

9 Maxilla

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Resections of tumors involving the passages of the nose and paranasal sinuses present the ultimate challenge in surgical pathology dissection. These passages are walled by bony structures that defy efforts to section, expose, and sample. Moreover, the three-dimensional anatomy of these regions is inherently complex and difficult to reconstruct once the specimen has been removed from the patient. Nowhere are these difficulties more significantly encountered than during resection of the maxilla.

The maxillary sinus is somewhat pyramidal in shape and is surrounded on all sides by craniofacial bone. The daunting anatomic complexity of this region can be simplified by envisioning yourself in a room with a floor, a ceiling, and four walls. At your feet is the hard palate. Pass through this floor, and you enter the oral cavity. Above your head is a ceiling that forms the floor of the orbit. Pass through this ceiling, and you enter the orbital cavity. Turn medially, and you face a wall that is shared with the nasal cavity (i.e., the lateral nasal wall). Pass through this wall, and you enter the nasal chamber. The remaining walls are not shared with other chambers. Instead, the anterior and lateral walls form the bony surfaces of the face, which are bounded by the soft tissues and skin of the cheek. The posterior wall forms a boundary with the musculature and bony processes of the pterygoid complex. This conceptualization should help you discern the specific location of a tumor in the maxillary sinus and understand the paths of tumor spread into adjacent chambers and anatomic structures.

With this image in mind, orient the maxillectomy specimen. Remember that only a portion of the maxilla is generally removed during a cancer resection (i.e., partial maxillectomy). Con-

sequently, only some of the surfaces are present, leaving the sinus exposed to visual inspection. The extent of the resection depends on the location and spread of the tumor. Specimen orientation is greatly facilitated by the recognition of a few key landmarks. Teeth, when present, identify the floor of the maxillary sinus (alveolar process) and help you discern the anterior and lateral aspects of the maxilla. The nasal choana are seen as smooth longitudinal folds or pouches of mucosal-lined tissues. These form the lateral wall of the nasal sinus and identify the medial aspect of the maxilla. Some specimens include the eye. In these cases, identification of the superior and anterior aspects of the specimen is obvious. If present, skin from the cheek marks the lateral and/or anterior aspect of the specimen. If you have done your best to identify these landmarks but still have trouble with orientation, do not hesitate to contact the surgeon.

Once you have confidently oriented the specimen, measure it in three dimensions. Identify and describe the anatomic boundaries of the specimen and note the presence of important anatomic structures (e.g., eye, skin, nasal choana, teeth). Ink the external margins of the soft tissue enveloping the maxilla, being careful not to let ink seep into the sinus. Without sectioning the specimen, look into the exposed maxillary sinus and try to identify the tumor. In addition to documenting the size of the tumor, determine its location within the maxillary sinus. Specifically, identify which walls are grossly involved by tumor. Determining the site of tumor origin helps guide further sectioning of the specimen to determine the path of tumor spread. For instance, a tumor arising from the floor of the sinus generally extends inferiorly and laterally into the palate and

the alveolar process of the maxilla (infiltrating between and around molar teeth). More medially placed tumors are prone to extend into the nasal cavity. Tumors along the lateral wall may infiltrate the skin and soft tissues of the cheek. Tumors involving the roof of the sinus tend to extend into the orbital cavity, ethmoid air cells, ethmoid sinus, or cribriform plate. For tumors involving more than one chamber, try to determine the epicenter of the tumor. For example, if a tumor involves the floor of the maxillary sinus, try to distinguish between a maxillary sinus carcinoma that extends inferiorly into the palate and an oral cavity carcinoma that extends superiorly into the maxillary sinus.

Depending on your laboratory's preferences, the specimen can be dissected in the fresh state or be sectioned after fixation in formalin. After tissue has been obtained for special studies as needed, we recommend fixation before further processing. Tissue fixation facilitates the difficult process of stripping mucosal margins from underlying bone. Tissue fixation also minimizes tissue fragmentation and distortion should sawing be required to section through bone. Finally, adequate fixation is essential before the sample can be processed in demineralizing solutions should specimen decalcification be required.

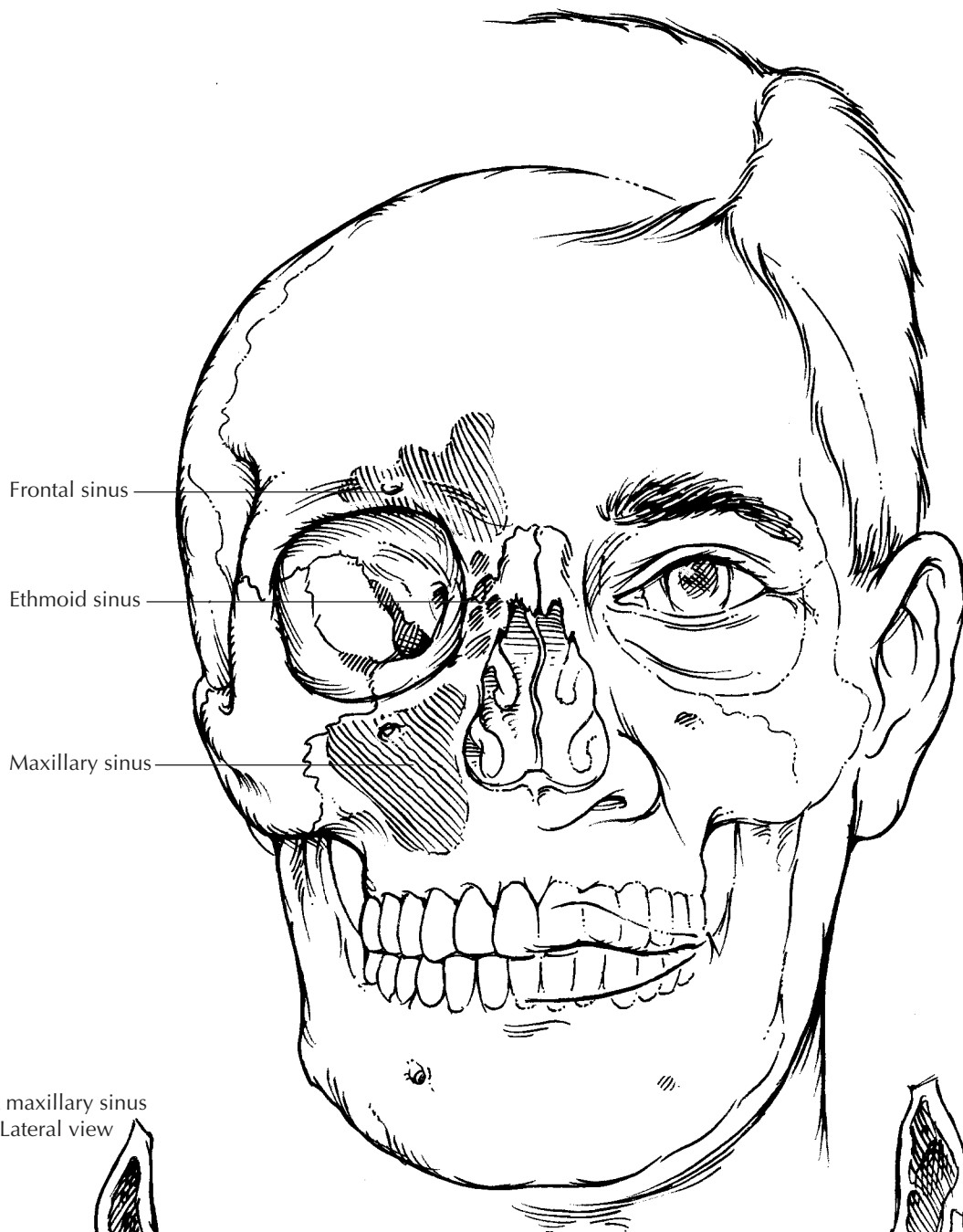
Begin your dissection by sampling all of the margins including the soft tissues, bone, mucosa, and skin. The number and type of margin sections depend on the nature and extent of the resection. For example, if the medial wall of the sinus is removed, you need to sample the mucosa all along the nasal cavity margin. If the resection includes the orbit, you need to submit a shave section of the optic nerve. Before taking these sections, it is helpful first to tabulate all of the various chambers and tissue components present in the specimen so that no margin is overlooked. Sampling some of these margins can be challenging. For example, the presence of teeth and underlying bone are formidable barriers to well-oriented perpendicular sections that radiate from the edge of the specimen toward the center of the tumor. Instead of the standard perpendicular sections, the mucosal edges of the maxillary resection (particularly along the alveolar process of the maxilla) may have to be taken as thin parallel sections that are gently peeled off the underlying bone. Again, these sections are easier to obtain if the mucosa is well fixed. The soft tissue margins, in

contrast, can be submitted as perpendicular sections. Be sure to include in your gross description details of the precise location and type of each margin. A photograph that indicates the location of each margin section is highly recommended.

After all of the margins have been sampled, bisect the specimen along a plane that passes through the epicenter of the tumor and best demonstrates the tumor's relationship to adjacent compartments. Before making this first cut, it may be useful to consult the preoperative imaging studies to determine the location of the tumor and its path of spread. This section may require the use of a band saw, particularly when the sections must pass through the dense bone of the alveolar process and palatal alveolus. A detailed description of the use of bone saws with an emphasis on safety issues is provided in Chapter 22. Teeth are particularly dense tissues, and they are difficult to section even with powerful bone saws. Unless there are indications to sample a tooth, sections through the alveolar process of the mandible should avoid the teeth. Direct the blade of the saw between the teeth. Make additional sections to further assess the extent of the tumor and its relationship to surrounding structures. When intact teeth are included within the portion of the specimen to be histologically evaluated, it may be prudent to remove the crowns of these teeth. This practice shortens the decalcification time and lessens decalcification-induced artifacts. Removal of crowns can be facilitated by use of a bone saw or dental drill with a stream or spray of coolant water.

Now that the tumor has been more fully exposed, describe its appearance and growth characteristics. Is the tumor exophytic, endophytic, erosive, and/or infiltrative? Measure and record its dimensions including its deepest level of invasion. Determine the anatomic structures and compartments the tumor involves. Is the tumor confined to the maxillary sinus? If there is invasion into bone, has the tumor extended beyond the bone and into an adjacent chamber?

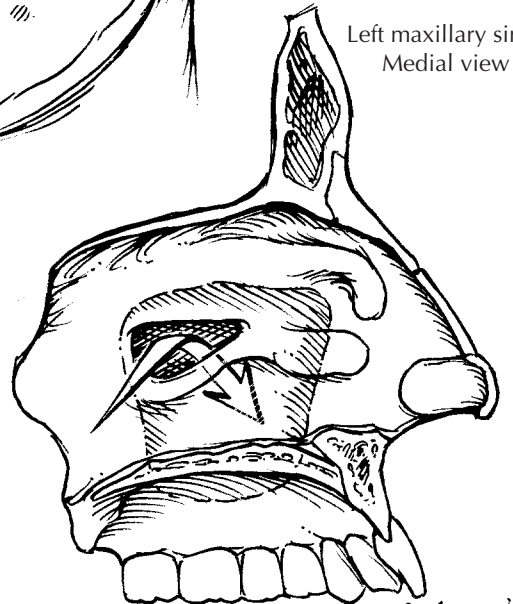
When sampling the tumor, submit sections to demonstrate the relationship of the tumor to the surrounding mucosa and the underlying bone. In addition, submit sections to determine tumor spread into adjacent anatomic structures and compartments. For example, the nasal mucosa should be amply sampled for tumors involving the medial maxillary wall. If an eye is included in a resection of the superior wall of the maxilla,



Left maxillary sinus
Lateral view



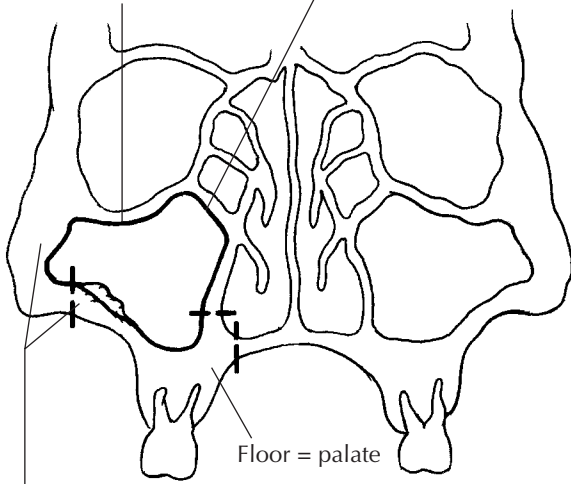
Left maxillary sinus
Medial view



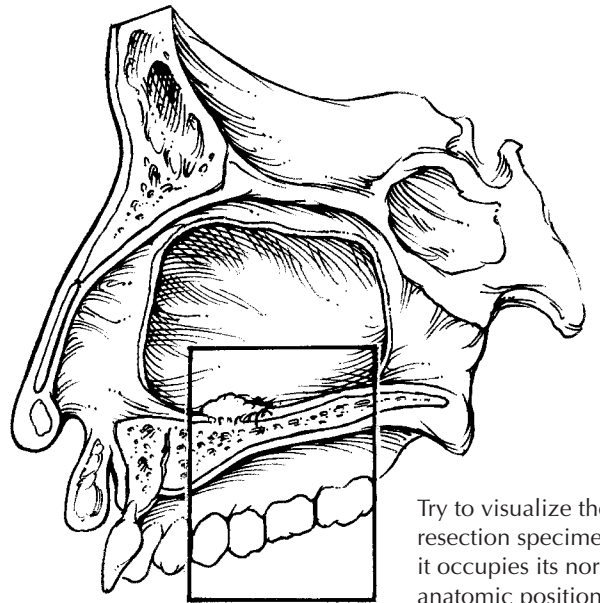
T. Palma

Walls of maxillary sinus

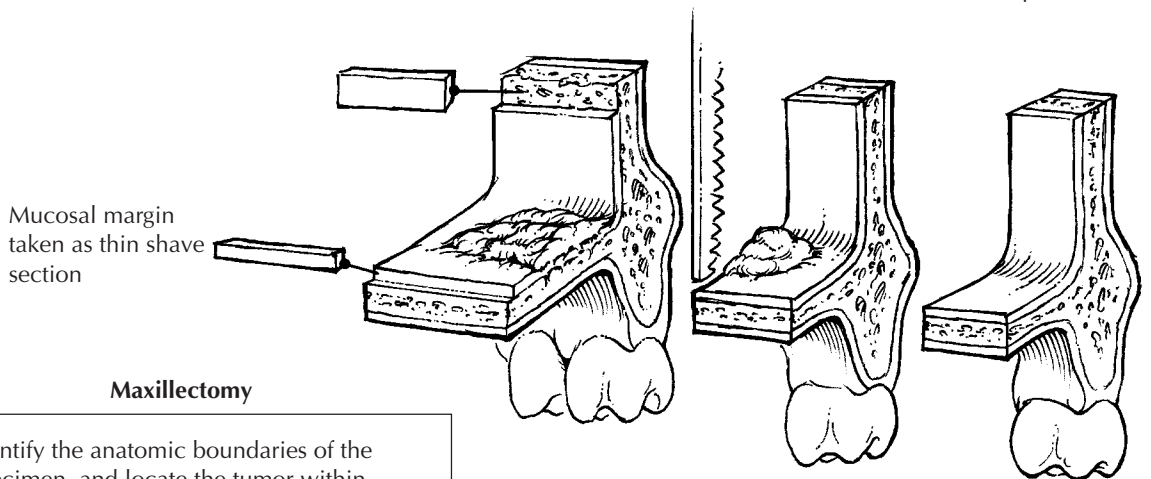
Roof = orbital floor Medial wall = lateral nasal wall



Lateral and anterior walls = facial tissues



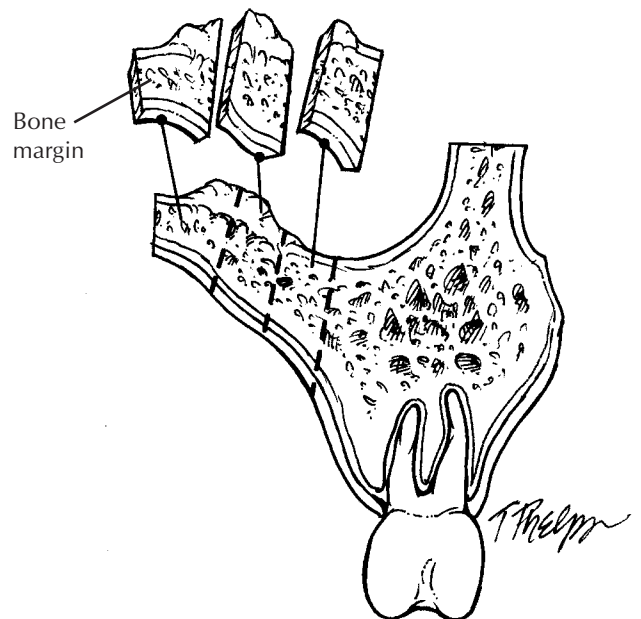
Try to visualize the resection specimen as it occupies its normal anatomic position in the patient



Mucosal margin taken as thin shave section

Maxillectomy

1. Identify the anatomic boundaries of the specimen, and locate the tumor within the maxillary sinus.
2. Ink the mucosal and soft tissue margins.
3. Sample all of the margins including the soft tissue, bone, mucosa, and skin. It may be most practical to submit the mucosal margins as thin shave (parallel) sections that are peeled off the underlying bone.
4. Section the specimen along a plane that best demonstrates the tumor's relationship to adjacent structures and compartments. These sections may require the use of a bone saw. Make additional sections to determine the tumor's size and extent of spread.
5. Submit sections of the tumor that demonstrate its relationship to adjacent anatomic structures and compartments.



submit sections of the orbital contents. For the eye itself, one section (in addition to the optic nerve margin) is generally sufficient to document its presence and to demonstrate its relationship to the tumor. If there are reasons to perform a more thorough evaluation of the eye, follow the guidelines for enucleation specimens provided in Chapter 35.

Regional lymph nodes are usually removed separately by the surgeon and submitted as separate specimens. They should be anatomically oriented, and each level should be carefully dissected (see Chapter 10). Each lymph node should be submitted for histologic evaluation.

Important Issues to Address in Your Surgical Pathology Report on Maxillary Sinus Resections

- What procedure was performed, and what structures/organs are present?
- Is a neoplasm present?
- What is the probable site of tumor origin (maxillary sinus, maxillary bone, palate, nasal cavity)? For tumors of the maxillary sinus, from what surface does the tumor arise (inferior, superior, medial, lateral, anterior, posterior)?
- What is the size of the tumor (in centimeters), and what is the greatest depth of tumor invasion?
- What are the histologic type and grade of the tumor? Is an *in situ* component present?
- Does the tumor extend into bone? If so, does the tumor extend beyond the bony confines of the maxillary sinus to involve adjacent compartments and structures (e.g., nasal cavity, oral cavity, orbital cavity, skin, pterygoid complex)?
- Does the tumor involve the margins (mucosal, skin, bone, soft tissues)?
- Does the tumor involve regional lymph nodes? Include the number of nodes examined and the number of nodes involved.