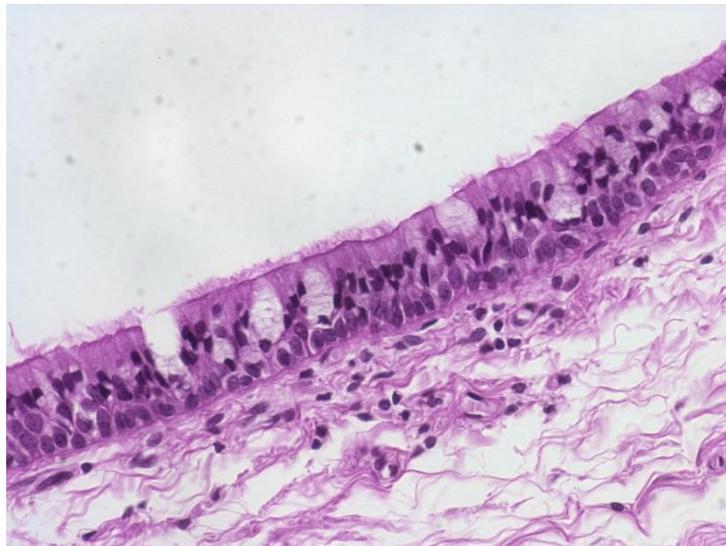
**The epithelial layer:**

- The epithelial layer of the maxillary sinus lining is thinner than that of the nasal cavity.
- Composed predominantly of pseudostratified columnar ciliated cells derived from the olfactory epithelium of the middle nasal meatus, in addition to columnar non ciliated cells, basal cells and mucous producing and secreting goblet cells.
- **The pseudostratified columnar ciliated epithelial cells** have nucleus and electronlucent cytoplasm containing numerous mitochondria, enzyme containing organelles and basal bodies. The latter serve to attach the ciliary microtubules to the apical cell membrane.
- Structurally **the cilia** are composed of 9 + 1 pairs of microtubules which provide the mucociliary motile function to the sinus epithelium, which moves the debris, microorganisms, and the mucous film lining the epithelial surface of the sinus into the nasal cavity through the ostium maxillare. The cilia beat automatically, they are not under nervous control.
- **The goblet cell** is a unicellular gland, it is mucous synthesizing and secreting cells. It resembles an inverted wine glass with a short stalk like basal end containing the nucleus and a swollen apical end containing mucin. It is an apocrine gland, i.e. it pours its secretion through rupture of its apical cell membrane that gets regenerated. So it has all the criteria of the synthesizing and secreting cells.

**The subepithelial connective tissue layer (lamina propria):**

- The lamina propria of the maxillary sinus lining is much thinner than that of the nasal mucosa.
- It is formed of connective tissue cells, and intercellular substance of collagen bundles and few elastic fibers. It is moderately vascular. The lamina propria contains subepithelial antral glands composed of mixed glands formed of serous and mucous acini or

seromucous acini as well as myoepithelial cells. The antral glands are more concentrated in the lamina propria located around the ostium maxillare. The mixed secretory product of the antral glands reach the sinus cavity through their excretory ducts.



### **Function of the maxillary sinus:**

1. Lightening the weight of the skull.
2. Resonance of voice.
3. Olfactory and respiratory modulations through regulation of the air pressure within the sinus during respiration.
4. Inspired air conditioning.
5. Craniofacial protection against mechanical trauma.
6. Production of the bactericidal enzyme (lysozyme) which may be significant in protection against bacterial infection of the nasal mucosa.

### **Clinical considerations:**

1. Nerves that supply maxillary teeth are those that supply the maxillary sinus accounting for dental pain from healthy teeth arising from maxillary sinusitis.
2. Bone forming the floor of the sinus can also be the bone surrounding the apex of a tooth. Consequently periapical infection of teeth can spread to maxillary sinus. The reverse can occur with maxillary sinus infection being perceived as originating from teeth.

3. Pain from carious lesion or other insults to the dental pulp may be referred to the sinus.
4. Accidental communication between the sinus and oral cavity may occur during tooth extraction or surgical procedures leading to oroantral fistula.
5. Roots of maxillary posterior teeth may have close relationship to the floor of the maxillary sinus. Molars are more related than premolars in the following order: first molar, second premolar, second and third molars, first premolar and rarely the canine.