Benign and Malignant Epithelial Tumors: Lesions of Glandular Origin

BENIGN AND MALIGNANT EPITHELIAL TUMORS: LESIONS OF GLANDULAR ORIGIN

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Key Points

- Epithelial tumors of glandular most commonly arise from the major and minor salivary glands.
- Benign and malignant glandular tumors typically have distinct yet not strictly diagnostic gross morphology as seen on computed tomography and magnetic resonance imaging.
- These tumors have a great deal of biologic variability.

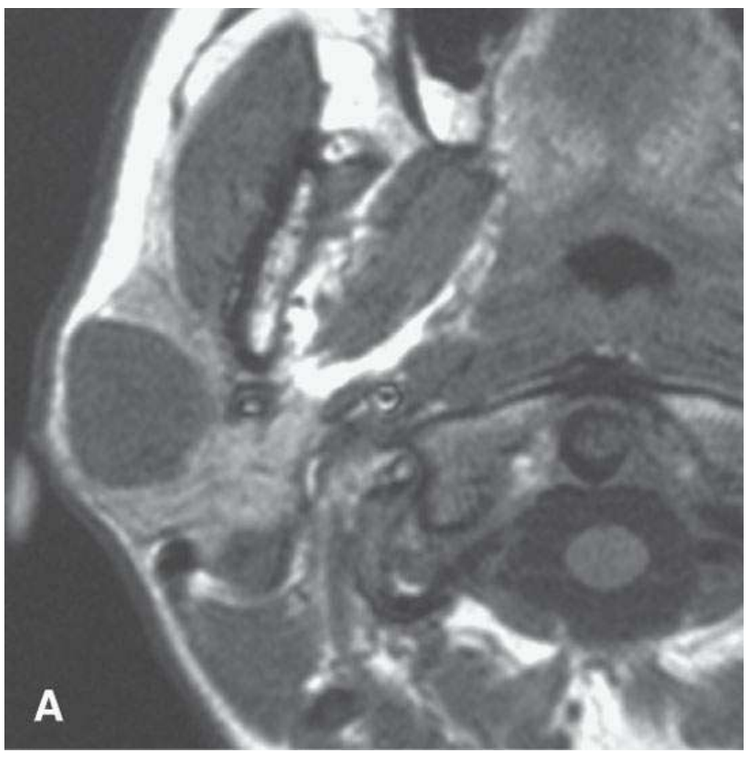
This chapter takes a pathologic point of view of tumors of glandular cell origin. These may arise from mucosal and skin sources, but those are considered in conjunction with epithelial and cutaneous tumors in Chapters 23 and 24. The tumors considered here arise from glands. Most, aside from thyroid adenomas, arise from the major salivary and lacrimal glands. Some arise from the ubiquitous minor salivary glands scattered throughout the extracranial head and neck. Each tumor type is considered in terms of its occurrence at various head and neck sites. Also, the particular effect of a neoplasm's spread pattern, natural history, and cellular structure have on its computed tomography (CT), magnetic resonance (MR), and ultrasound (US) anatomic appearance1 are summarized since these general trends are presented in Chapter 21 in significant detail. The physiology as reflected on metabolic imaging studies such as fluorine-18 2-fluoro-2-deoxy-D-glucose positron emission tomography (FDG-PET) in this group of tumors is not predictable except that the more aggressive the lesion, the more likely it is to be FDG avid.2 Unfortunately, this leads to false-negative PET studies in malignant tumors, limiting the reliability and, therefore, usefulness of FDG-PET in the diagnosis and management of this group of neoplasms in an unpredictable manner. Diffusion-weighted magnetic resonance imaging (MRI) may be a tool useful to differentiate benign and malignant glandular neoplasms.3,4 While this is true in some cases, it is not useful for definitive clinical decision making and is certainly not a substitute for biopsy. The clinical and imaging implications of a particular type of tumor at a specific anatomic location are presented in site-specific discussions later in the text.

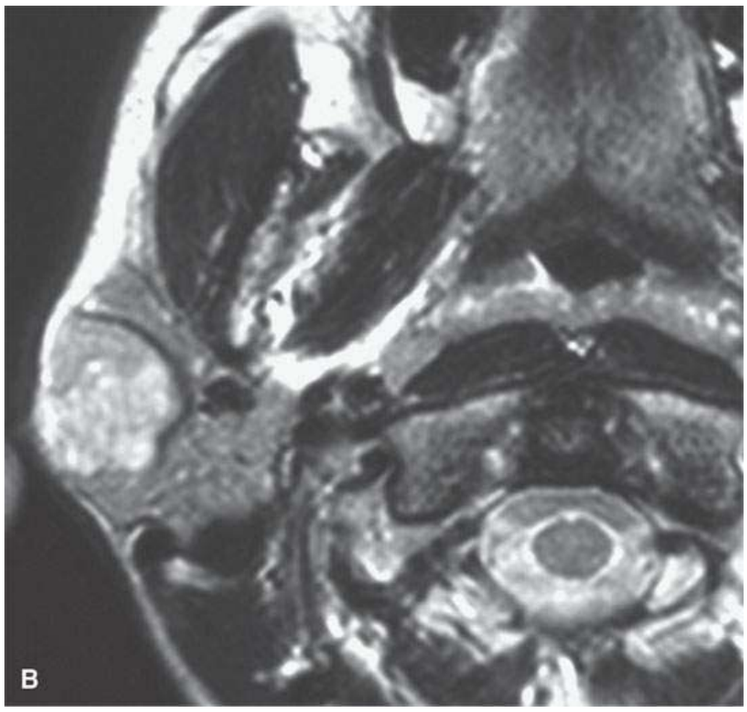
When evaluating the malignant varieties of glandular tumors, the appearance natural history of the lesion must be understood and appreciated on imaging with regard to its local extent, potential for perineural spread, and spread to regional lymph nodes. These are issues discussed elsewhere in general in Chapter 21 and in discussions of specific sites of occurrence.

BENIGN TUMORS OF GLANDULAR ORIGIN

Adenomas

Adenomas most commonly arise from salivary and endocrine glandular tissue in the head and neck. Pleomorphic adenomas of the parotid gland (Figs. 22.1 and 22.2) and thyroid adenomas are the types that present for imaging most commonly as a mass and are also the most commonly imaged as incidental findings (Fig. 22.3). Thyroid and parathyroid adenomas are discussed in more detail in Chapters 170 and 174. Invasive pituitary adenomas are discussed in Chapter 32. This chapter deals primarily with tumors of salivary gland origin.

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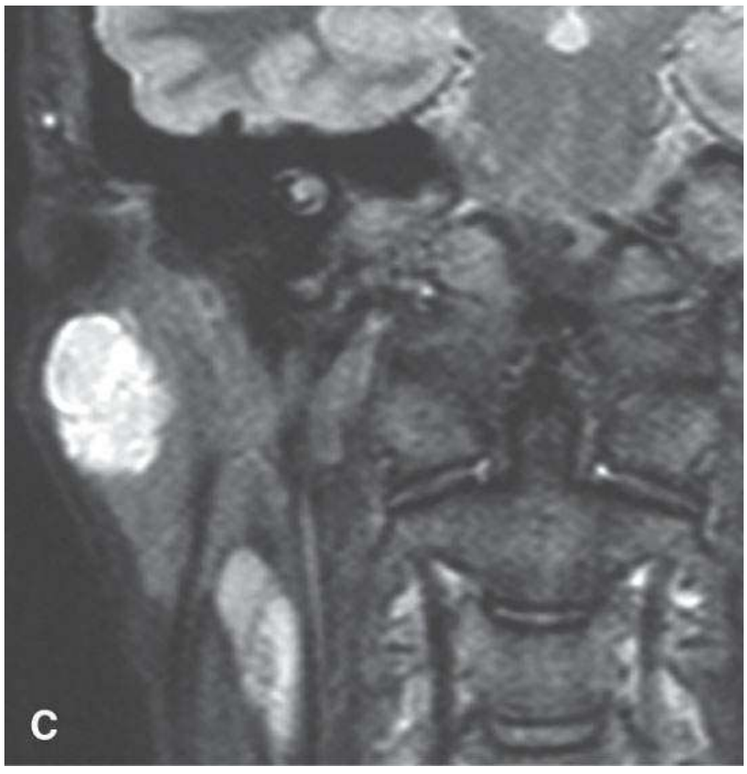
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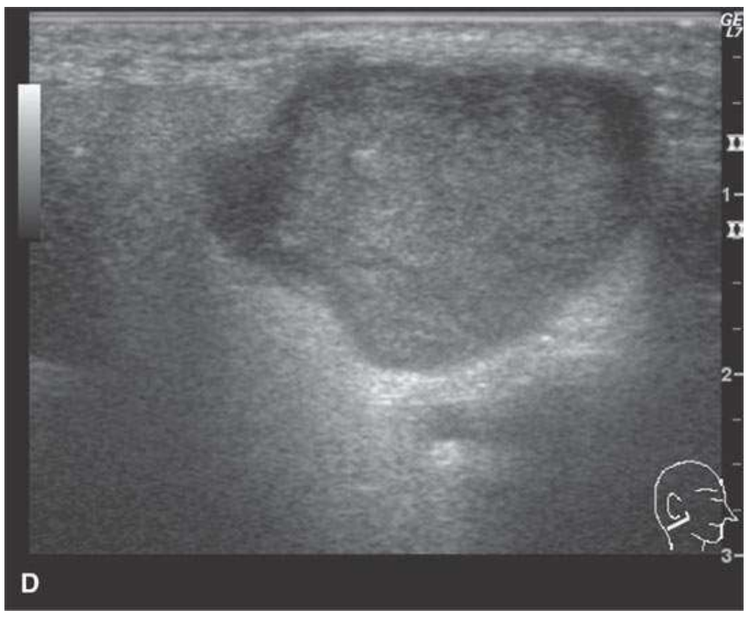
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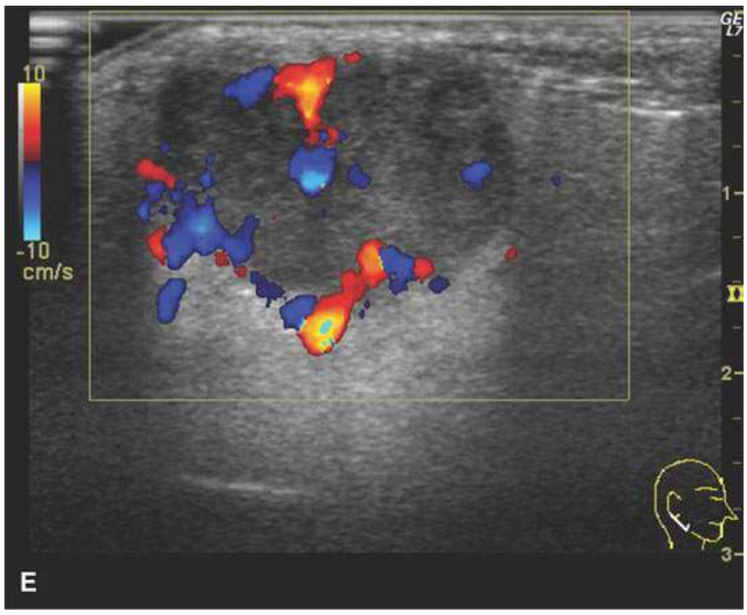
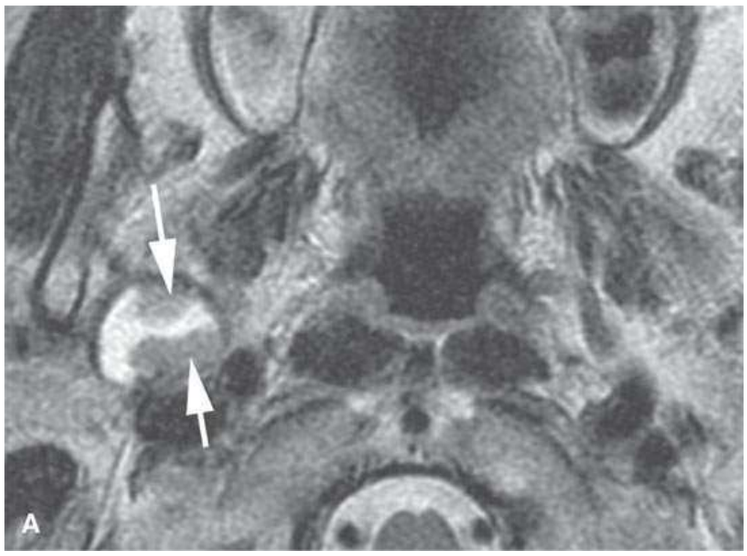
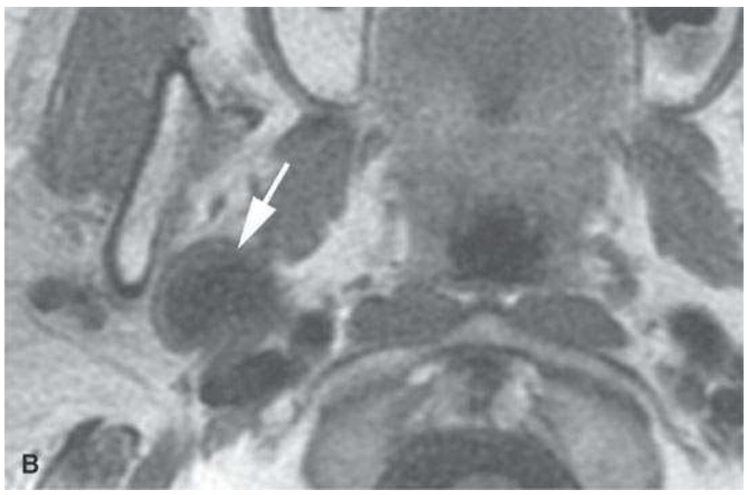
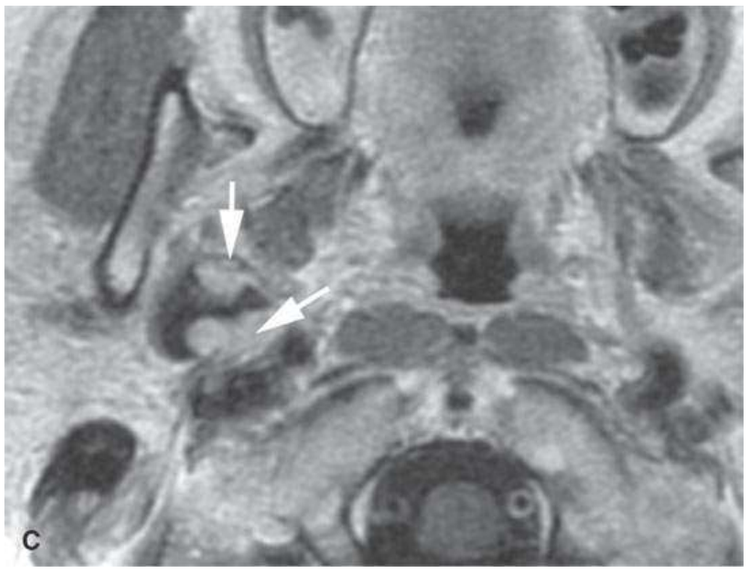


FIGURE 22.1. Magnetic resonance imaging and ultrasound (US) of the same benign mixed tumor of the parotid gland. **A:** Non–contrast-enhanced T1-weighted image. **B:** T2-weighted image. **C:** Short T1 inversion recovery (STIR) image. **D:** US showing good through transmission and a strong back wall reflecting the microcystic nature of the lesion. **E:** Color flow US showing a scattered peripheral and nonspecific flow pattern not consistent with a vascular malformation.



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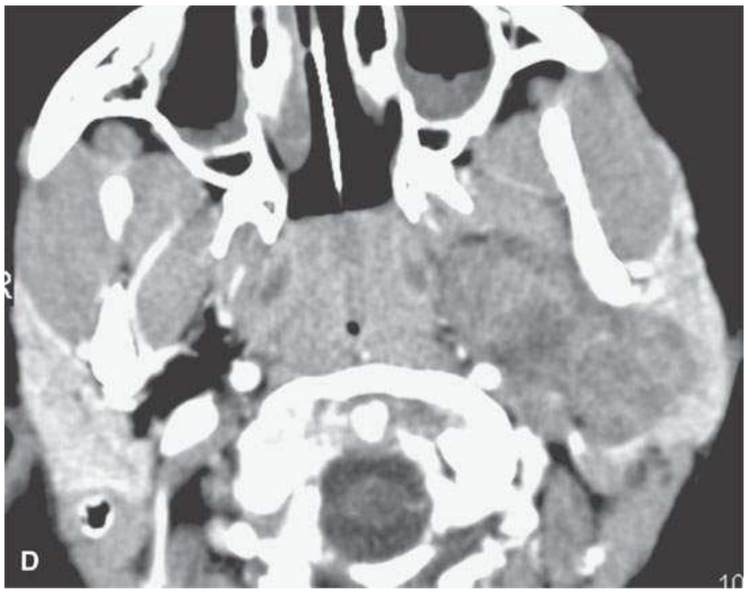
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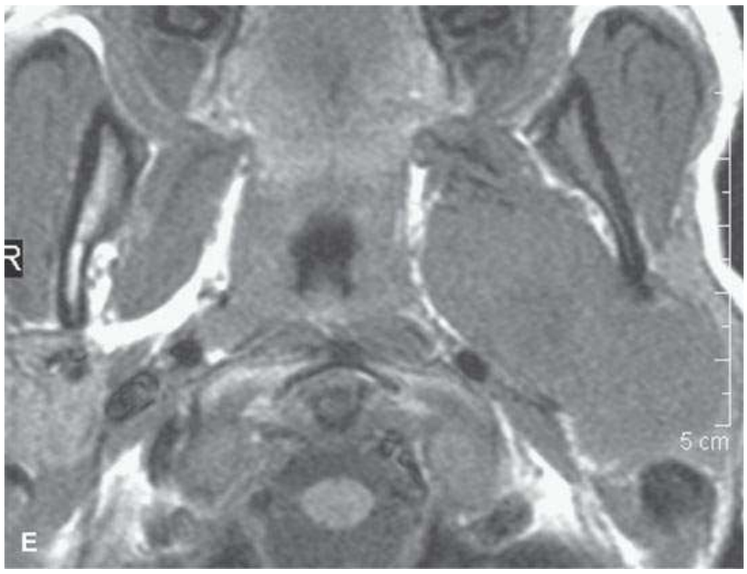
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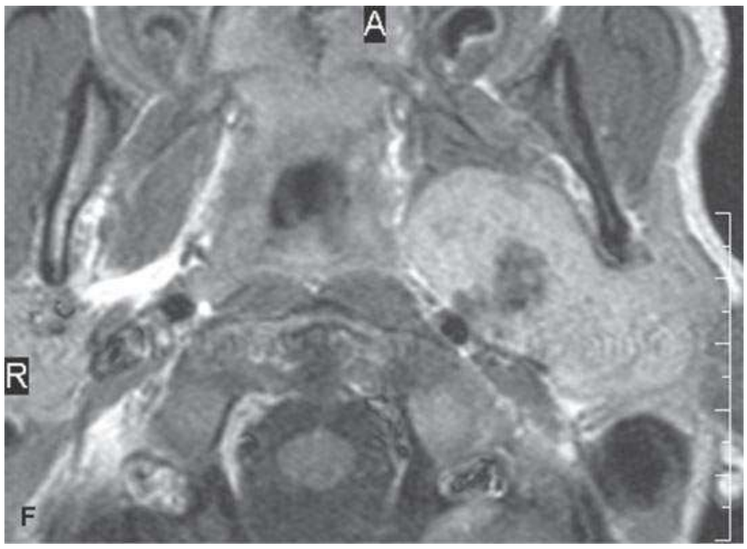
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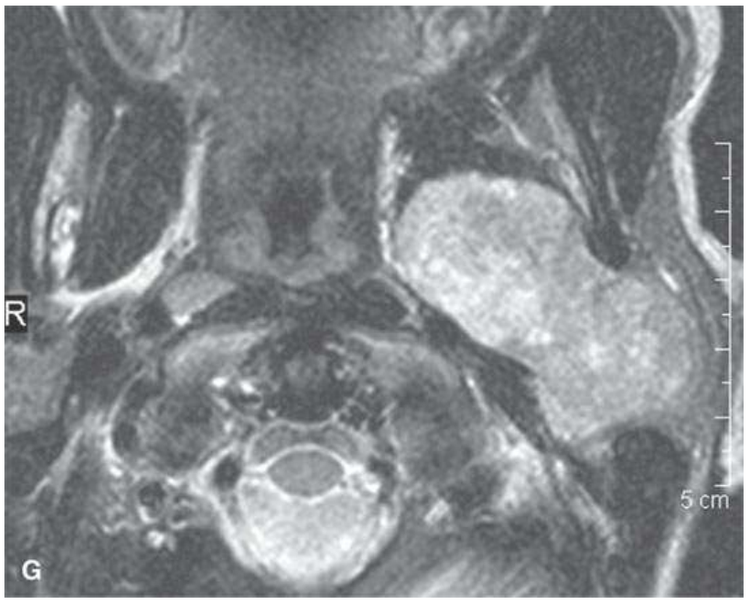
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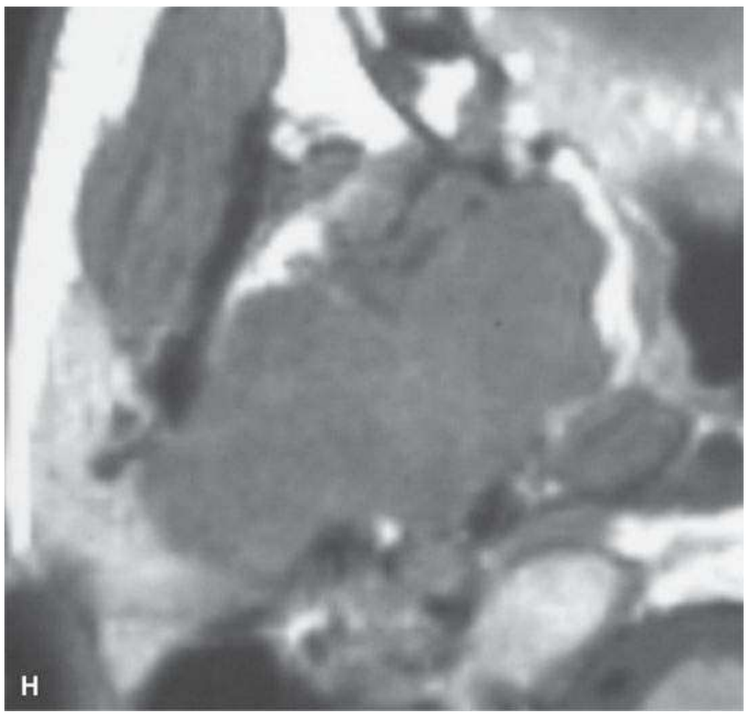
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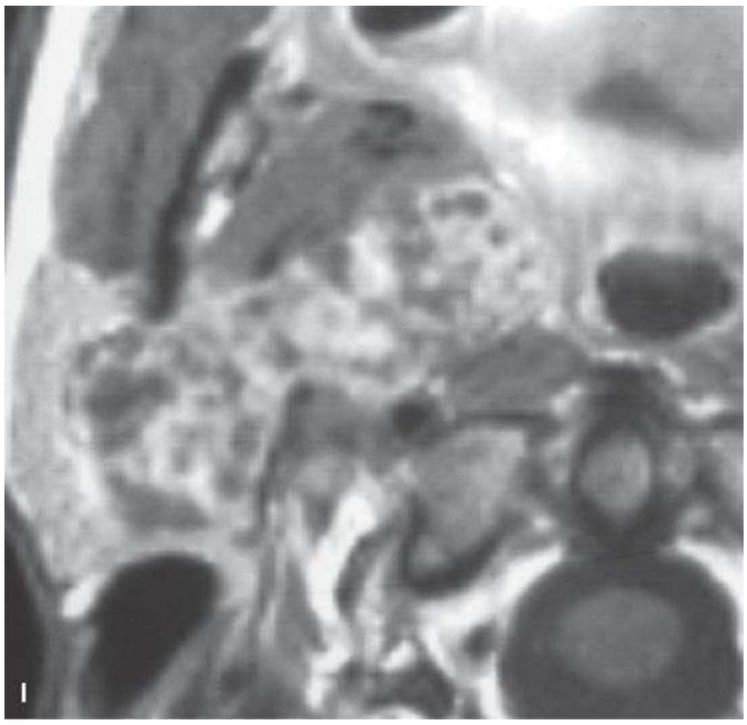
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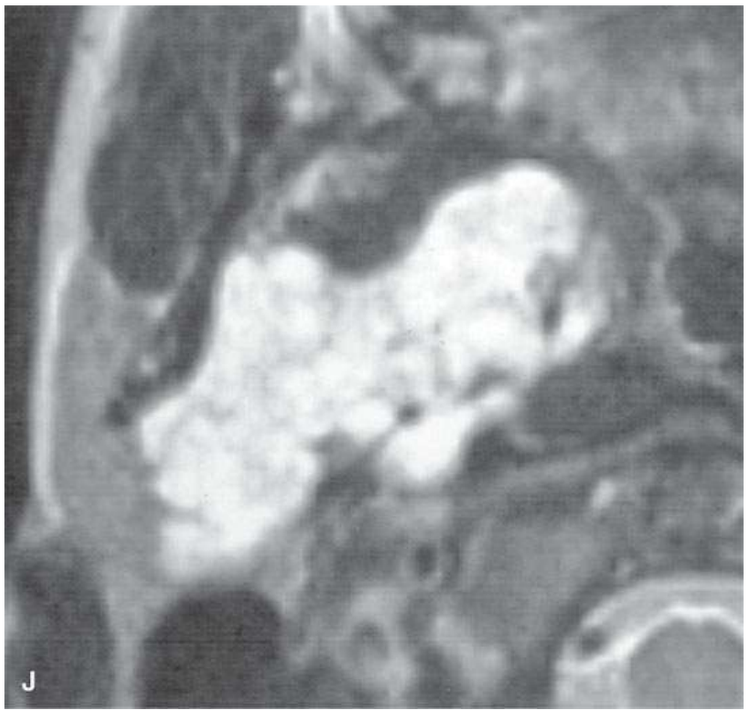
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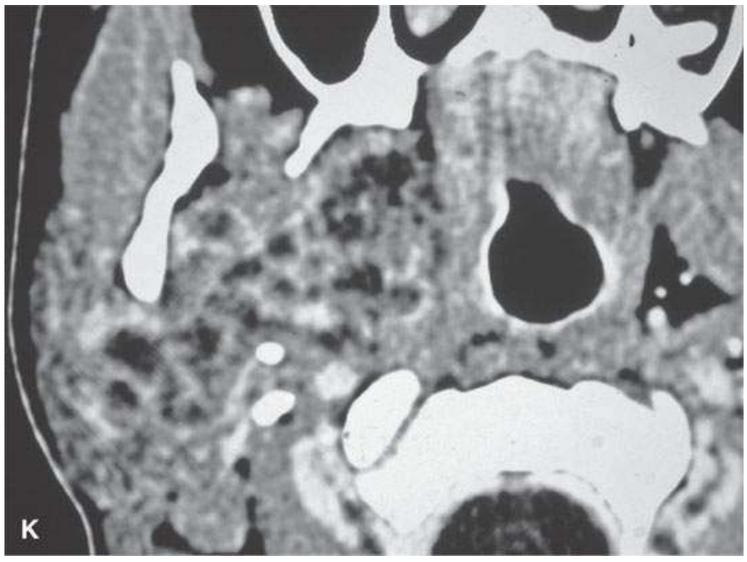
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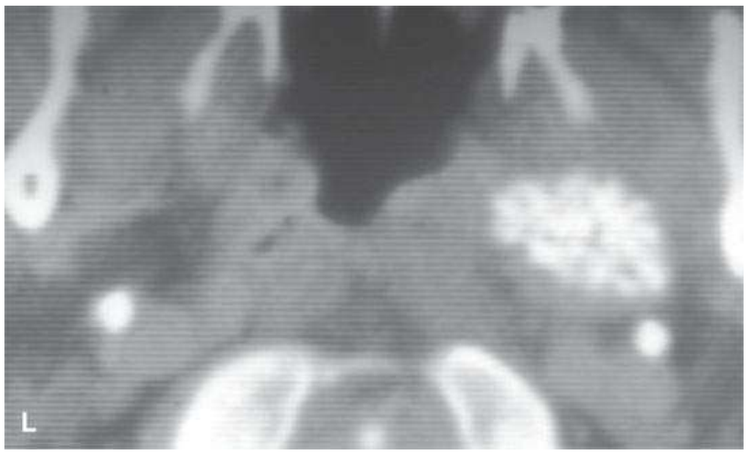
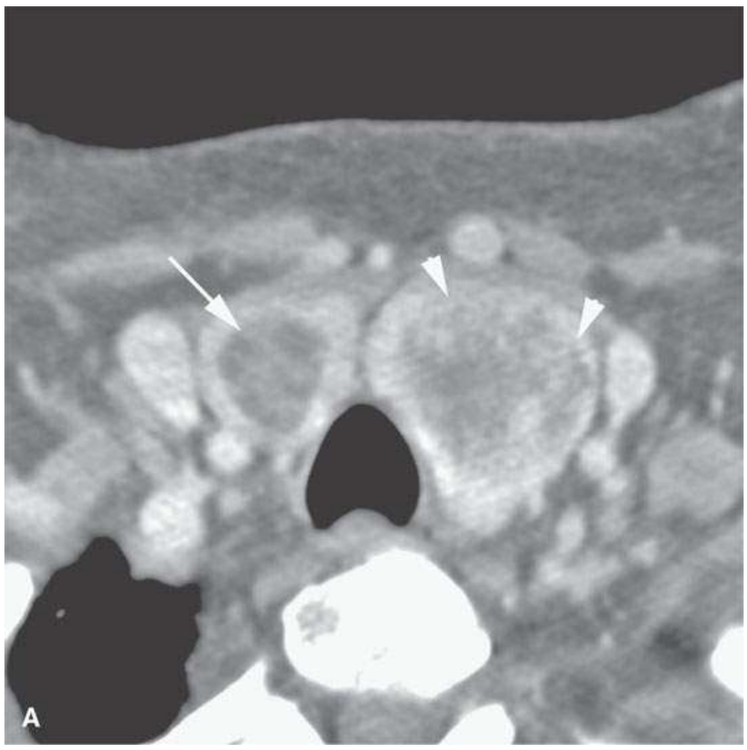
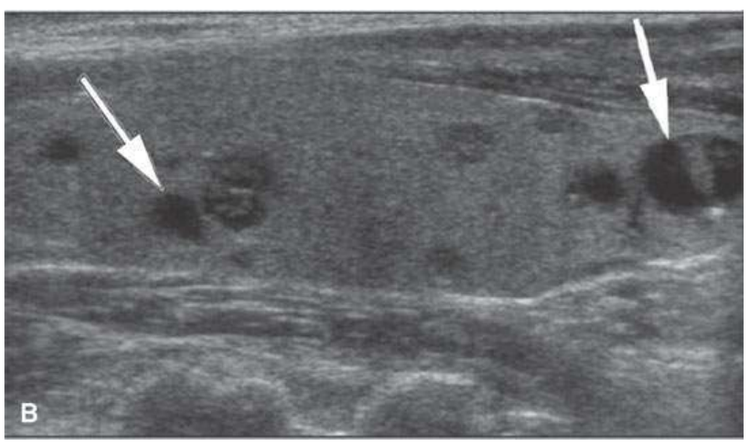


FIGURE 22.2. Magnetic resonance imaging and computed tomography (CT) studies of four benign mixed tumors of the parapharyngeal space demonstrating the range of appearance possible in these relatively common parapharyngeal lesions. The first tumor was discovered incidentally. The microcystic or macrocystic zones are admixed with solid cellular components (arrows) in a T2-weighted (T2W) image **(A)**, non–contrast-enhanced T1-weighted (T1W) image **(B)**, and contrast-enhanced T1W image **(C).** The second tumor is predominantly solid and cellular: contrast-enhanced computed tomography (CECT) **(D)**, non–contrast-enhanced T1W image **(E)**, contrast-enhanced T1W image **(F)**, and T2W image **(G).** The third tumor is composed of many macro- and microcystic components: non–contrast-enhanced T1W image **(H)**, contrast-enhanced T1W image **(I)**, T2W image **(J)**, and CECT **(K). L:** CT of a benign mixed tumor with extensive calcification a highly unusual appearance. When calcification occurs in these lesions, it is usually focal or scattered multifocal in nature.





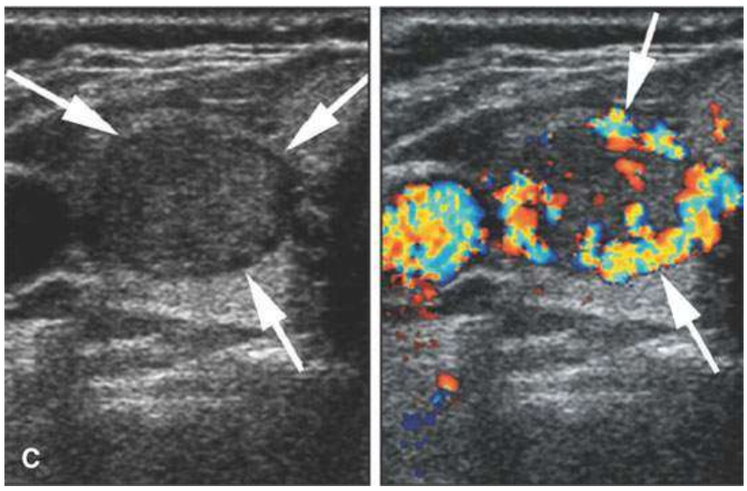
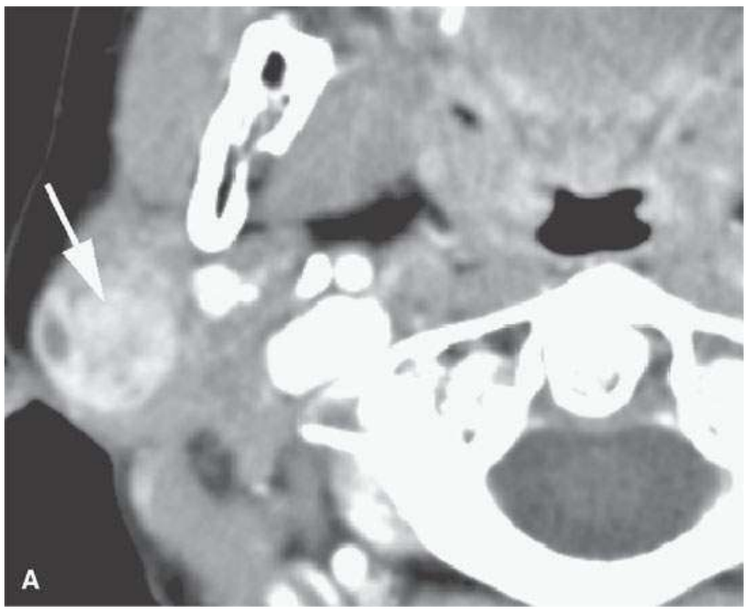
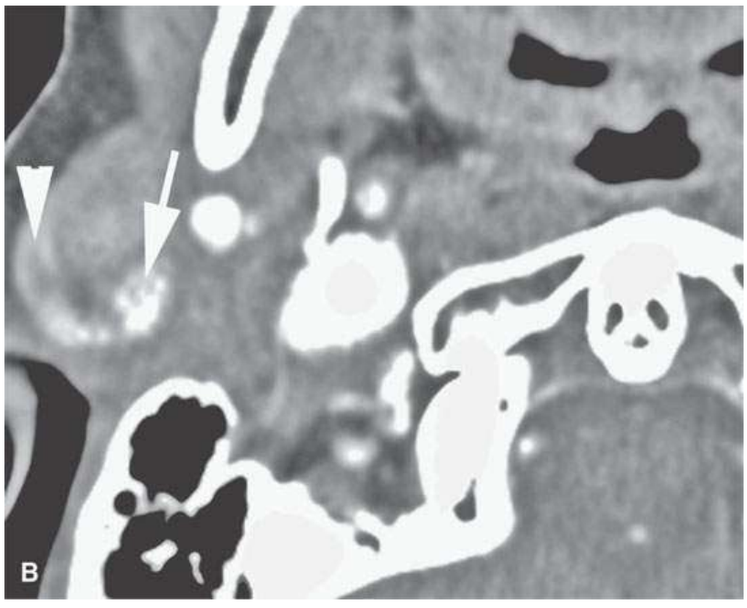
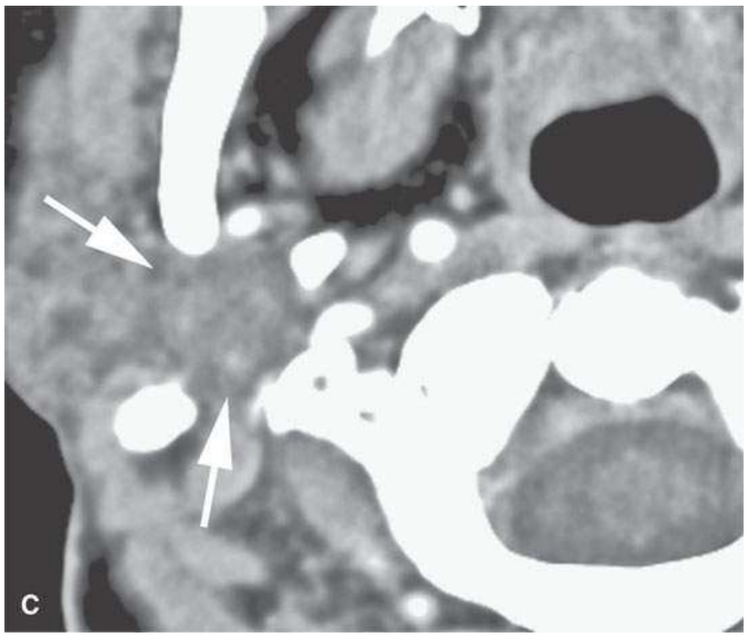


FIGURE 22.3. Three patients with thyroid adenomas. **A:** Contrast-enhanced computed tomography shows incidentally imaged adenomas—the one in the right lobe sharply marginated (arrow) and the one in the left lobe slightly less so (arrowheads); both are benign. **B:** Ultrasound (US) of multiple small adenomas, the larger of which (arrows) are not obviously cystic. **C:** Routine US shows a halo (arrows), a fairly reliable sign of the lesion being benign and color flow US showing obvious hypervascularity (arrows), which is common in both benign and malignant thyroid nodules.

Pleomorphic adenomas are most frequently encountered in the parotid gland and prestyloid parapharyngeal space (Figs. 22.1, 22.2, and 22.4). Sites of origin that also commonly come to imaging are the submandibular gland (Fig. 22.5), oral cavity/buccal space (Fig. 22.6), and hard palate. Sites of very infrequent presentation include the sublingual space in the floor of the mouth, neck (Fig. 22.7), and larynx and trachea (Fig. 22.8).



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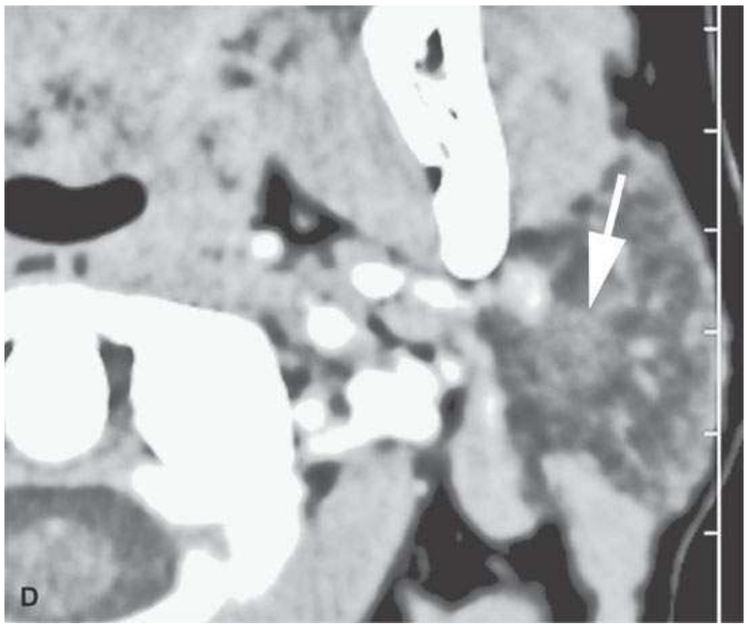
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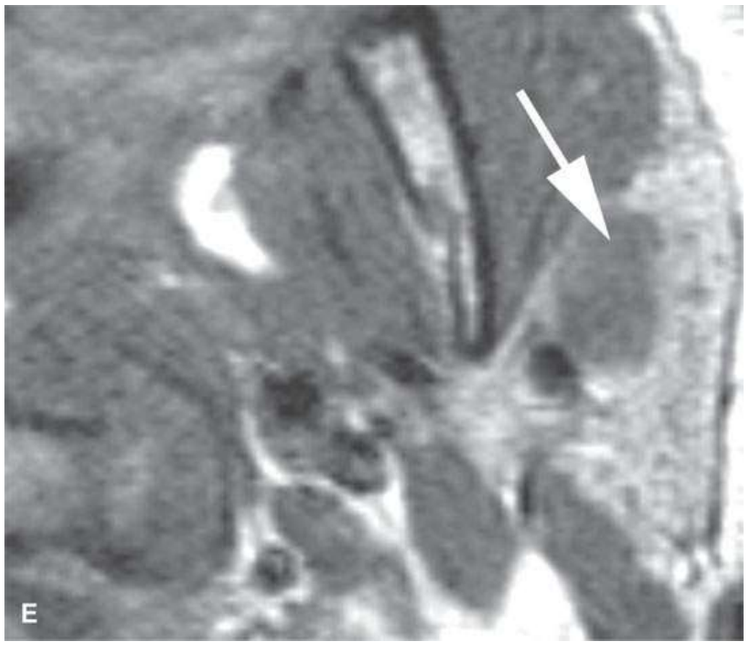
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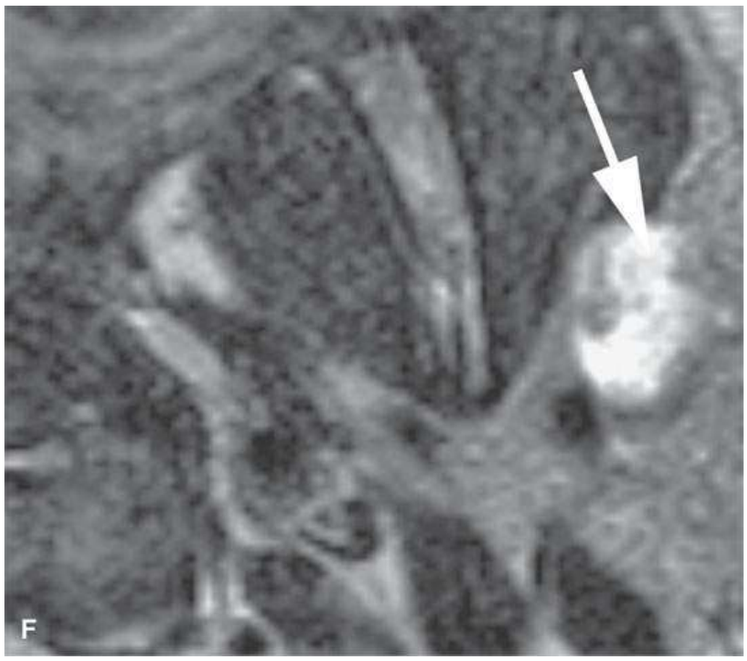
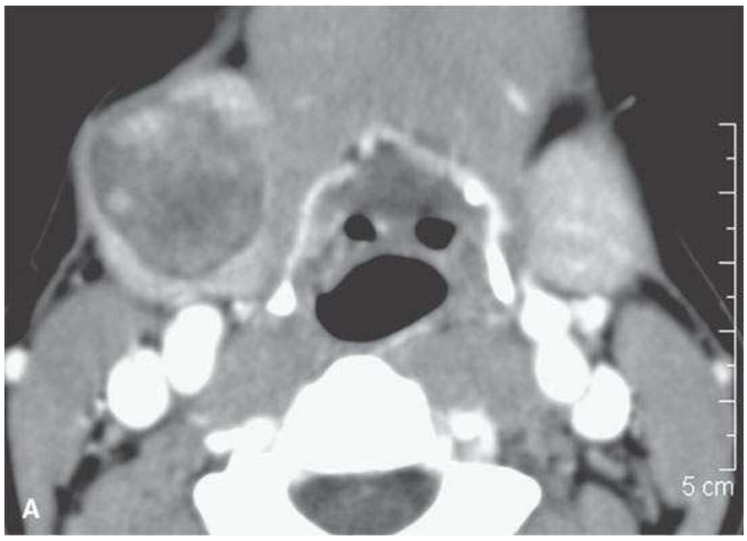
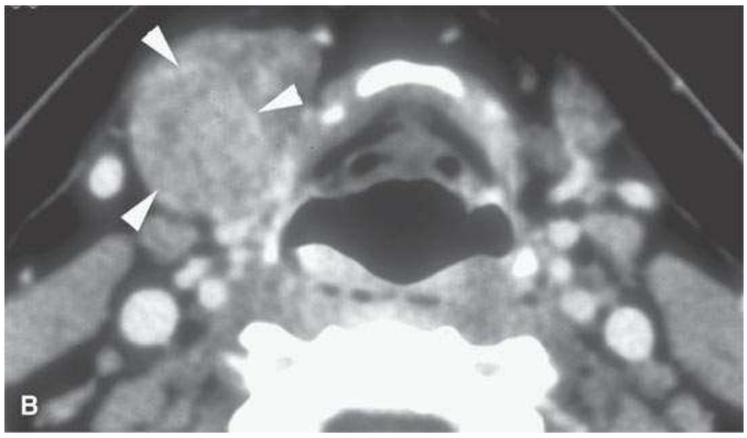
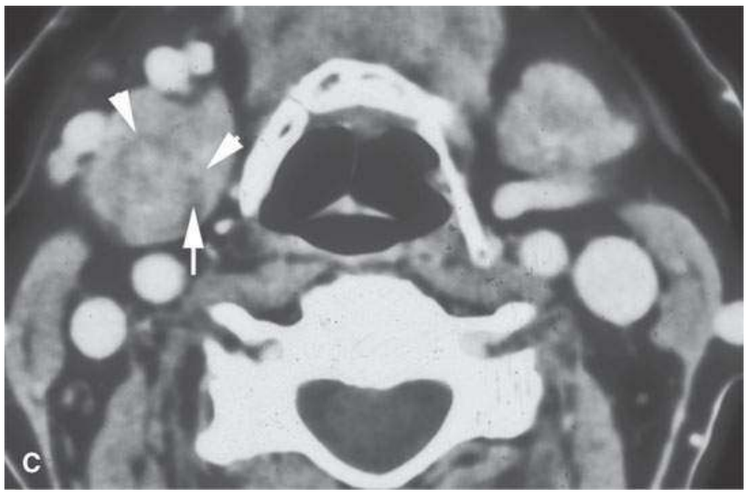


FIGURE 22.4. A–D: Contrast-enhanced computed tomography of four benign mixed tumors of the parotid gland: one that generally enhances (arrow in **A**), one that is partially calcified (arrow) and only minimally enhancing **(B)**, one in the deep portion of the gland that is difficult to discern (arrow in **C**), and one that does not enhance at all and might not be seen if the gland were not fatty (arrow in **D**). **E, F:** T1- and T2-weighted images show the tendency of parotid benign mixed tumors to be more conspicuous on magnetic resonance imaging.







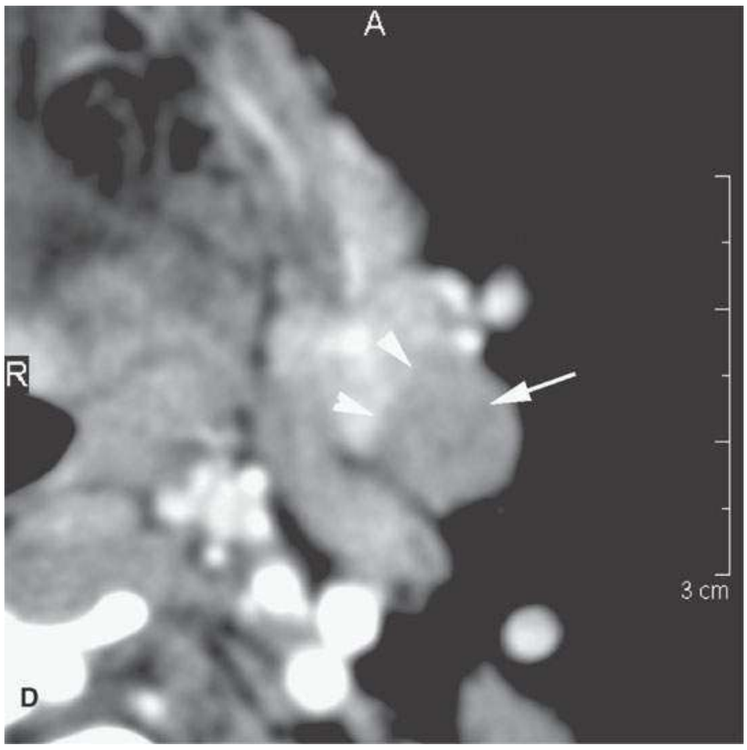
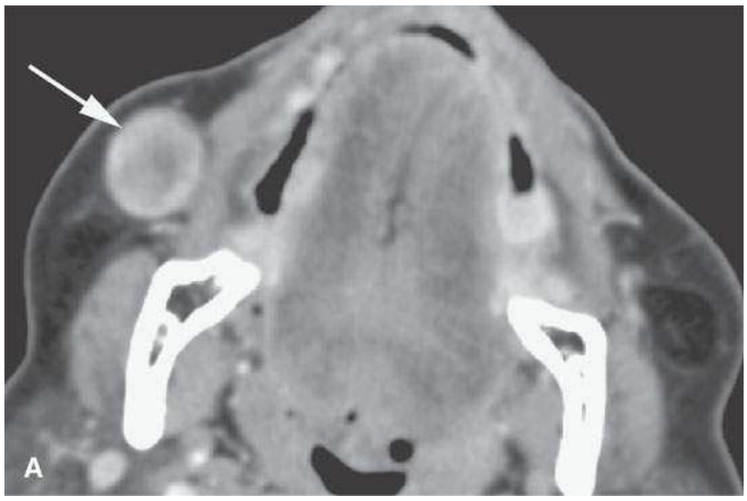


FIGURE 22.5. A–D: Contrast-enhanced computed tomography of four benign mixed tumors of the submandibular: one that is relatively low density (A), one that is minimally enhancing (arrowheads in **B**), one that is sharply marginated (arrowheads in **C**) and but for its peripheral lucency would be difficult to tell from the rest of the gland parenchyma (arrow), and one that does not enhance but is sharply marginated (arrowheads in **D**); the gland does enhance, and tumor protrudes from the gland surface (arrow).



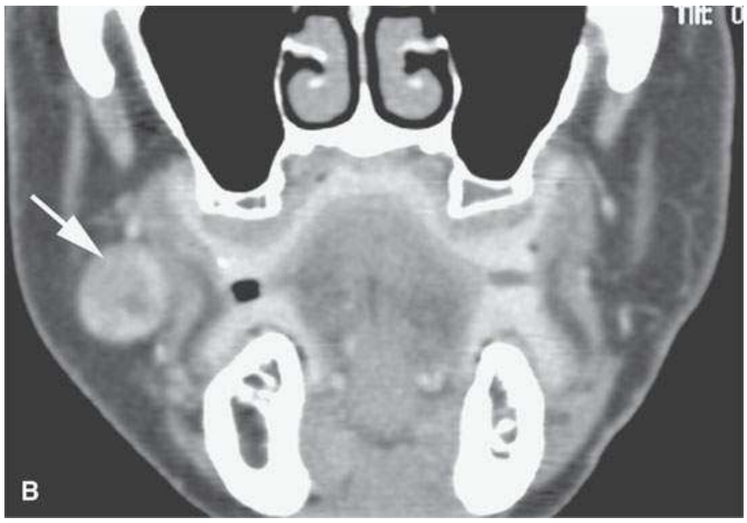


FIGURE 22.6. Contrast-enhanced computed tomography of a benign mixed tumor of the buccal space (arrows).

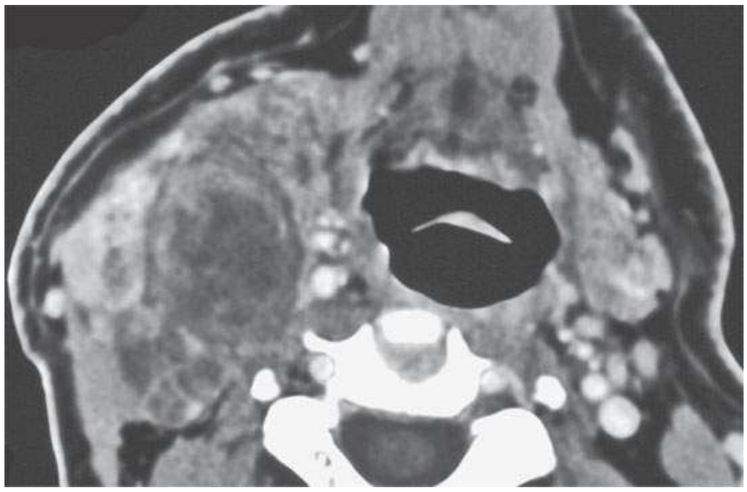


FIGURE 22.7. Contrast-enhanced computed tomography of a benign mixed tumor of the lateral compartment of the neck.

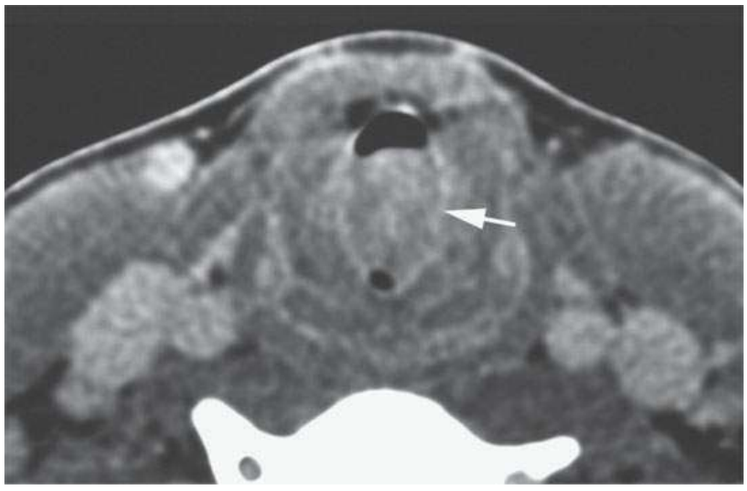


FIGURE 22.8. Contrast-enhanced computed tomography of a benign mixed tumor of the larynx and trachea.

Rests of ectopic salivary tissue can be found in the tonsils, lymph nodes, larynx, hypopharynx, neck, external auditory canal, middle ear, and thyroglossal duct; pleomorphic adenomas, therefore, may occur in these sites.[5,6] Pleomorphic adenomas present more commonly in females, and peak age incidence is about 50 years and older.

The margins of benign mixed tumors are typically well demarcated from surrounding tissue, are smooth, and have a capsule of variable thickness (Figs. 22.1, 22.2, and 22.4–22.8). They often are lobulated, which on sectional imaging can lead to the mistaken impression that they are multifocal. Compression of surrounding tissue is common, but invasion of these tissues is not common despite indistinct tumor margins that may suggest such locally aggressive behavior (Fig. 22.7). Attempts to enucleate these tumors usually leave foci of tumor in the operative bed probably because of small protrusions of tumor through the thinner portions of the tumor-pseudocapsule. Multifocal recurrence following attempted enucleation is, therefore, commonplace (Fig. 22.9). Such recurrence is frequently admixed with scar and, if in the parotid gland, may surround the facial nerve, making surgical resection potentially very morbid due to potential facial nerve injury. The pseudocapsules are often not visible on CT but may be seen on T2-weighted MR (Fig. 22.2A), if they are thick and fibrous enough, to appear different from surrounding compressed glandular or soft tissue elements.[6]

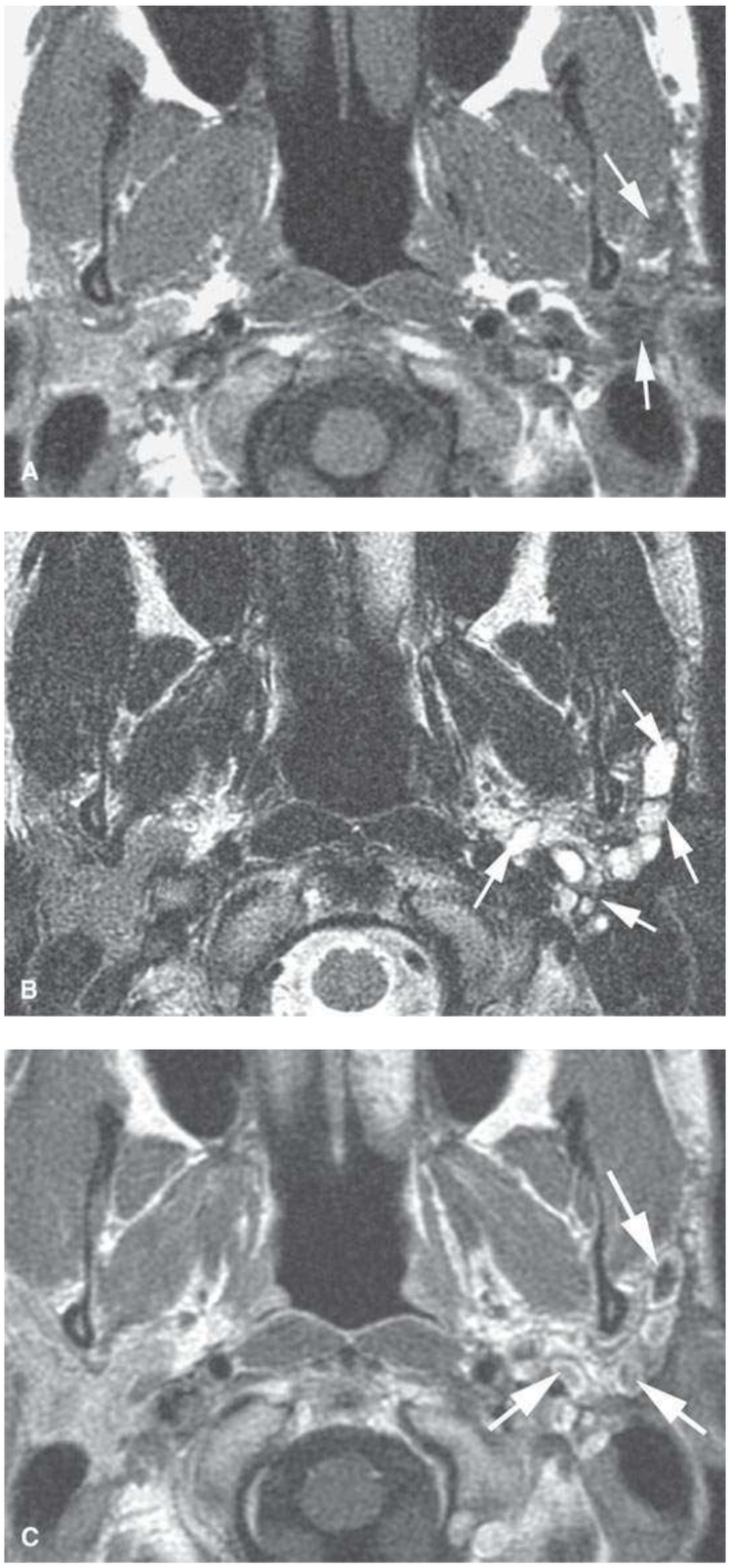
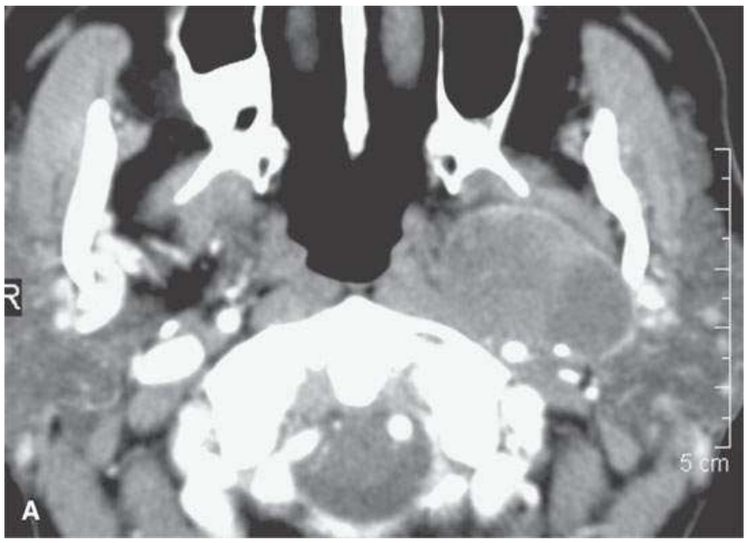


FIGURE 22.9. Magnetic resonance imaging of a patient with a persistent benign mixed tumor as a result of tumor spillage during the initial attempt at removal. The recurrent nodules (arrows) are admixed with scar and present all along and deep to the expected course of the main trunk of the facial nerve: non–contrast-enhanced T1-weighted image **(A)**, T2-weighted image **(B)**, contrast-enhanced T1-weighted image **(C)**.

The internal morphology of mixed tumors may be homogeneous or very complex (Figs. 22.1, 22.2, and 22.4–22.8). Both epithelial and mesenchymal elements must be present for pathologic diagnosis and to distinguish them from the far less common monomorphic adenoma (Fig. 22.10). The stroma may be scant or abundant relative to the epithelial component, leading to a diverse MR and CT appearance. The stroma may be mucoid, fibroid, chondroid, myxochondroid, and/or vascular. Calcification and ossification may occur but are uncommon (Figs. 22.2L and 22.4A). On CT, the tumors may show areas of marked contrast enhancement, low density (fluidlike), muscle density, and calcification (Figs. 22.2 and 22.4–22.8). On non–contrast-enhanced T1-weighted MR, the lesions are typically slightly hypointense to normal glandular tissue and clearly hypointense to fat. Contrast-enhanced MR may make the more vascular portions of the matrix isointense to surrounding glandular tissue or fat. The appearance on T2-weighted images is quite diverse. The glandular volume of the tumor tends to be bright on heavily T2-weighted images due to the water content of glandular spaces and/or mucoid stroma (Figs. 22.1, 22.2, 22.4, and 22.9). The relative amount of this in any particular lesion is not predictable (Figs. 22.4G vs. 22.4H). Densely cellular areas will behave the same as any solid, cellular neoplasm. Areas of fibrosis or chondroid stroma or calcification and ossification will produce foci of low signal intensity on T2-weighted images.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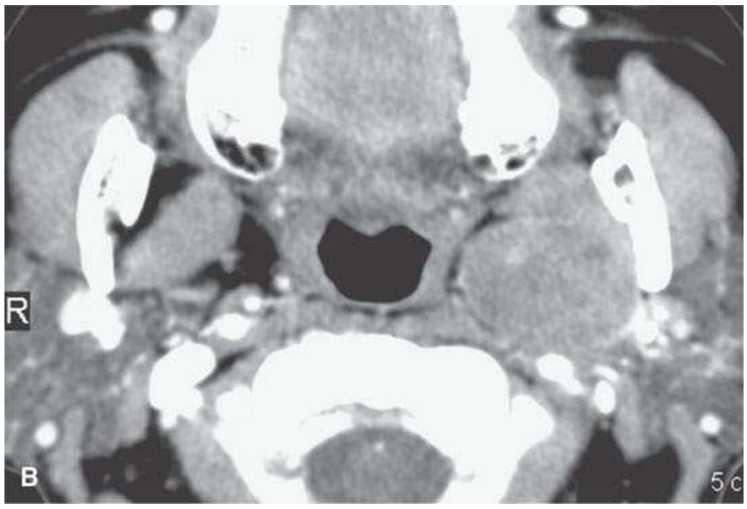
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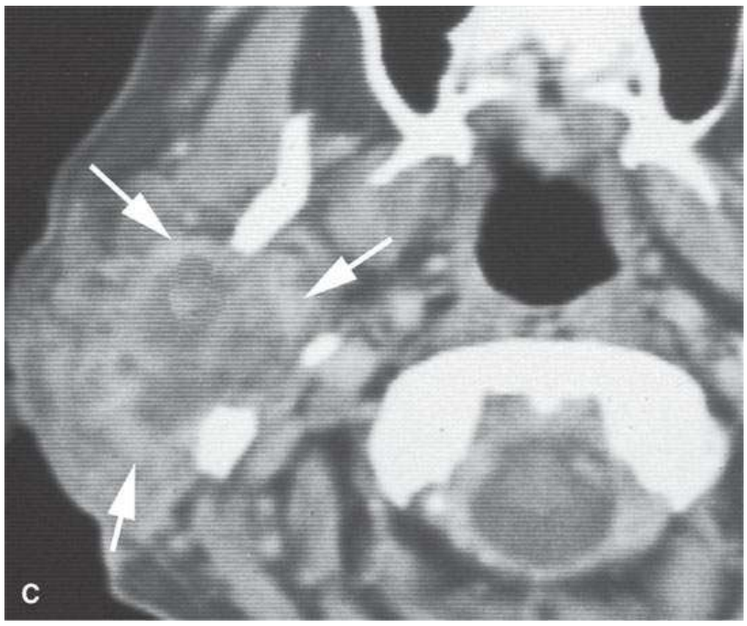
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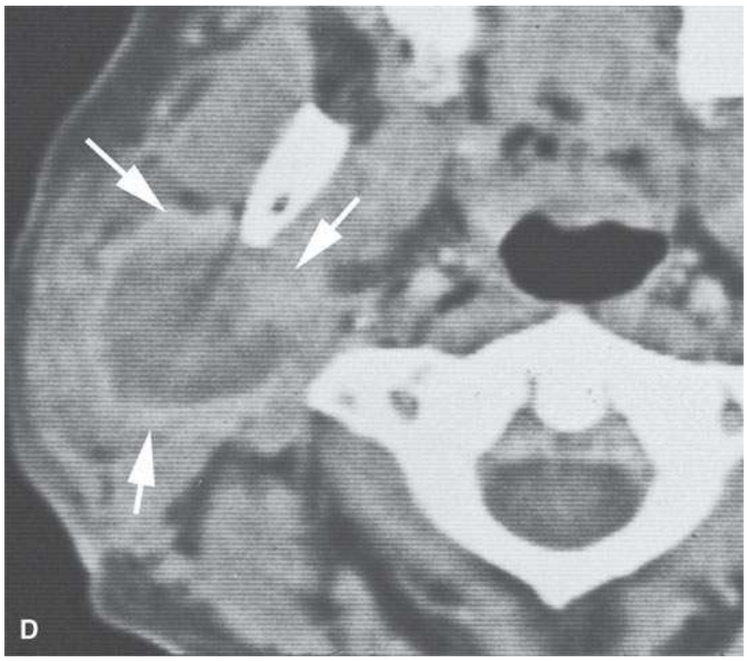
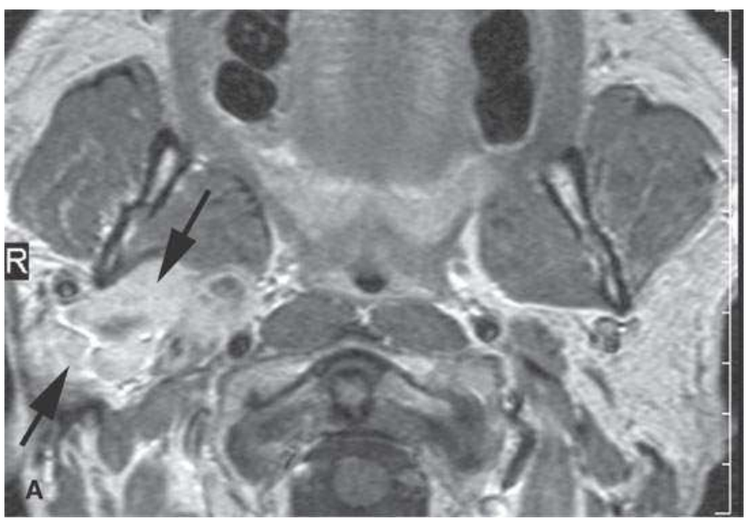
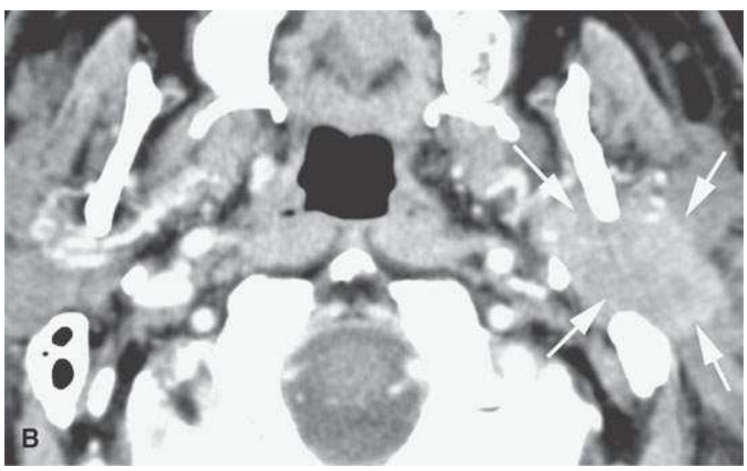


FIGURE 22.10. Contrast-enhanced computed tomography of a well-circumscribed parapharyngeal monomorphic adenoma **(A, B)** and a monomorphic adenoma **(C, D)** with more aggressive margins (arrows). Both were benign.

The clinical course of mixed tumors is almost entirely related to the adequacy of treatment. These tumors must be excised with a margin of surrounding normal tissue. If the capsule is violated during surgery, the tumor will likely spill into the operative site (Fig. 22.9). Fine needle biopsy does not seem to raise the risk of spread. Incisional biopsy or subtotal removal is a mistake and can be avoided by preoperative imaging that allows one to know the full extent of the lesion before it is approached surgically. Biopsy across a mucosal surface should be avoided, as it might subsequently require resection and repair of a violated mucosal area. Recurrences are best diagnosed by MR. The usually bright foci of recurrence are readily distinguished from postoperative scar on heavily T2-weighted, short T1 inversion recovery (STIR) images or contrast-enhanced fat-suppressed images (Fig. 22.9). Radiotherapy is occasionally used to slow the growth of recurrent disease when reoperation is not desirable or possible.

Carcinoma arising in a benign mixed tumor or carcinoma ex pleomorphica is an uncommon occurrence. Often, this pathologic diagnosis is a surprise clinically; however, if an unusually aggressive feature is present, such as facial nerve palsy, or if nodal spread or local invasion is present, one should suspect this diagnosis even if the initial histologic review suggests a benign mixed tumor (Fig. 22.11).





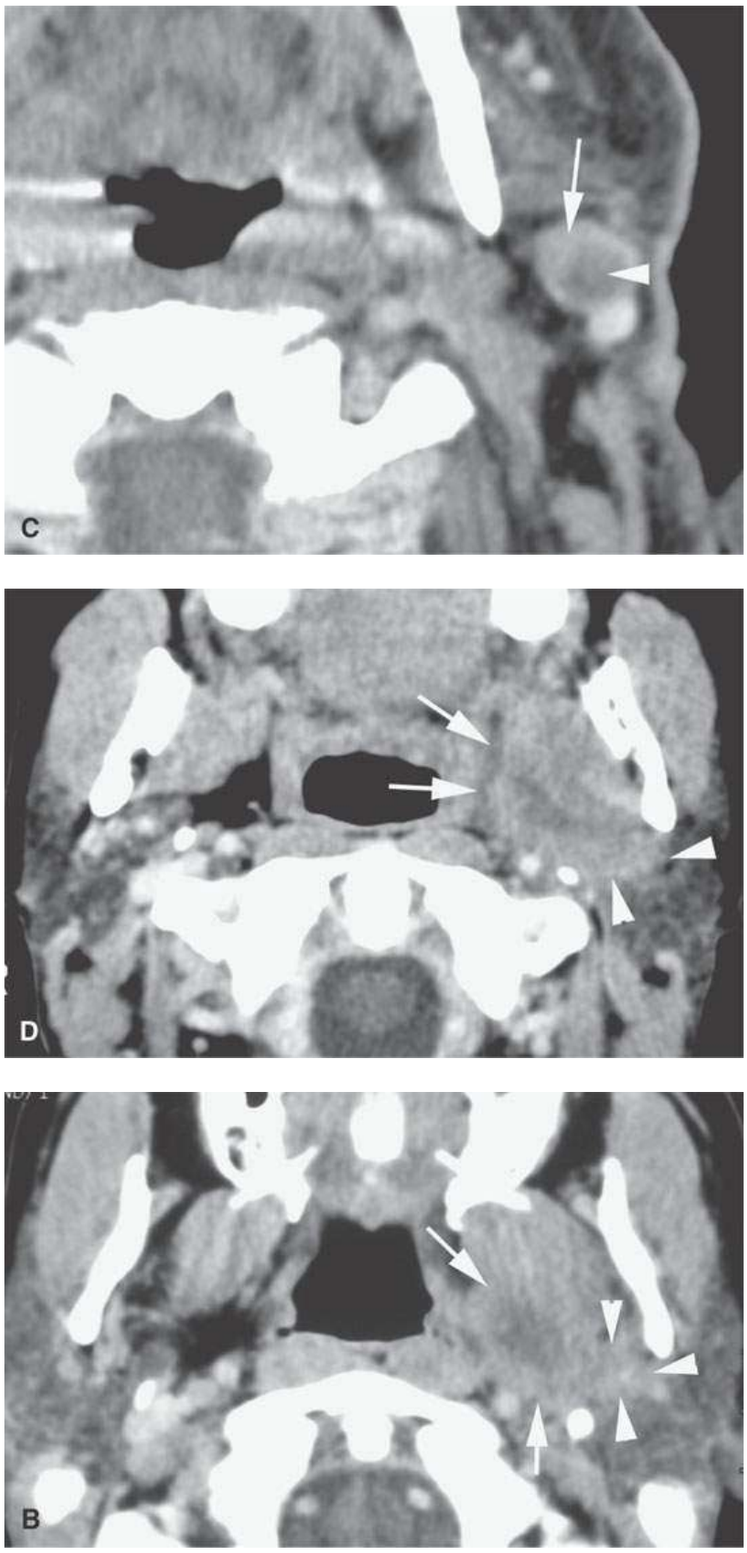


FIGURE 22.11. Three patients with carcinoma arising from a benign mixed tumor (carcinoma ex pleomorphica). **A**: Contrast-enhanced T1-weighted images showing the multifocal cancer with aggressive margins in the deep portion of the parotid gland and adjacent parapharyngeal space. **B, C**: Contrast-enhanced computed tomography (CECT) showing the parotid-origin cancer (C) and related node (arrow in **D**) containing a metastatic deposit. **D, E**: CECT of a cancer arising from a parapharyngeal BMT; the parapharyngeal fat is infiltrated (arrows), and the lateral margin of the mass suggests locally aggressive behavior (arrowheads) **(D)**; the otherwise well-circumscribed mass (arrows) invades laterally along the pterygoid plexus (arrowheads) **(E)**.

Monomorphic adenomas are rare outside of the parotid gland. Membranous, basal cell, or hybrid varieties are possible (Fig. 22.10). Some variation in appearance on T1- and T2-weighted MR is to be expected because their cellular and stromal elements vary. Contrast enhancement is possible because of a prominent vascular component. There are a few reported cases with imaging, and there is little reason to believe that they could be distinguished from other parotid lesions based on CT and/or MRI morphology.

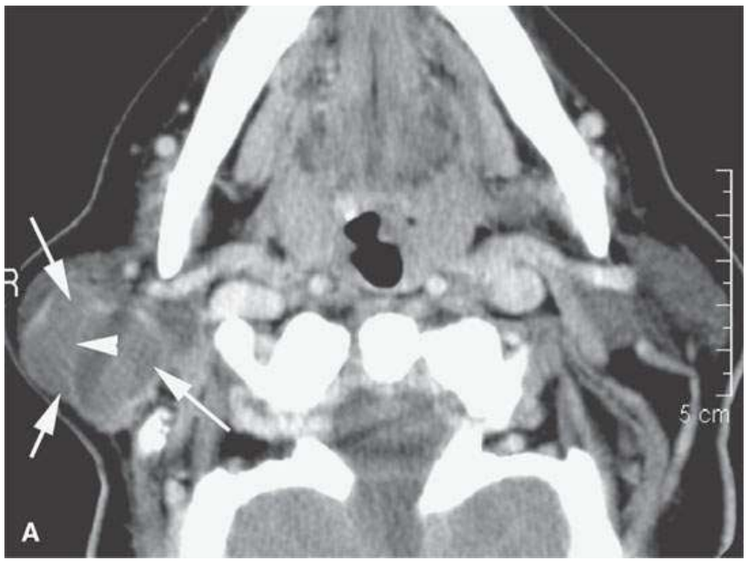
The external auditory canal mucosa contains exocrine glands, modified apocrine glands, and sebaceous glands; thus, it can be the site of an adenoma. Pleomorphic adenomas are known to occur in the external canal. Apocrine adenomas (ceruminoma) may also arise in the external auditory canal. These lesions, when large enough, can cause regressive remodeling and expansion of the bony external auditory canal. On CT, they are indistinguishable from other benign, slowly growing masses such as congenital epidermoid cyst or acquired external canal cholesteatoma. Since these tumors contain glandular spaces, one might anticipate a bright appearance on T2-weighted MR, but this would not distinguish them from an acquired cholesteatoma, epidermoid or pleomorphic adenoma, or even a malignancy with micro- or macrocystic component.

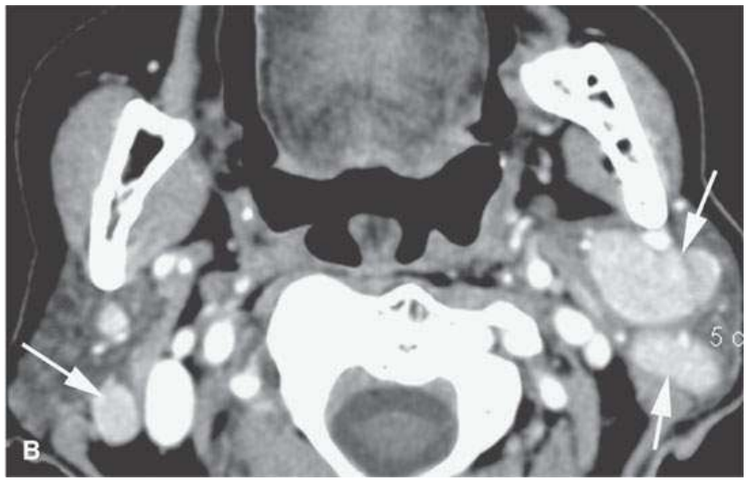
Warthin Tumor (Papillary Cystadenoma Lymphomatosum)

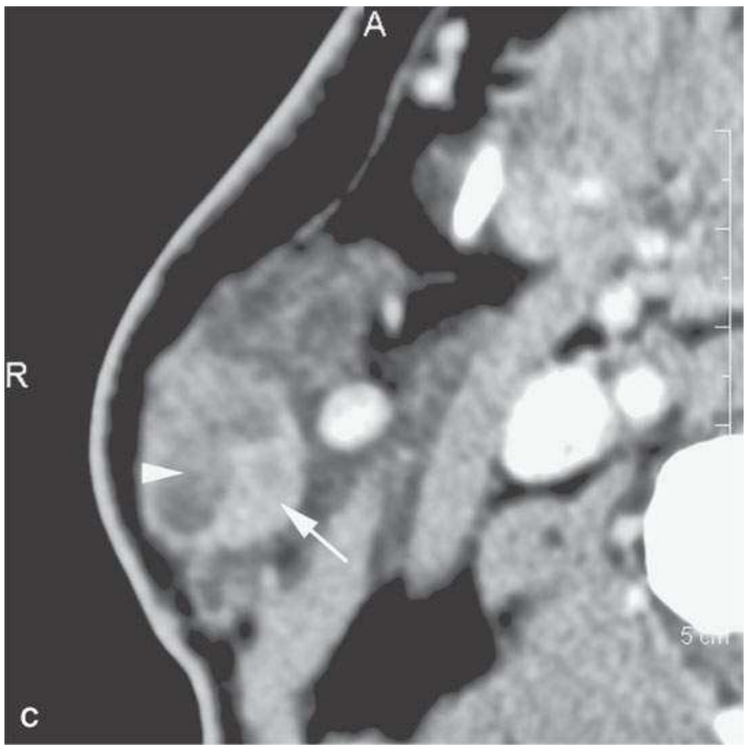
Despite the allusion to “lymphoma” in its name, papillary cystadenoma lymphomatosum, or Warthin tumor, is benign and contains benign lymphoid elements. The developing parotid gland envelopes some of the surrounding lymph nodes, fat, and vascular structures incorporating them in the gland. Likewise, bits of salivary tissue may be folded into lymph nodes that end up within the gland and in periglandular locations. These are the origins of the lymphoid elements in Warthin tumor and the explanation for multiple and extraglandular tumors. The tumor is typically encapsulated, smooth, and round or oval. Macrocystic areas are common; when aspirated, these contain mucoid and brown-tinged fluid. Solid glandular and lymphoid elements are always present.

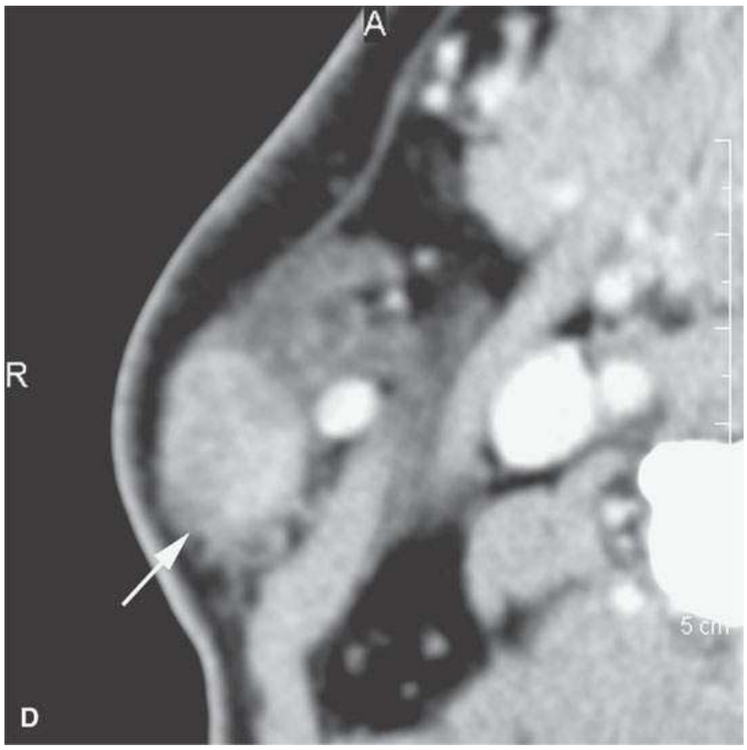
The gross morphologic features just described give rise to much variation in their CT and MR appearance. On contrast-enhanced computed tomography (CECT), a smooth, round mass with minimal to modest enhancement and inhomogeneous internal architecture is the rule. Obviously, cystic areas are often

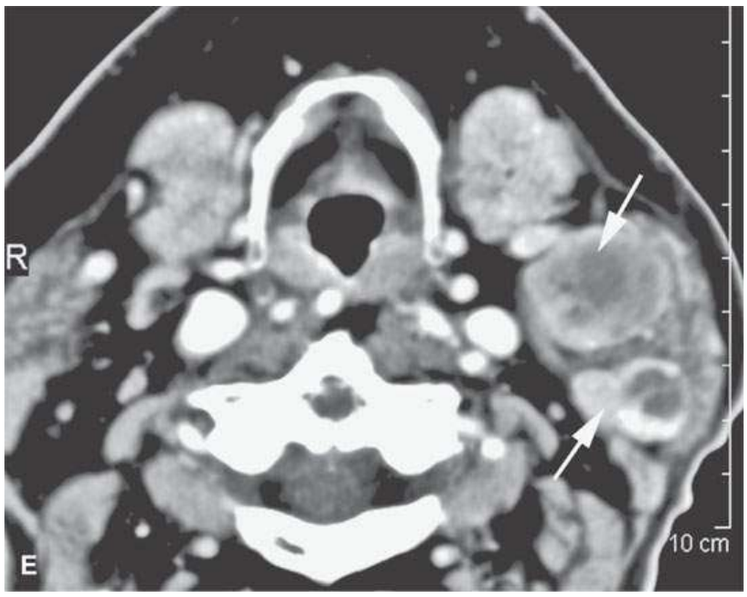
present (Fig. 22.12). On MR, the same well-circumscribed lesion typically will show small focal to large discreet areas of high signal intensity on T2-weighted images. Broad zones of hypointensity relative to fat and normal parotid tissue commonly are visible (Fig. 22.13). T1-weighted images usually reveal a hypointense mass relative to the normal gland and intervening inhomogeneous areas of even lesser signal intensity.











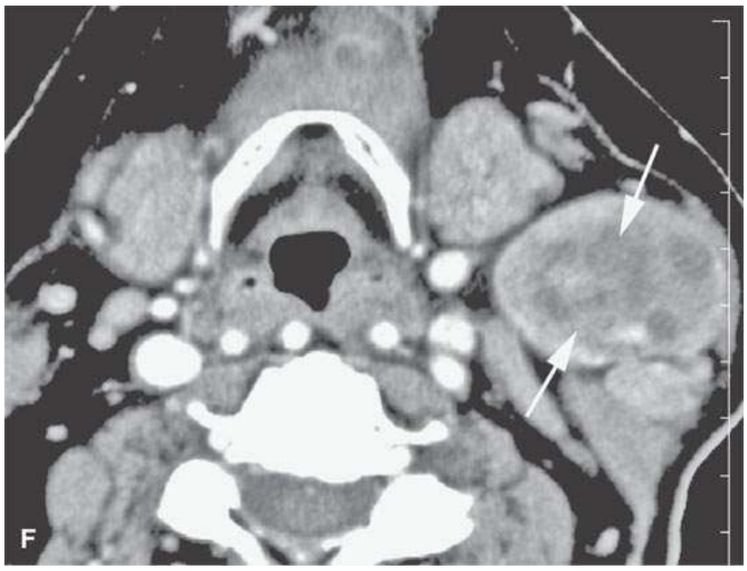
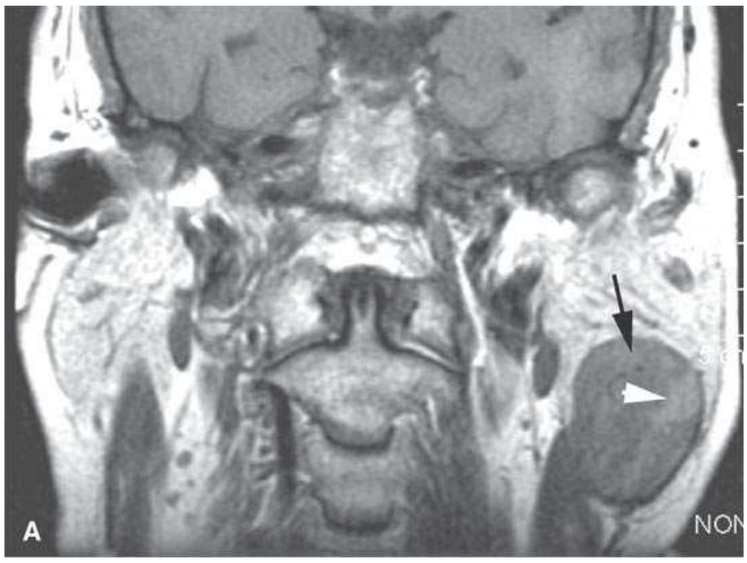


FIGURE 22.12. Contrast-enhanced computed tomography of patients with Warthin tumors**. A:** Septated (arrowhead) mainly cystic tumor (arrows) with sharp margins**. B:** Multiple bilateral enhancing tumors with sharp margins (arrows)**. C, D:** Partially cystic and partially solid sharply marginated **(C)** tumor with slightly ill defined margin in **(D). E:** Multiple sharply marginated cystic and solid masses with calcification**. F:** Large solitary sharply marginated cystic and solid mass with calcification**.**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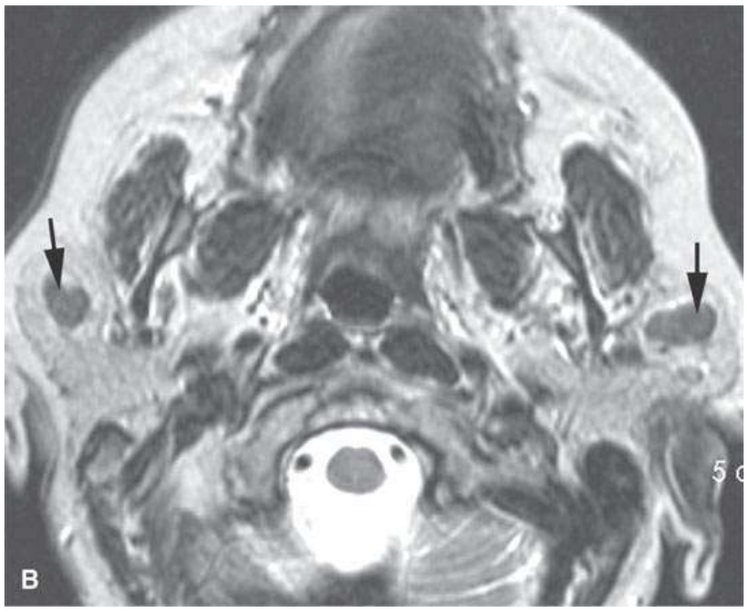
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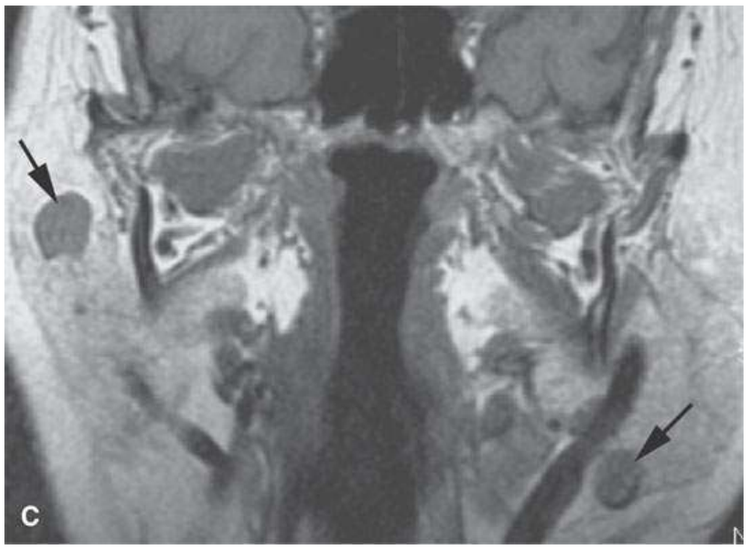
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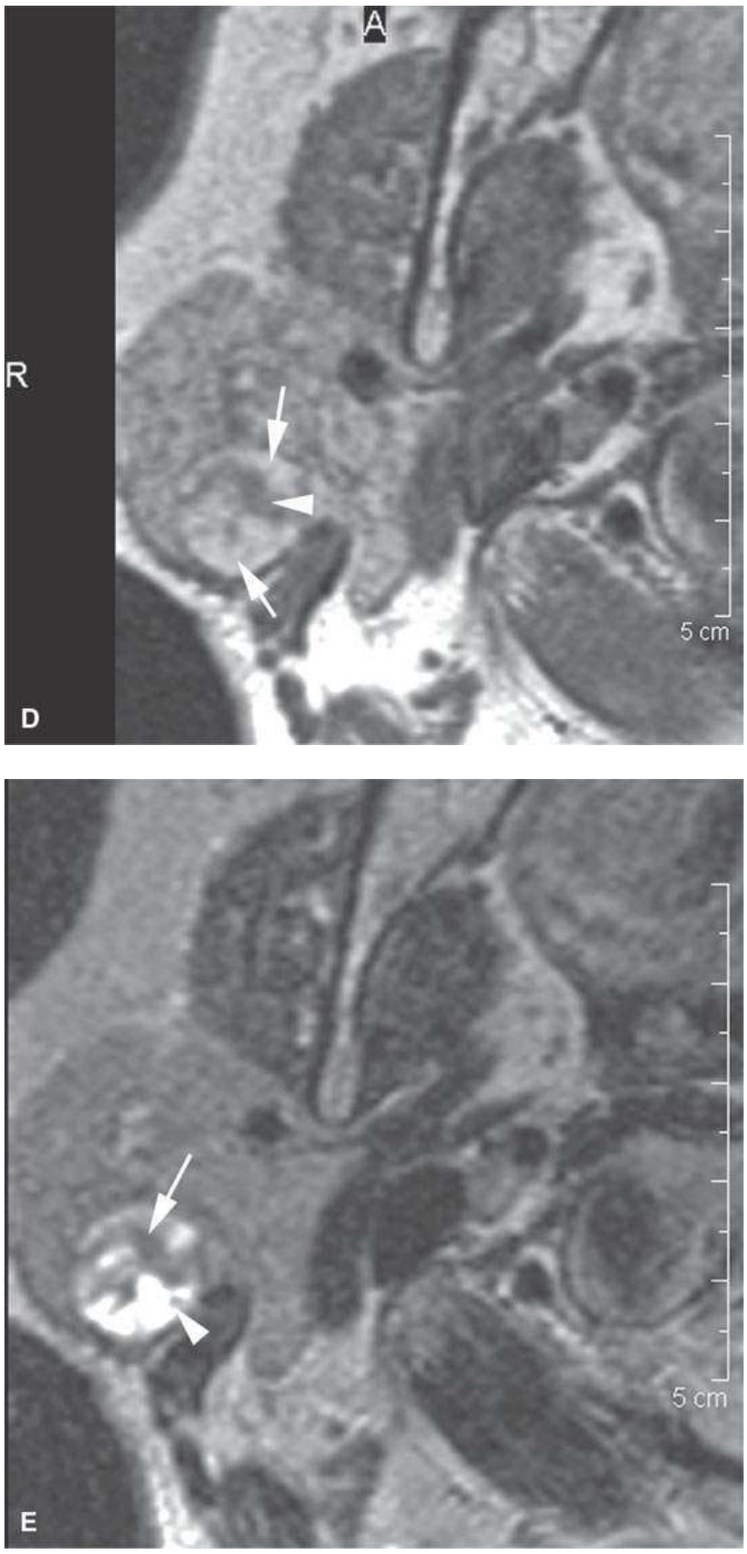


FIGURE 22.13. Various patients with Warthin tumors as seen on magnetic resonance imaging studies. **A:** Solitary mass, in the tail of the gland on T1-weighted (T1W) image (arrow) with mixed signal intensity (arrowhead). **B, C:** Multiple small bilateral Warthin tumors on T2-weighted (T2W) image **(B)** and T1W image **(C). D, E:** Solitary tumor in the parotid tail partially enhancing (arrows) and partially not (arrowhead) on the T1W contrast-enhanced image in (**D**) and solid (arrow) partially cystic (arrowhead) on the T2W image in (**E**).

Peak occurrence of Warthin tumors ranges from 41 to 70 years of age. Some authors state that there is a decided male preponderance.7 Malignancy is rare. Treatment is needle biopsy and observation or wide surgical excision.

Oncocytoma

Oncocytic tumors are named for their size and oxyphilic cytoplasm. The cells are actually parenchymal elements of acini or intralobular ducts. These are solid, slow-growing neoplasms most commonly found in the parotid gland, but occasionally they arise in other major or minor salivary glands. Those arising outside of the major salivary glands may be cystic, and the tumor cannot be morphologically distinguished from other tumors at these sites. Oncocytomas are rarely malignant, and even if the histology indicates malignancy, the clinical course is relatively indolent. These tumors will have smooth well-circumscribed margins on CT and MR. Internally, they are relatively homogeneous (Fig. 22.14).

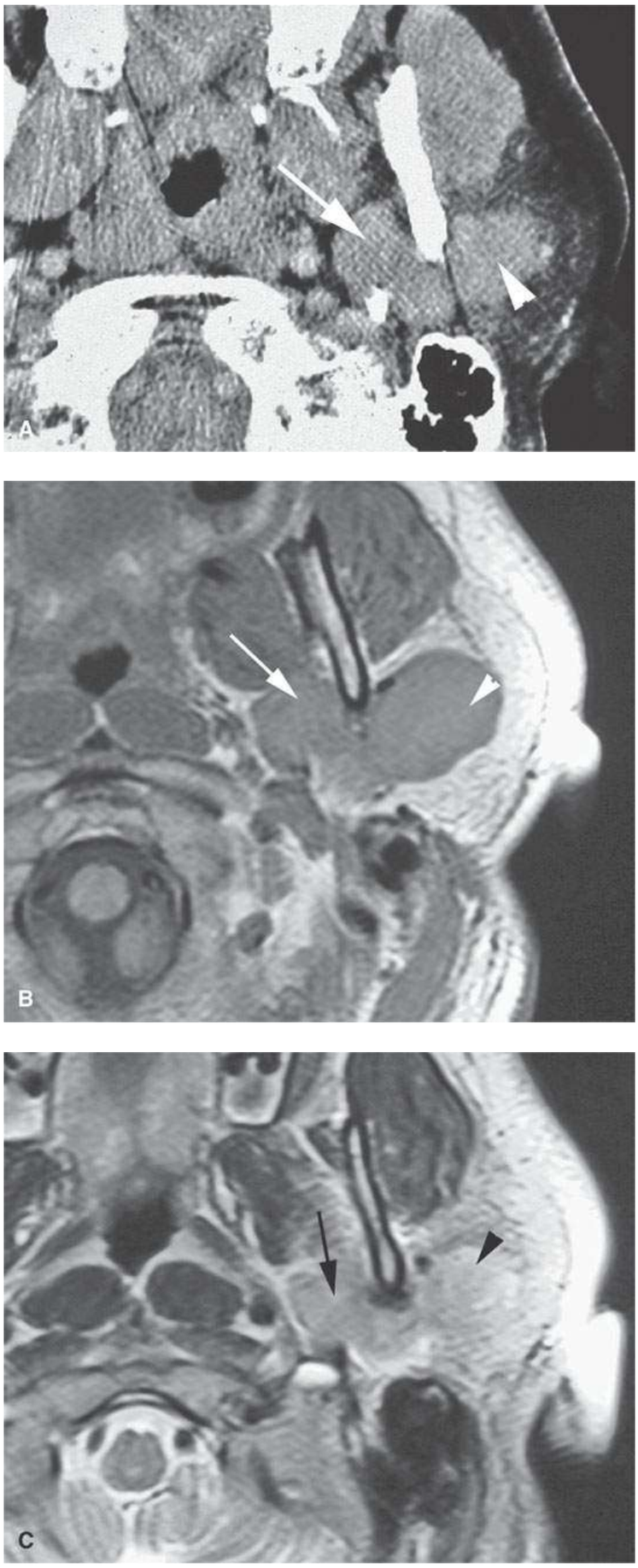


FIGURE 22.14. Computed tomography and magnetic resonance imaging study in a patient with an oncocytoma both deep (arrows) and superficial (arrowheads) to the plane of the main trunk of the facial nerve: contrast-enhanced computed tomography **(A)**, contrast-enhanced T1-weighted image **(B)**, and T2-weighted image **(C)**.

MALIGNANT TUMORS OF GLANDULAR ORIGIN

Adenocarcinoma

Adenocarcinoma arises from surface epithelium, major salivary glands, minor salivary glands, and congenital rests of salivary tissue that may be scattered throughout the head and neck region, as described in the preceding Adenomas section in this chapter (Fig. 22.15). The mucosal lesions arise in pseudostratified columnar epithelium and in seromucinous glands. There is an increased incidence of these lesions in the sinonasal region in the furniture makers and woodworkers.8 The specific carcinogen is not known. Those that arise from mucosal and skin sources are considered in conjunction with epithelial tumors at those sites in Chapters 23 and 24.

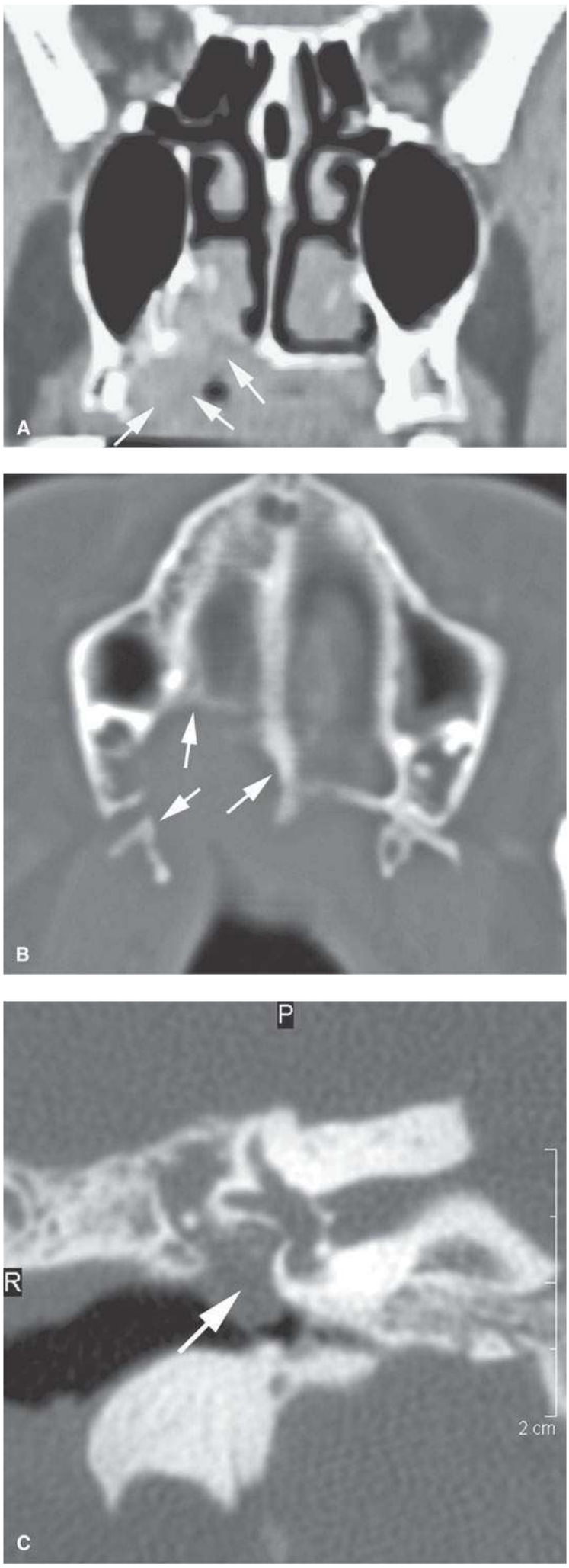
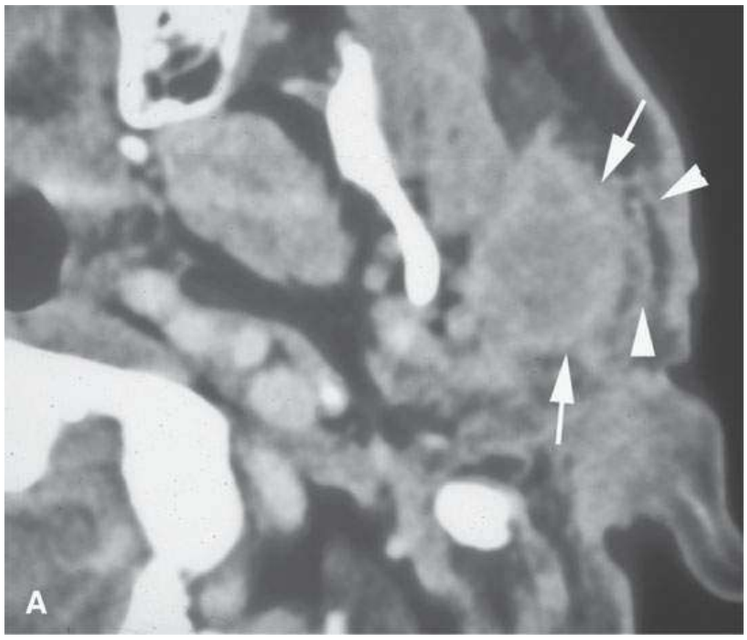
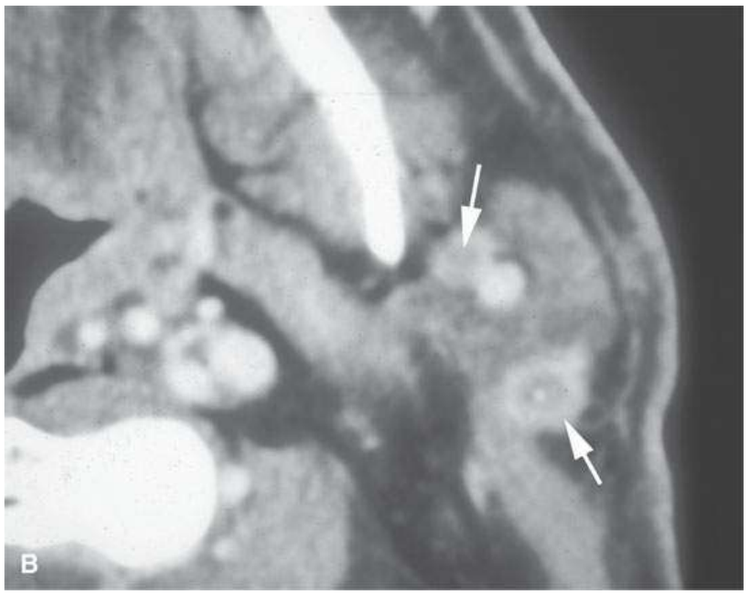


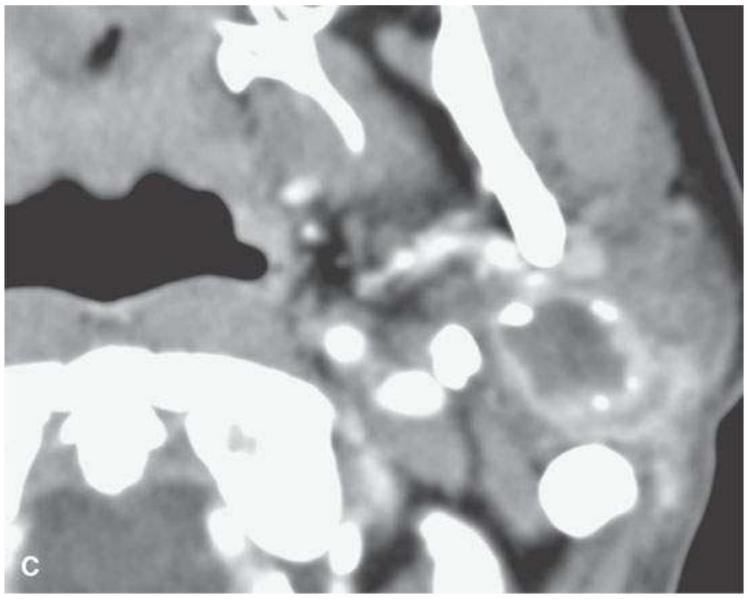
FIGURE 22.15. Computed tomography studies of adenocarcinomas arising in minor salivary glands. **A, B:** Contrast-enhanced computed tomography of a relatively indolent-appearing hard palate cancer (arrows) with relatively smoothly marginated bone erosion. **C:** Tumor of the middle ear with no features that identify it as different from a cholesteatoma or other benign middle ear disease.

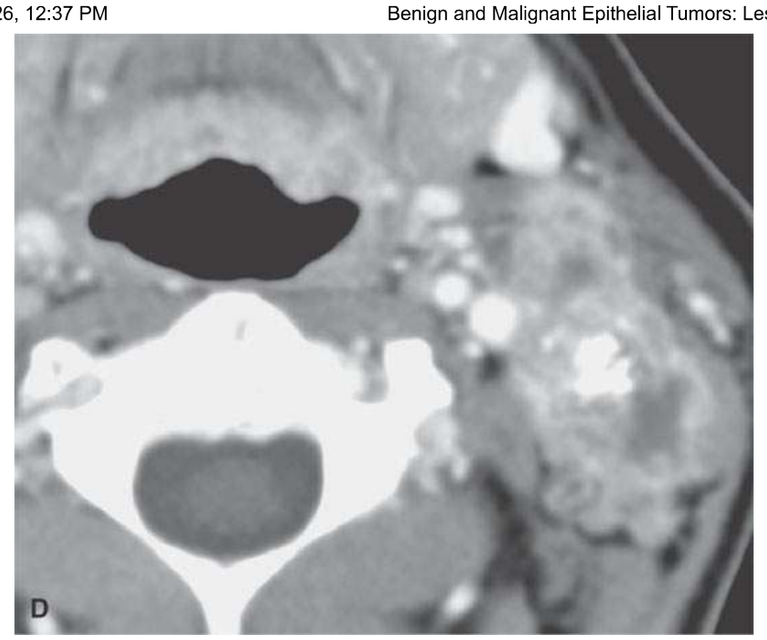
Adenocarcinomas are largely exophytic, with either a sessile or polypoid growth pattern in mucosal lesions; however, a highly aggressive pattern of deep infiltration is common in tumors of major and minor salivary gland origin. A more indolent-appearing morphology is also possible (Fig. 22.16). They are most common in parotid and submandibular glands (Figs. 22.16 and 22.17). The tumors may contain glandular spaces filled with mucoid material; thus, their appearance on T2-weighted images may be bright relative to fat. However, they are usually solid cellular lesions and show gross morphologic CT and MRI

features similar to those for other squamous cell carcinomas described in discussions of the general morphology of malignancies and again in conjunction with mucosal and skin origin cancers in Chapters 21, 23, and 24.









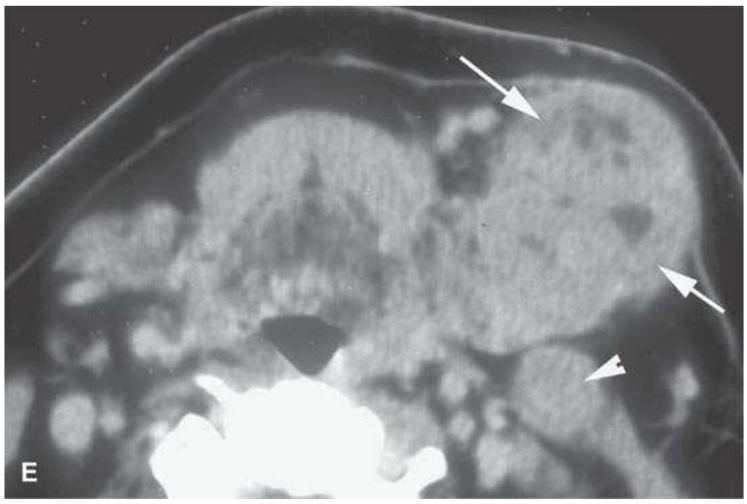
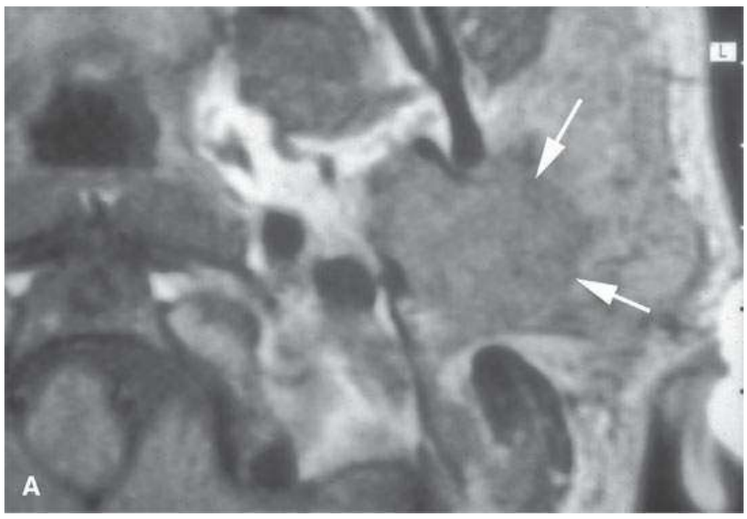
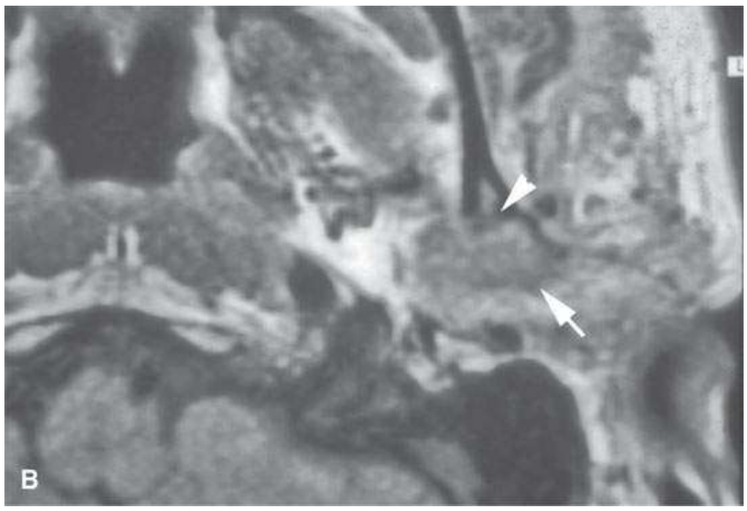


FIGURE 22.16. Contrast-enhanced computed tomography studies of three patients with adenocarcinoma of a major salivary gland. –**A**, **B:** Aggressive margins (arrows) and infiltration of the subcutaneous fat (arrowheads) as well as the metastatic parotid nodes (arrows in **B**) indicate the aggressive nature of this mass. **C:** Partially calcified mass with locally with infiltrating gross margins and related level 2 metastatic adenopathy **(D). E:** Submandibular gland adenocarcinoma growing eccentrically from the gland.

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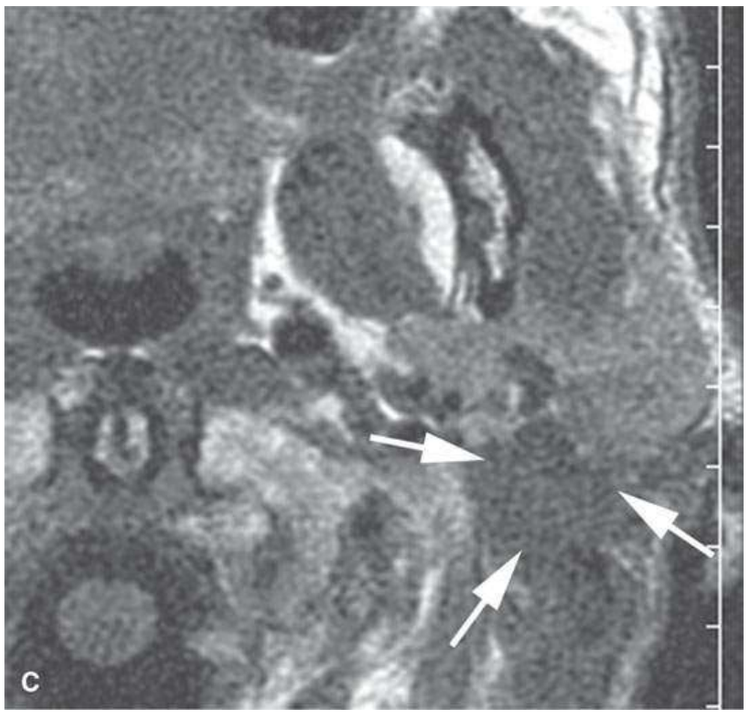
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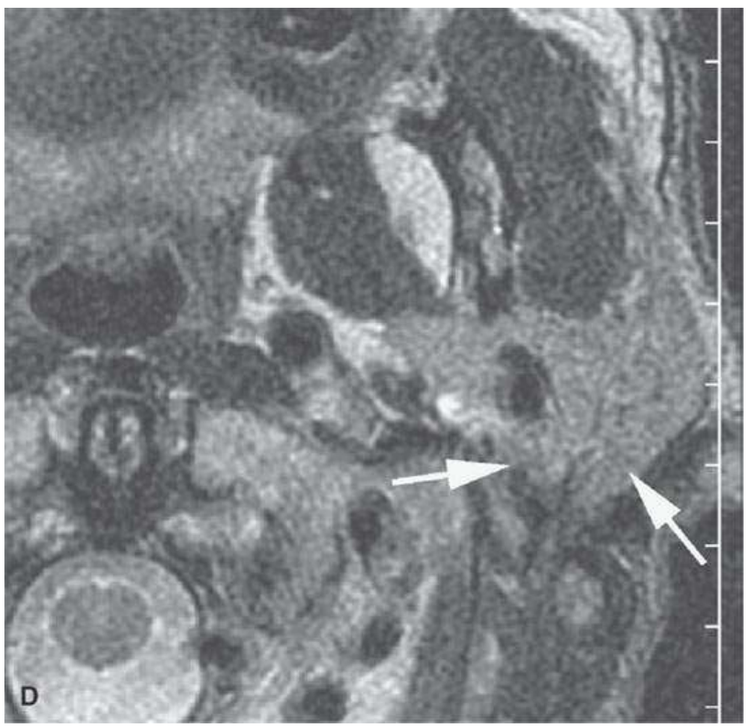
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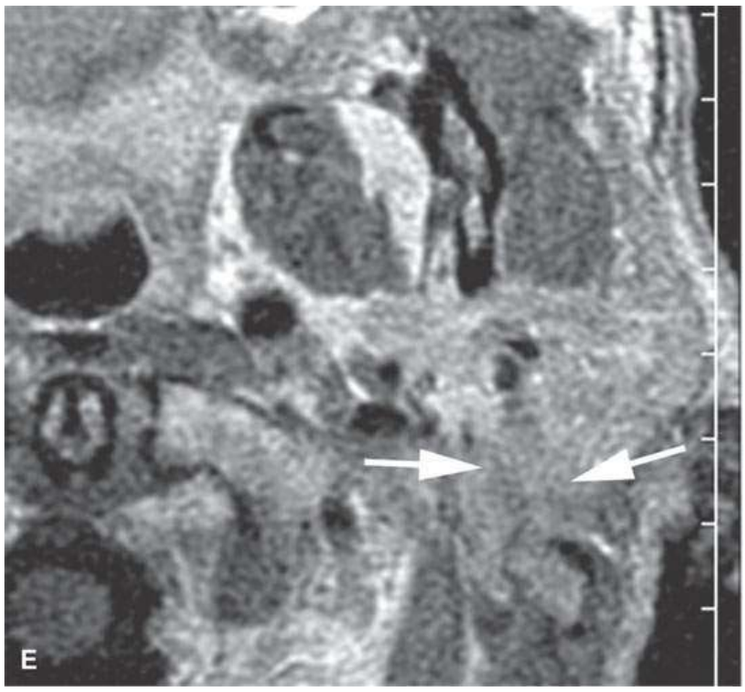
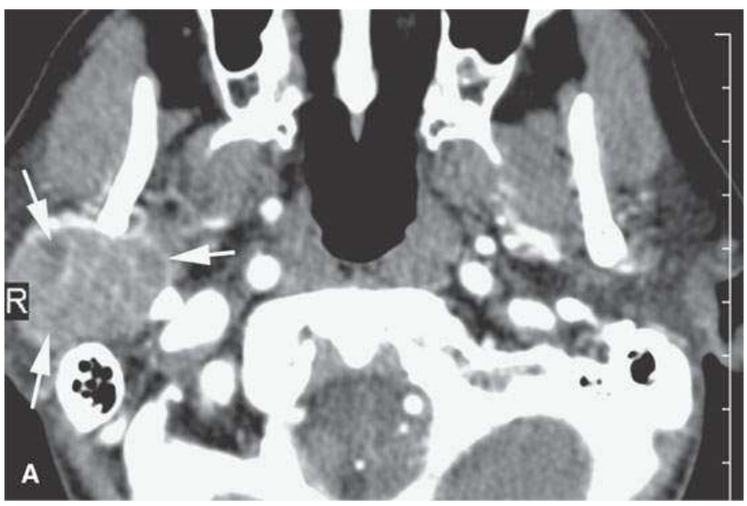


FIGURE 22.17. Magnetic resonance imaging studies of two patients with parotid adenocarcinomas. **A, B:** T1-weighted (T1W) non–contrast-enhanced images show the infiltrating borders of the mass in the deep portion of the parotid gland invading normal parotid tissue (arrows) with the unusual feature of mandibular invasion (arrowhead). **C–E:** A second patient to illustrate the appearance of these lesions on a T1W image without contrast **(C)**, T2-weighted image **(D)**, and contrast-enhanced T1W image **(E)**.

If lymph node metastases are present at initial presentation, the chances for cure are dramatically reduced in patients with adenocarcinoma and even more so than in patients with squamous cell carcinoma.

Adenoidcystic Carcinoma

Adenoidcystic carcinoma is a particularly insidious cancer. It arises from major and minor salivary glands, but like other lesions of predominantly salivary gland origin, it can occur anywhere that rests of salivary tissue have been left behind during development. Adenoidcystic carcinomas probably arise from the canaliculi and intercalated ducts of the peripheral ducts of the salivary glands. The term cylindroma was dropped long ago, as it was an older term referring to a more heterogeneous group of tumors. Adenoidcystic carcinoma accounts for a significant percentage of parotid and submandibular gland malignancies and smaller percentages of cancers arising at other sites (Figs. 21.30 and 22.18). Frequent areas of occurrence outside the major salivary glands include the hard and soft palate (Fig. 22.19), lacrimal gland (Fig. 12.8), and sinonasal region. Unusual sites include the ear canal, pharynx (Fig. 21.15), larynx (Fig. 22.20A,B), trachea (Fig. 22.20C), and parapharyngeal space.



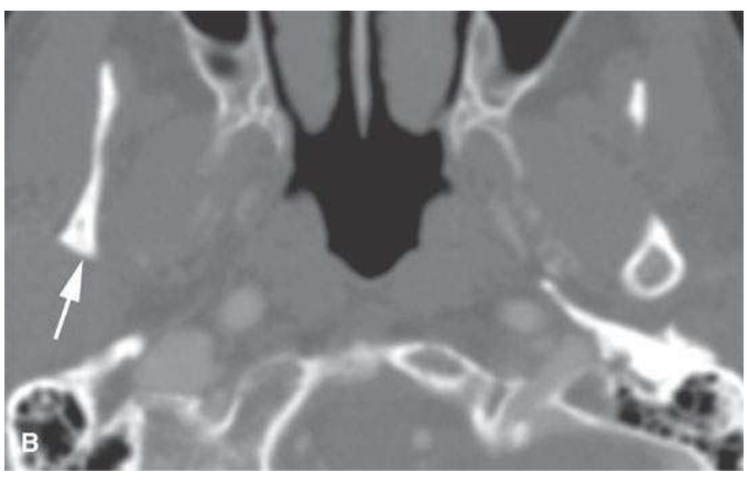
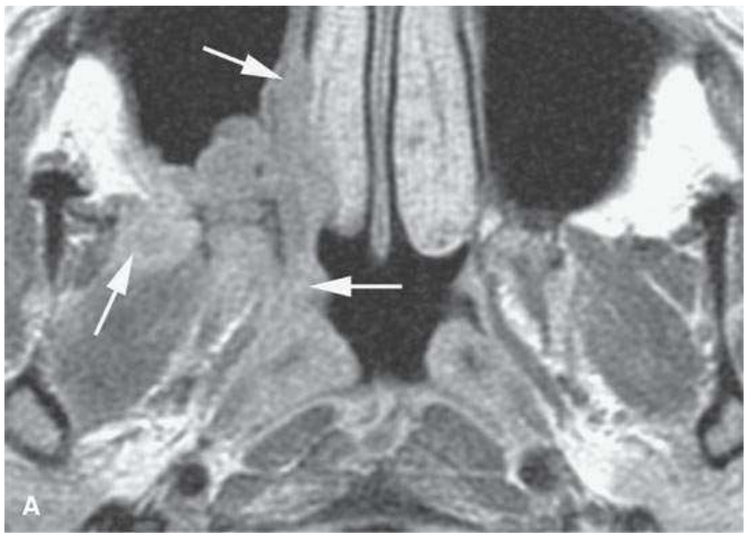


FIGURE 22.18. Contrast-enhanced computed tomography in a patient with adenoidcystic carcinoma showing a well-circumscribed mass (arrows in **A**) much like a benign salivary neoplasm might have; however, the tumor erodes the condylar neck (arrow in **B**).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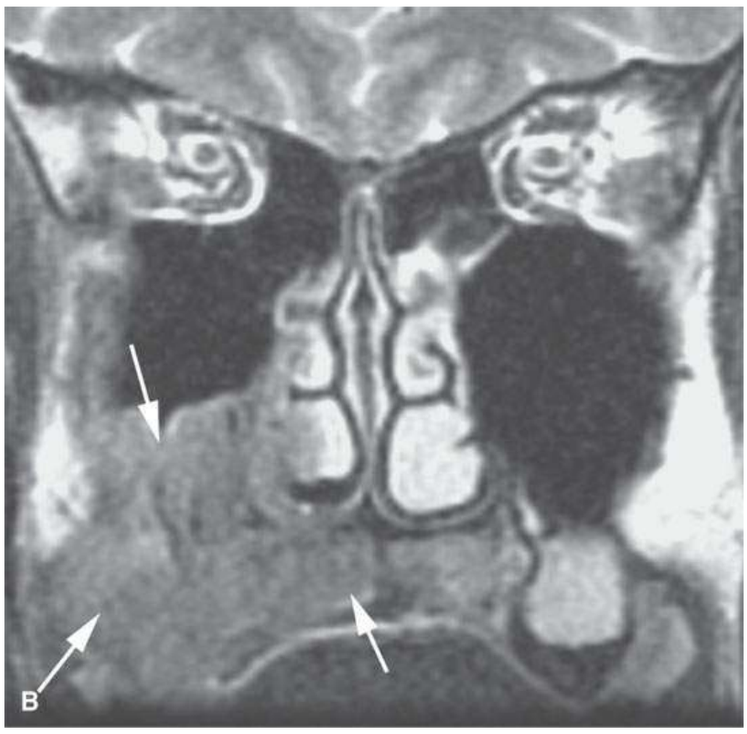
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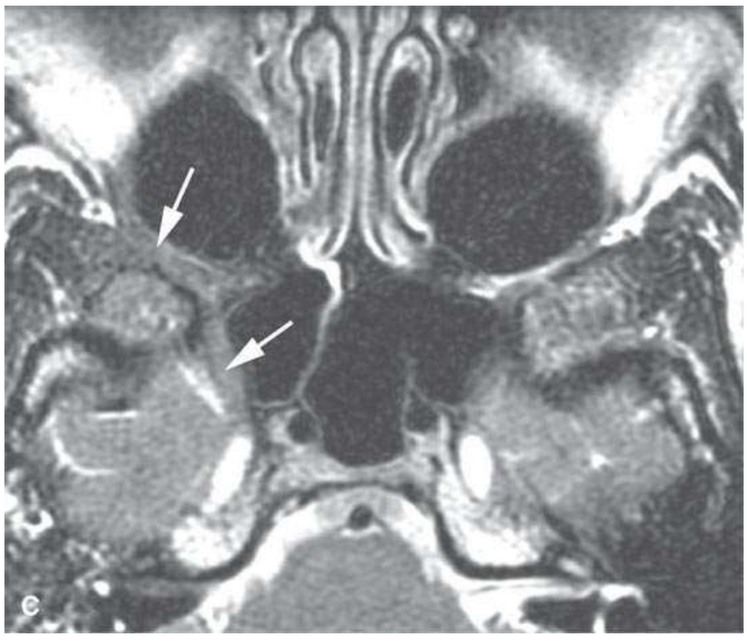
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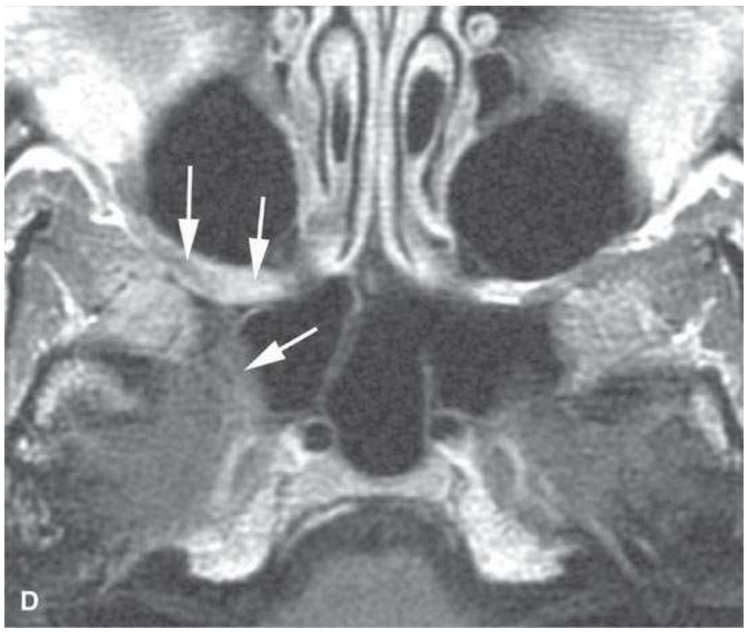
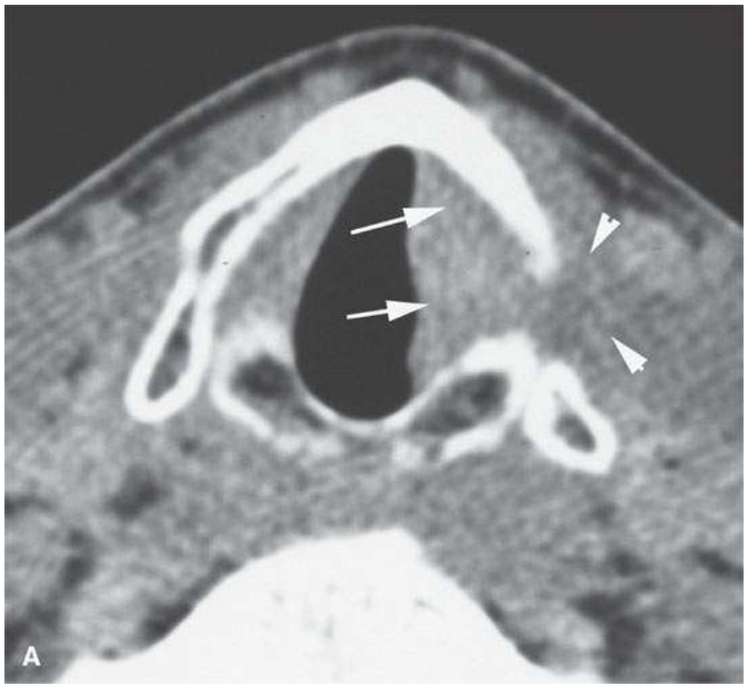
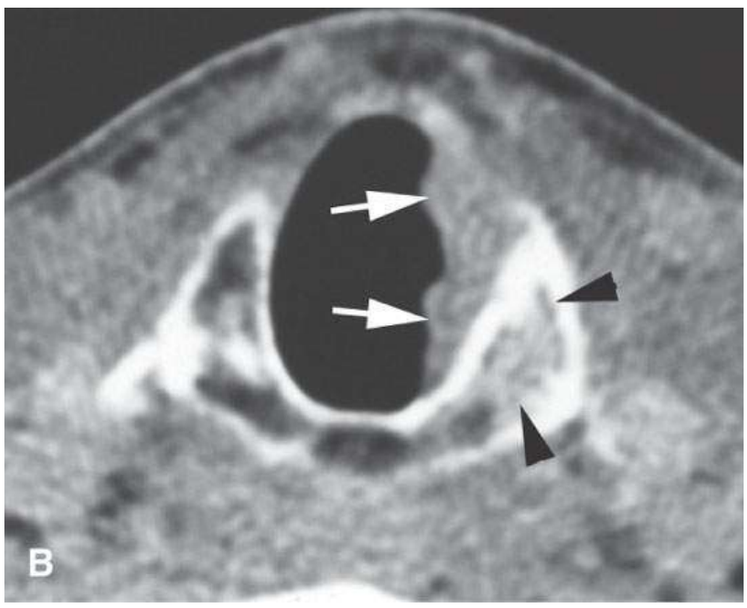


FIGURE 22.19. Patient with adenoidcystic carcinoma of the hard palate**. A:** Contrast-enhanced T1-weighted (T1W) image showing the highly infiltrating nature of the tumor. –**B**, **C:** T2-weighted image showing the infiltrating nature of the tumor and perineural spread to the pterygopalatine fossa and foramen rotundum (arrows)**. D:** Contrast-enhanced T1W image correlating with the perineural spread (arrows) image in **(C).**





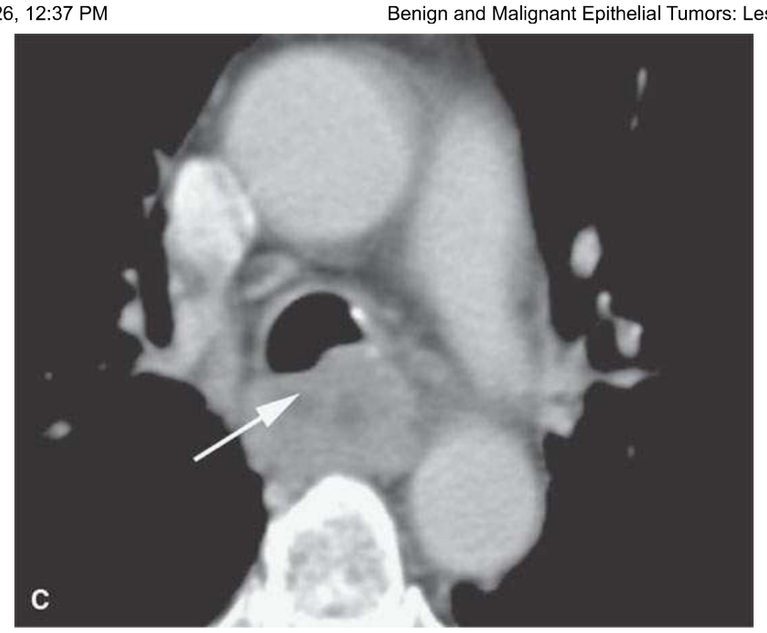


FIGURE 22.20. Contrast-enhanced computed tomography studies in two patients with adenoidcystic carcinoma of the larynx **(A, B)** and trachea **(C). A:** Tumor grows on the undersurface of the true vocal cord (arrows) and into the soft tissues of the neck (arrowheads). **B:** Subglottic spread with reactive changes of the adjacent cricoid cartilage. **C:** Tracheal-origin cancer involving the adjacent esophagus (arrow).

Detection of these lesions is often delayed more than in other cancers because of a submucosal growth pattern or at least gross morphology that is not obviously exophytic. This tendency depends, in large part, on the site of origin. There seem to be two basic varieties of adenoidcystic carcinoma: One has a tendency to disseminate and lead to death over a 2- to 4-year period (Fig. 22.19), and one has a protracted (Figs. 12.8 and 21.30) course of repeated local failure and late metastases. Death from the latter varieties often occurs 10 to 15 years after initial diagnosis, and patients may survive several years with extensive metastatic disease. The biologic aggressiveness is not necessarily predictable on the basis of histology. Ten-year survival rates are very poor for sinonasal lesions compared to parotid lesions, and such outcomes probably are linked to the site of origin and extent at presentation as well as histologic findings.

The primary tumor in these patients may appear well circumscribed or highly infiltrative or anywhere in between9 (Figs. 12.8, 21.30, and 22.18–22.20). These tumors show modest enhancement with intravenous contrast (Figs. 22.18–22.20). On MR, they tend to be slightly hyperintense to muscle on T1-weighted images and anywhere from slightly hyperintense to obviously hypointense to fat on T2-weighted images (Figs. 12.8, 21.30, and 22.19). However, there is a spectrum of histologic appearance, including cribriform, tubuloglandular, solid cellular, and hyaline. Microcystic spaces filled with mucoid and hyalinized materials are present in many lesions, and depending on the state of hydration of this material, they may range from very bright to iso- or hypointense to fat on T2-weighted images.

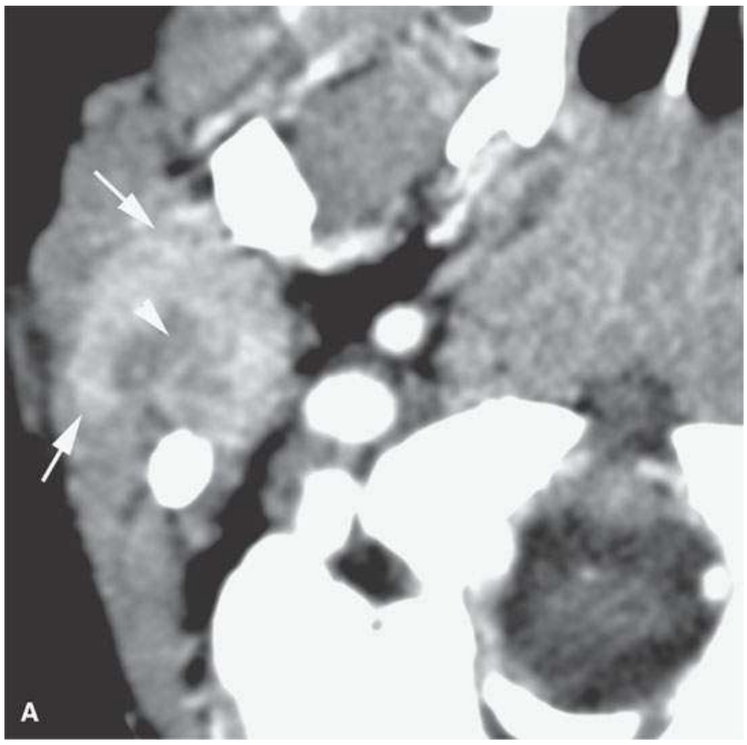
All adenoidcystic carcinomas should be presumed to have perineural spread (Fig. 22.19). It is incumbent on the diagnostic imager to design a protocol for each tumor that will cover the pathways of major nerves known to pass near or through the area of involvement. This may include something as obvious as a detailed study of the course of the facial nerve through the temporal bone in parotid lesions and, perhaps less obviously, a detailed study of the course of the greater and lesser palatine nerves in hard and soft palate lesions. Imaging studies can profoundly influence treatment plans in patients with adenoidcystic carcinoma. Patterns of perineural spread are discussed in detail at each anatomic site and are presented in summary form in Chapter 21.

Lymph node metastases are relatively uncommon in adenoidcystic carcinoma, usually occurring late and only in about 15% of cases.10,11 Hematogenous metastases are much more common, occurring eventually in the majority of patients. Distant metastases do not necessarily suggest a poor short-term prognosis since patients can live for long periods with metastases and often succumb first to problems arising from persistence or recurrence at the primary site.10–12

Surgery for small lesions can be curative. Surgery for larger lesions is usually performed with the knowledge that microscopic perineural spread has taken the tumor beyond its clinically obvious borders. Gross total resection is usually followed by radiotherapy. Radiotherapy alone is usually employed for palliation or to slow the growth rate of surgically inaccessible tumors or for patients who will not or cannot accept the morbidity of the planned curative surgical procedure. Radiotherapy may be undertaken with curative intent; however, chances for cure by radiation alone are often limited.

Mucoepidermoid Carcinoma

Mucoepidermoid carcinoma arises from the major and minor salivary glands and occasionally from congenital rests of salivary tissue. These tumors account for a small proportion of all benign and malignant salivary gland tumors, most likely arising from the epithelium of the large ducts of salivary glands. The parotid gland is the most common site of origin (Figs. 22.21 and 22.22). This tumor represents the most common parotid malignancy and a significant proportion of submandibular (Fig. 21.26), sublingual (Fig. 21.38), and minor salivary gland malignancies. The hard palate is the most common site of minor salivary gland lesions followed by the cheek and lip, tongue, and sinonasal regions. They also occur in the oral cavity, particularly near the retromolar trigone. They may arise in salivary rests in the parapharyngeal and buccal spaces and in the trachea (Fig. 22.23).



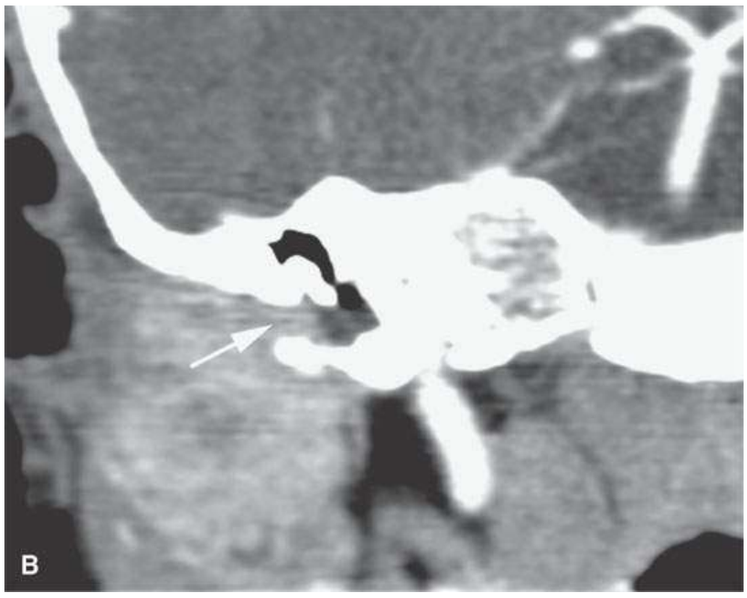
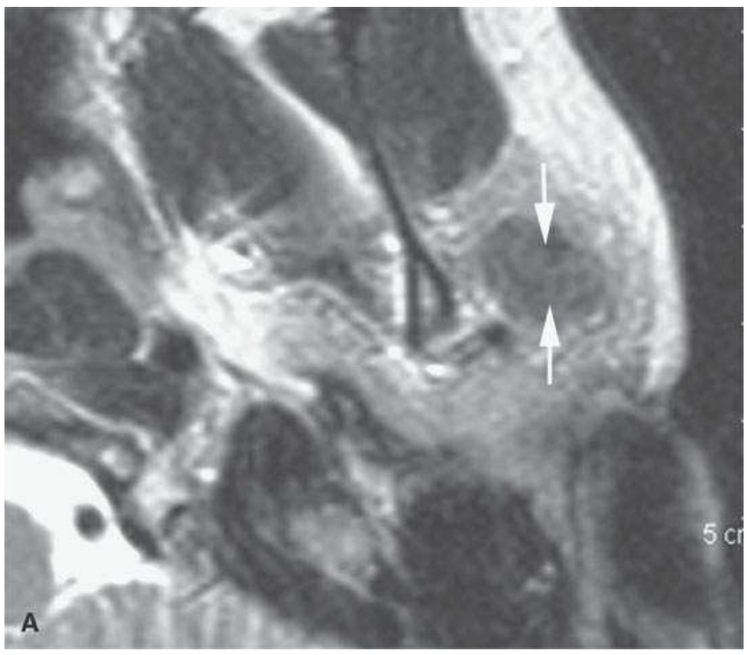


FIGURE 22.21. Contrast-enhanced computed tomography of a 4 year old with mucoepidermoid carcinoma of the parotid gland**. A:** The mass is well circumscribed, but its margins (arrows) suggest an invasive nature; the low-density center (arrowhead) is nonspecific**. B**: The aggressive nature of the mass is clear from its invasion of the external auditory canal (arrow)**.**



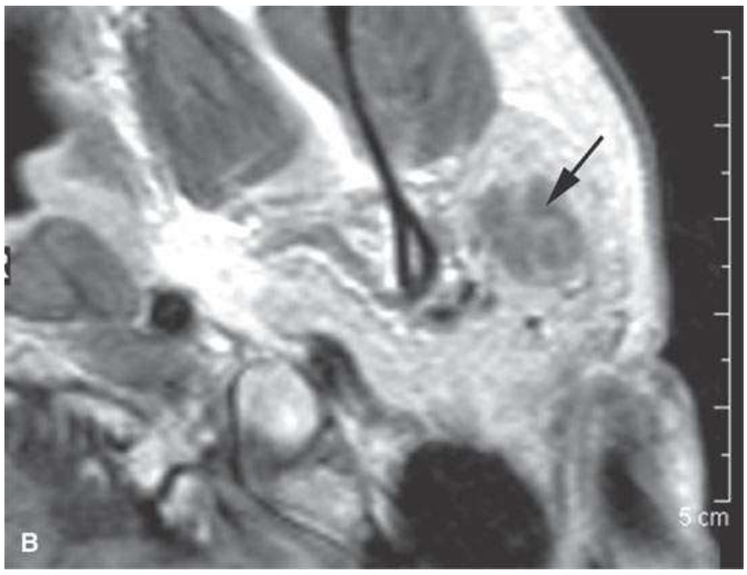
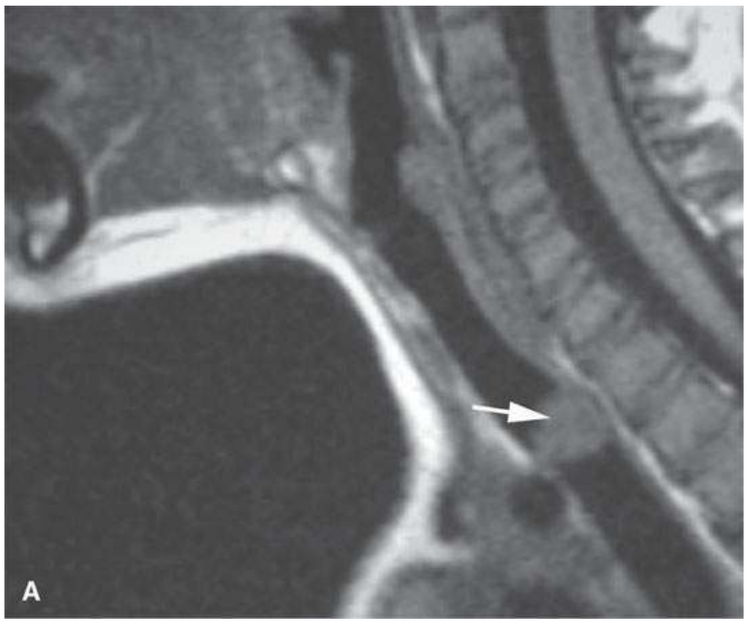


FIGURE 22.22. Magnetic resonance imaging of the parotid gland in a patient with mucoepidermoid carcinoma that (arrows) remains of low signal intensity on the T2-weighted image **(A)**, strongly suggesting a malignant epithelial tumor. The enhancement seen on **(B)** is nonspecific.



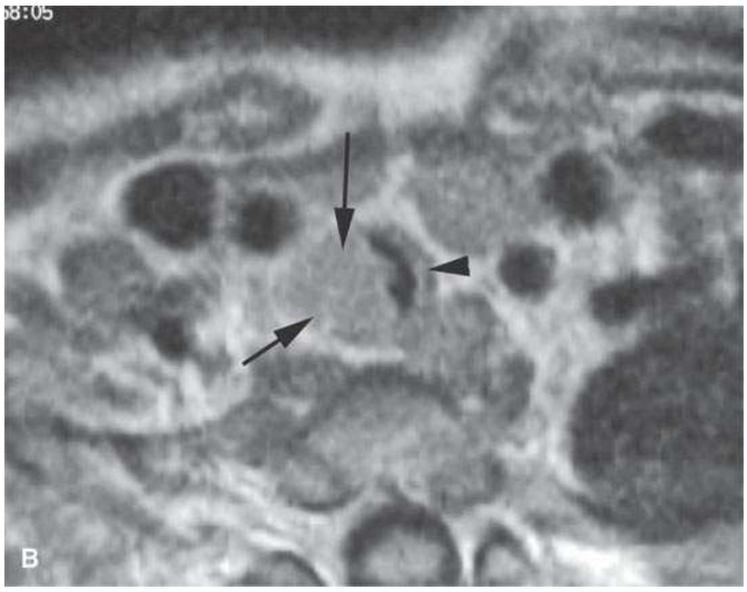


FIGURE 22.23. Magnetic resonance imaging in a pediatric patient with mucoepidermoid carcinoma of the trachea. **A**: Non–contrast-enhanced T1-weighted (T1W) image. **B**: Contrast-enhanced T1W image shows invasion of the trachea (arrows) compared to the remaining normal trachea.

Grossly, the tumor may be solid or show varying degrees of gross cystic change. The variable gross morphology reflects in part the cellular complexity and relative amount of each component cell type. It is perhaps the most diverse appearing of all the glandular origin malignancies. Several cell lines may be present. The gross morphology likely mirrors the heterogeneity of cells of origin also reflecting the biologic behavior of these cancers. For many years, investigators have attempted to differentiate benign and malignant varieties of mucoepidermoid tumors. All should be considered malignant, but some have a very benign natural history. This variation in aggressiveness has led to a widely accepted tendency to separate the lesions into low, intermediate, and high grades. The low-grade tumors have a natural history similar to benign mixed tumors with slow growth, a tendency for local recurrence if incompletely excised, and rare tendency to metastasize. The high-grade tumors, in contrast, grow quickly and show high rates of local and distant metastases. This diversity in aggressiveness may or may not be reflected in the gross morphology as seen on CT or MRI.

The lower-grade tumors tend to have cystic spaces that will be manifested by sometimes macrocystic internal zones of low attenuation on CECT and high signal intensity on T2-weighted MR (Fig. 21.26). High and intermediate grades tend to be progressively more solid and enhancing; thus, the tendency for high

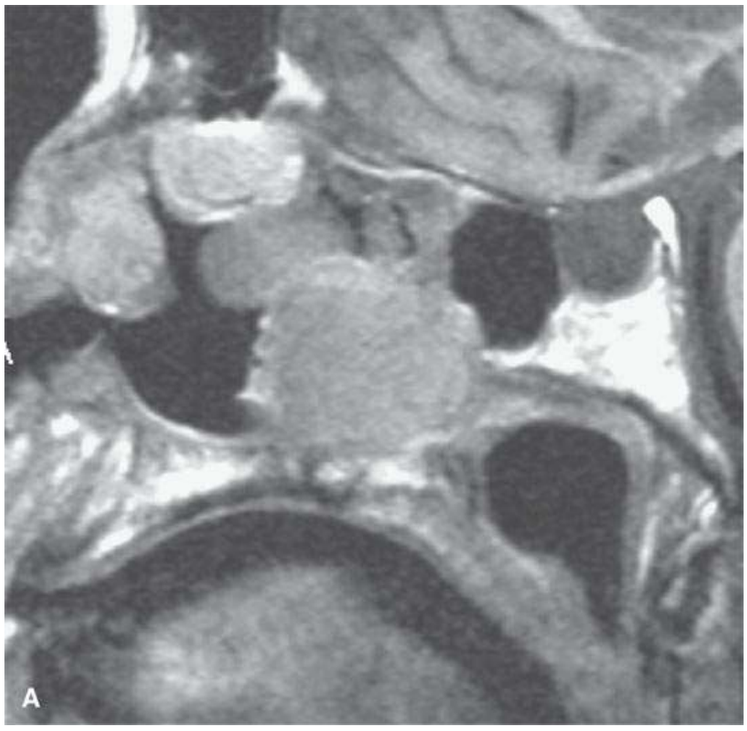
signal intensity on MR and obvious cystic change on CT diminishes. However, diffuse enhancement may be present in any grade lesion (Fig. 21.38). The margins may be anywhere from smooth to highly infiltrative. Unfortunately, high-grade lesions may have relatively smooth margins, and the histologically lower-grade lesions may occasionally show a more aggressive margin (Figs. 21.38 and 22.21). The cervical nodes must be studied in any major or minor salivary gland cancer, even though nodal metastases are relatively uncommon. This is especially true in mucoepidermoid carcinoma because its gross morphology and even histology may not reflect its malignant potential.

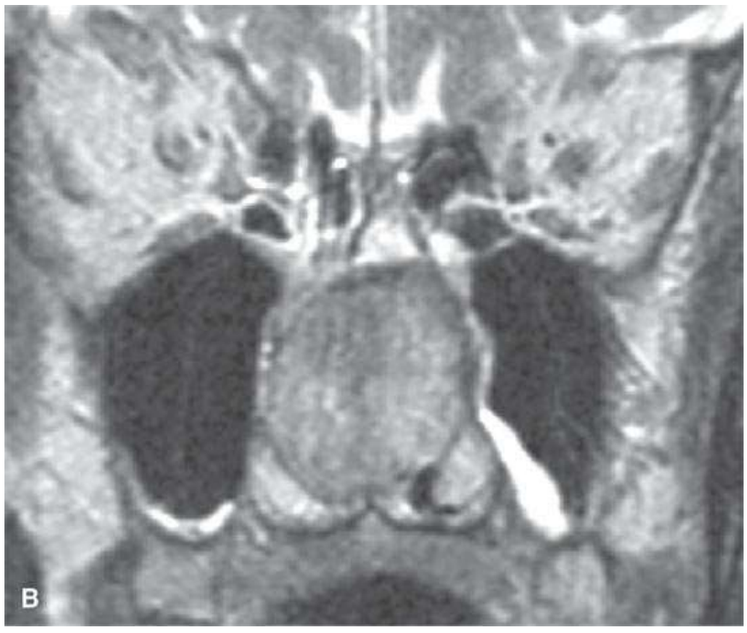
The treatment for mucoepidermoid carcinoma is wide local excision. Neck dissection may be added, depending on the histologic features and clinical-radiologic examination of the neck.[10–13] Radiation is occasionally used as an adjunctive therapy. Cure rates are 90% to 100% for low-grade tumors and =40% for high-grade lesions, depending on the site of origin.

Acinic Cell Carcinoma

Acinic cell carcinoma is the least common of the strictly salivary tissue origin cancers. It accounts for a small proportion of parotid, submandibular, and minor salivary gland tumors.[10] There is a very small chance of bilateral parotid acinic cell cancer, placing them just behind Warthin tumors in this tendency.

Grossly, the tumors are usually smooth and may have a thin capsule. Microcystic elements may produce a bright appearance on T2-weighted images (Fig. 21.21B–D). However, lymphoid and collagenous elements may be present as well as calcification; thus, a variable MR appearance is likely (Fig. 22.24). On CECT, these lesions usually appear solid (Fig. 22.24). Reported imaging experience with these lesions is very limited, and they are basically indistinguishable from other salivary origin neoplasms on the basis of gross morphology.[10–14] In fact, the gross appearance belies their malignant nature.





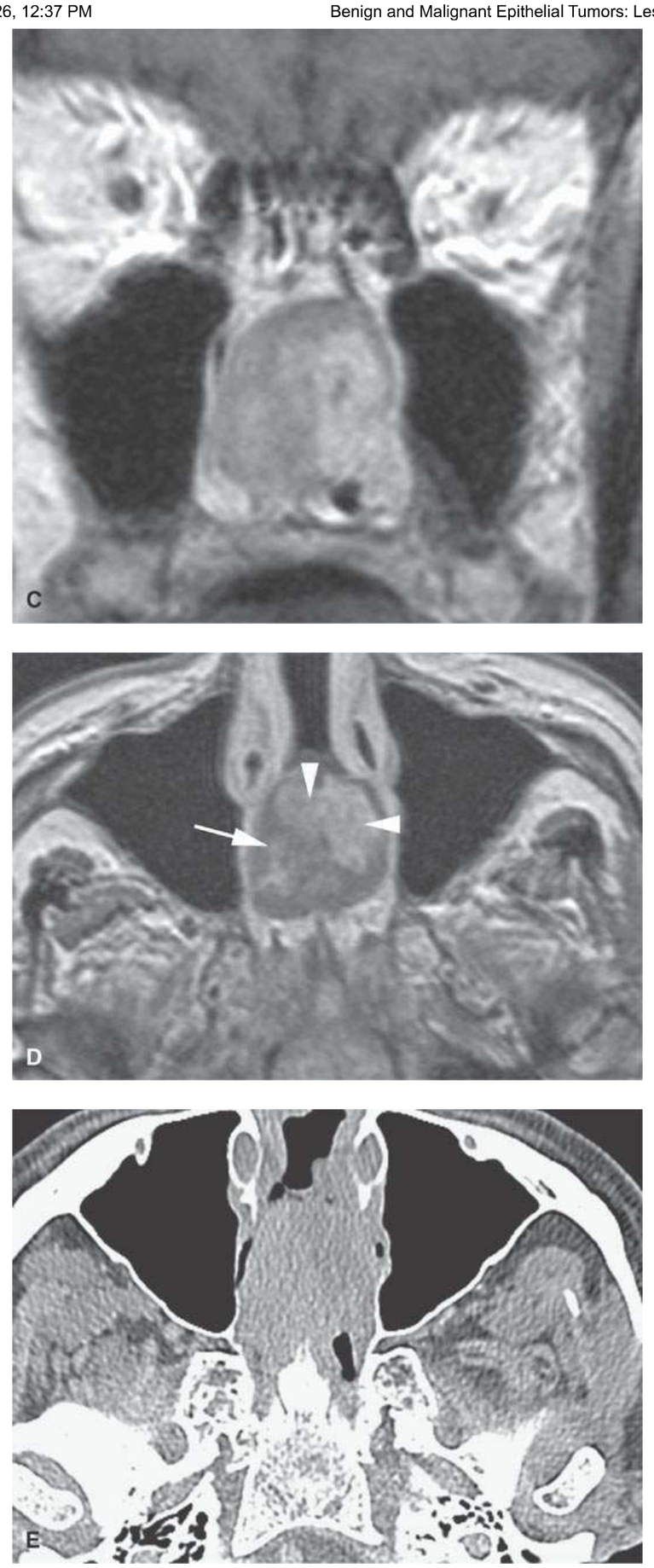


FIGURE 22.24. Magnetic resonance imaging and computed tomography of a patient with acinic cell carcinoma of the nasal cavity. **A:** Non–contrast-enhanced T1-weighted (T1W) image. **B:** T2-weighted (T2W) image. **C**, **D:** Contrast-enhanced T1W coronal and axial images showing zones that enhance (arrowheads in D) and those that do not (arrow in **D**); the enhancing zones tend to correlate with brighter zones on the T2W images, but this is nonspecific. **E:** Contrast-enhanced computed tomography.

Acinic cell tumors should be treated as low-grade malignancies. Wide local excision is the primary therapy. The facial nerve is preserved unless involved in parotid lesions. Lymph node metastases are seen in ≤10% to 15% of cases, and the neck is usually treated even if clinically or CT negative. Overall survival declines over periods of protracted follow-up. Prognosis is linked to the extent and adequacy of excision at first presentation.

Undifferentiated (Anaplastic) Carcinoma

Undifferentiated (anaplastic) carcinomas occur at virtually any site in the head and neck. Aggressive infiltration of surrounding soft tissues and bone usually is present at the primary site (Fig. 22.25). Regional, nodal, and distant metastatic disease is common. On imaging studies, there usually is evidence of widespread infiltration of deep tissue planes and invasion of muscles, vessels, and organs.15 There may be slight to mild enhancement of the tumor mass on CT (Fig. 22.26). On MR, they behave like other hypercellular tumors described earlier in this chapter and in Chapter 21.

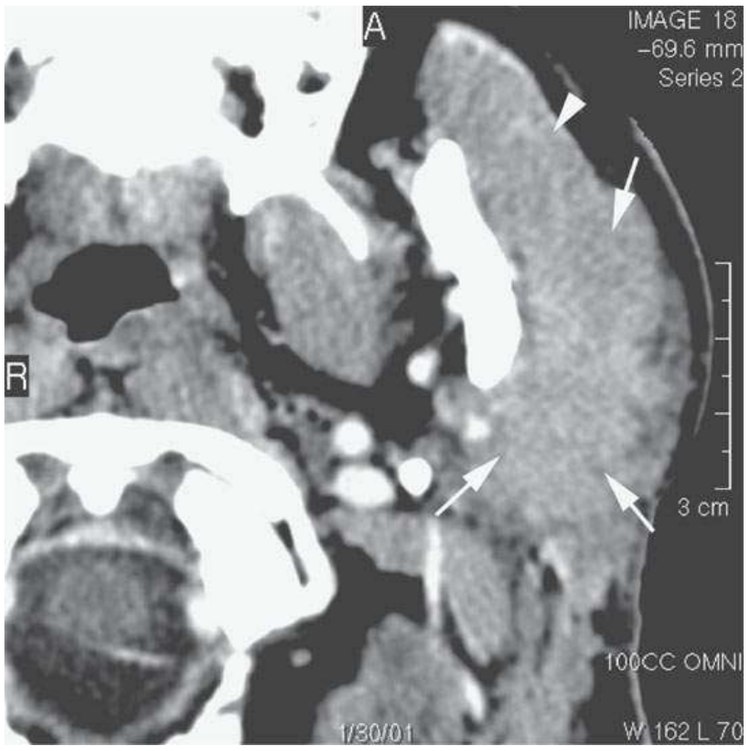
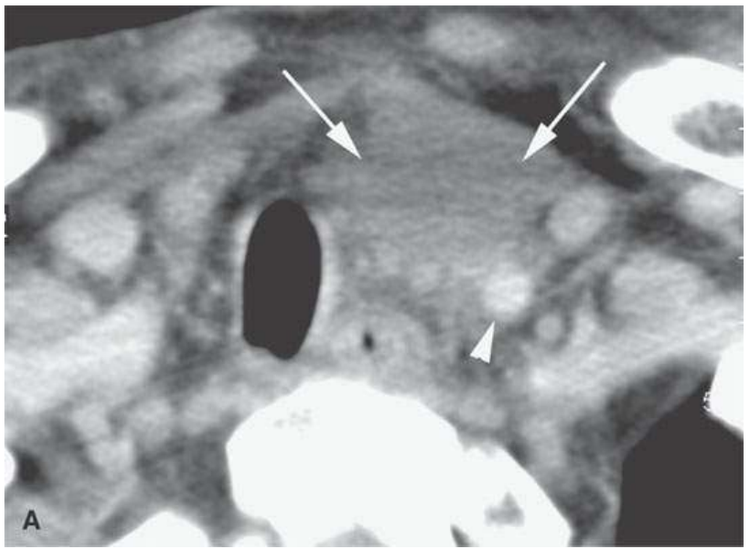
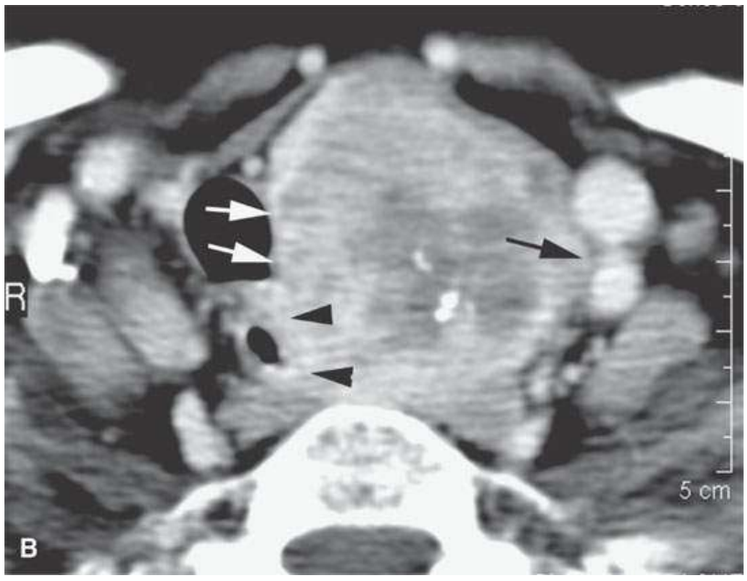


FIGURE 22.25. Contrast-enhanced computed tomography of a patient with poorly differentiated carcinoma of the parotid gland**.** The mass (arrows) is highly infiltrative, spreading to the masseter muscle (arrowhead)**.**





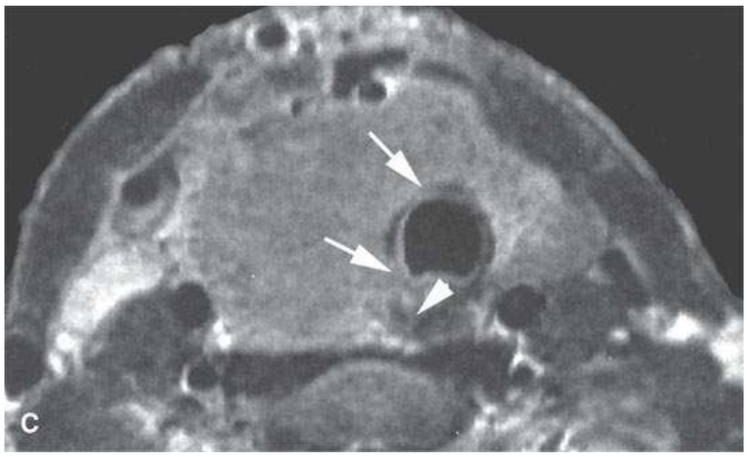


FIGURE 22.26. Three patients with anaplastic thyroid carcinoma. **A**: Contrast-enhanced computed tomography (CECT) of an early cancer (arrows) already encasing the carotid artery (arrowhead). **B**: CECT showing tracheal (white arrows) and esophageal invasion (black arrowheads) and displacement but not invasion of the carotid sheath structures (black arrow). **C**: T2-weighted image showing tracheal invasion (arrows) and esophageal invasion (arrowhead).

Suggested Readings

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Scianna JM, Petruzzelli GJ. Contemporary management of tumors of the salivary glands. Curr Oncol Rep. 2007;9(2):134–138.

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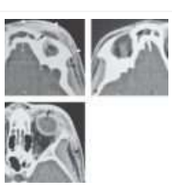
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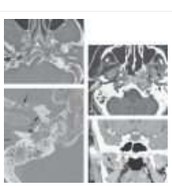
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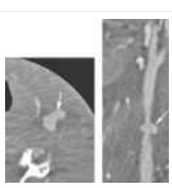
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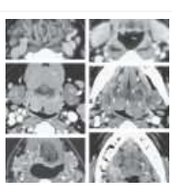
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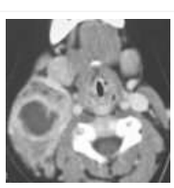
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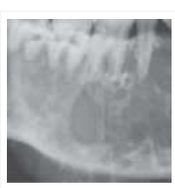
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