RadioGraphics

# Nontraumatic Orbital Conditions: Diagnosis with CT and MR Imaging in the Emergent Setting[1]

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Imaging provides crucial information regarding emergent orbital abnormalities, and the radiologist fulfills an important role in guiding patient care and contributing to favorable outcomes. Knowledge of the imaging features of nontraumatic orbital conditions commonly seen in the emergent setting—infections, inflammation, vascular abnormalities, and retinal and choroidal detachments—is necessary to achieve a prompt and accurate diagnosis, thereby avoiding permanent vision loss and other potentially devastating consequences. The ability to distinguish these entities from physiologic calcifications, posttherapeutic changes, and orbital devices allows optimal management without unnecessary further diagnostic work-up. For orbital imaging in the acute setting, computed tomography is the first-line modality, with magnetic resonance imaging playing an important secondary role.



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**LEARNING OBJECTIVES**

*After reading this article and taking the test, the reader will be able to:*

- Identify the imaging features of common nontraumatic emergent orbital conditions that may cause permanent vision loss or other serious consequences.
- Describe the clinical findings and complications associated with emergent orbital conditions.
- Recognize important additional findings and potential pitfalls at diagnostic imaging of nontraumatic orbital emergencies.

**TEACHING POINTS**

*See last page*

**Abbreviations:** AIDS = acquired immunodeficiency syndrome, CMV = cytomegalovirus, STIR = short inversion time inversion recovery

**RadioGraphics 2008;** 28:1741–1753 • **Published online** 10.1148/rg.286085515 • **Content Codes:** CT ER HN MR

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## Introduction

Familiarity with common infectious, inflammatory, and vascular orbital abnormalities is crucial to radiologists. A retinal or choroidal detachment seen on images obtained for other reasons may be indicative of a more serious underlying condition, such as an intraocular tumor. The article describes nontraumatic orbital abnormalities that are commonly encountered in the emergent setting and that must be identified promptly to optimize patient care and avoid permanent vision loss and other potentially devastating complications. Potential pitfalls in orbital image interpretation—features such as physiologic calcifications, posttherapeutic changes, and orbital devices—are discussed. An accurate assessment of these imaging features at the initial evaluation is particularly important to avoid unnecessary further work-up.

Computed tomography (CT) is the first-line imaging modality for orbital evaluation in the acute setting, with magnetic resonance (MR) imaging playing an important secondary role in the diagnostic work-up. CT offers rapid image acquisition and higher spatial resolution than MR imaging and is suitable for the evaluation of fractures, calcifications, and radiopaque foreign bodies. MR imaging offers exquisite contrast resolution of the orbital structures without exposing the patient to ionizing radiation, and it is superior to CT in the evaluation of orbital soft tissues. However, the presence of an orbital metallic foreign body is a contraindication to MR imaging because of the risk of foreign body migration, heating, and resultant damage to ocular structures (1).

## Infection

Orbital infections represent more than half of primary orbital disease processes (2). The location of an orbital infection is described with respect to the orbital septum, as either preseptal (periorbital) or postseptal (orbital). The orbital septum is a thin sheet of fibrous tissue that originates in the orbital periosteum and inserts in the palpebral tissues along the tarsal plates. The orbital septum provides a barrier against the spread of periorbital infections into the orbit proper (2). The distinction between periorbital and orbital processes is clinically important because postseptal infections are treated more aggressively to prevent devastating complications such as cavernous sinus thrombosis and meningitis.

Teaching Point

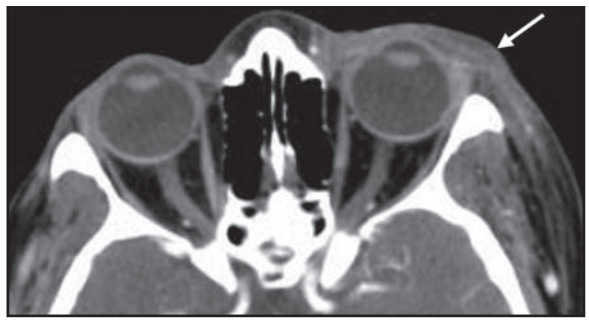


**Figure 1.** Periorbital cellulitis. Axial contrast-enhanced CT image, obtained in a 22-year-old man with swelling around the left eye, demonstrates left periorbital soft-tissue edema (arrow) without orbital abnormality.

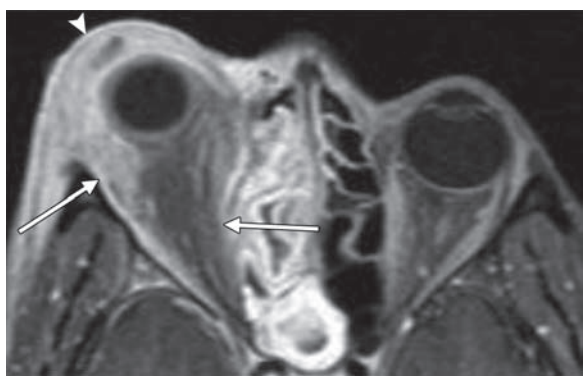
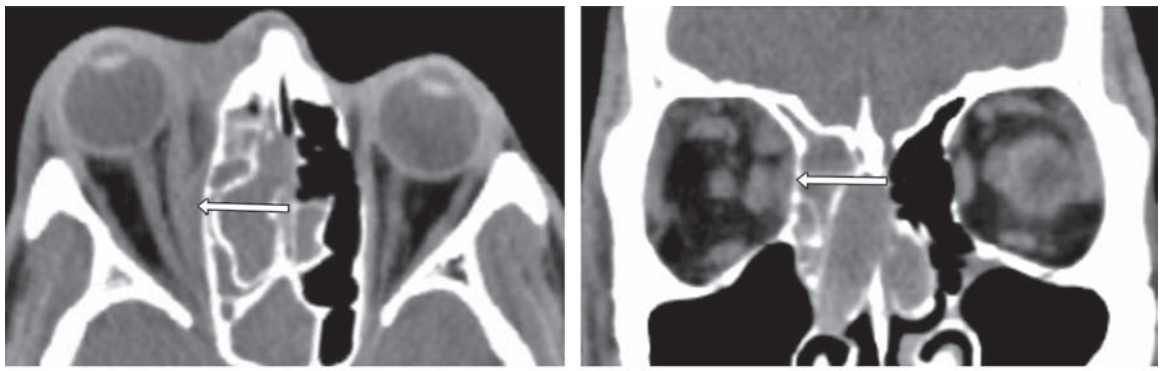


**Figure 2.** Orbital cellulitis secondary to ethmoid sinusitis. Axial contrast-enhanced fat-suppressed T1-weighted MR image obtained in a 40-year-old man demonstrates right exophthalmos and heterogeneous enhancement of orbital (arrows) and periorbital (arrowhead) fat.

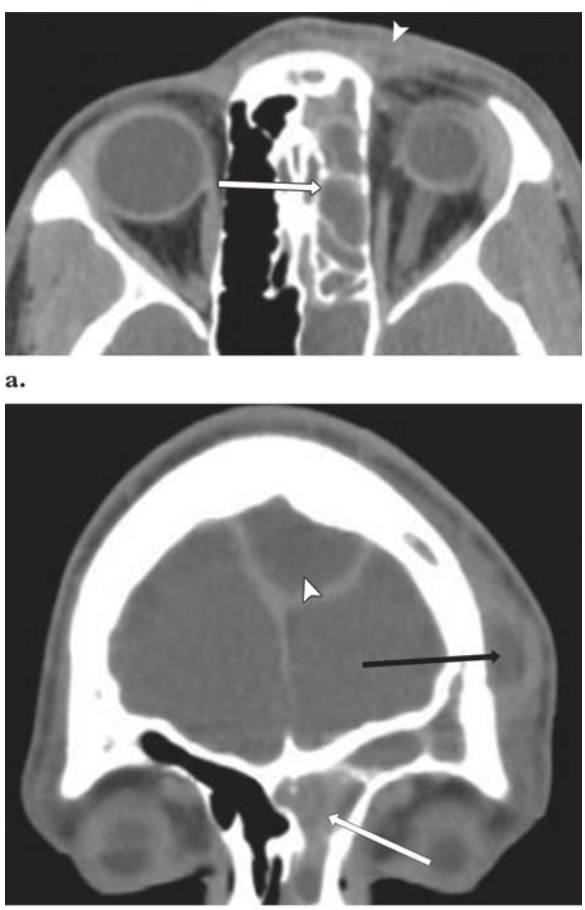
Periorbital cellulitis, which is defined as a preseptal process limited to the soft tissues anterior to the orbital septum, most commonly arises from the contiguous spread of infection from adjacent structures such as the face, teeth, and ocular adnexa. It also may arise from local trauma (3,4). Symptoms include swelling and erythema of the eyelids, chemosis, and, in severe cases, limitation of eye movement without proptosis. Cross-sectional imaging demonstrates diffuse soft-tissue thickening anterior to the orbital septum without abscess formation (Fig 1) (4). Periorbital cellulitis in adults typically is treated with antibiotics on an outpatient basis.

Orbital cellulitis is a postseptal infectious process most commonly caused by paranasal sinusitis (Fig 2), which spreads to the orbit via a



a. b.

**Figure 3.** Subperiosteal abscess due to ethmoid sinusitis. Axial **(a)** and coronal **(b)** nonenhanced CT images obtained in a 24-year-old man depict a subperiosteal abscess (arrow) along the medial wall of the right orbit, adjacent to the opacified ethmoid air cells, with resultant lateral displacement of the medial rectus muscle.



a.

b.

**Figure 4.** Frontal and ethmoid sinusitis complicated by Pott puffy tumor and epidural abscess. **(a)** Axial contrast-enhanced CT image obtained in a 13-year-old boy demonstrates opacified left ethmoid air cells (arrow) and periorbital cellulitis (arrowhead). **(b)** Coronal reconstruction from contrast-enhanced CT shows opacified frontal and ethmoid sinuses (white arrow); an extracranial abscess with an enhancing rim (black arrow), a finding indicative of a Pott puffy tumor; and a large intracranial collection with rimlike enhancement (arrowhead), a finding that represents an epidural abscess.

perivascular pathway (2). Thus, bone destruction is not usually seen. The symptoms at presentation are similar to those of periorbital cellulitis; however, patients with orbital cellulitis also may present with proptosis. Visual acuity is usually maintained (2). Treatment of orbital cellulitis typically requires the intravenous administration of antibiotics. Development of an orbital subperiosteal abscess is most commonly associated with ethmoid sinusitis (Fig 3). Drainage of the abscess may be necessary to avoid a rapid elevation of intraorbital pressure and resultant visual impairment (4). Since the advent of antibiotics, intraconal abscesses secondary to paranasal sinusitis have become rare. They are now most frequently seen as a complication of a penetrating orbital injury, ocular surgery, or a metastatic process (4). Symptoms include marked proptosis, chemosis, ophthalmoplegia, and impaired visual acuity. Intraconal abscesses usually require surgical drainage (5). Additional complications of orbital cellulitis include thrombosis of the superior ophthalmic vein, the cavernous sinuses, or both; bacterial meningitis; epidural and subdural abscess; and parenchymal brain abscess (4).

Teaching Point

Frontal sinusitis may cause periorbital cellulitis or frontal bone osteomyelitis with a secondary extracranial abscess known as a Pott puffy tumor (Fig 4a). Associated intracranial complications may include epidural (Fig 4b), subdural, or cerebral abscess; thrombophlebitis; and venous infarct (4). Treatment in such cases includes the surgical evacuation of the intracranial abscess, as well as intravenous antibiotic therapy (6).

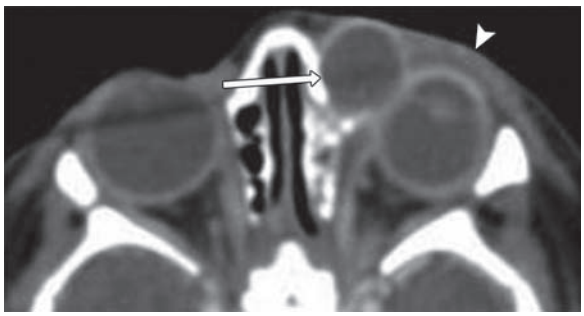


**Figure 5.** Dacryocystitis. Axial contrast-enhanced CT image, obtained in a 5-month-old boy with swelling and induration of the left eye, shows peripheral enhancement of the left lacrimal sac (arrow), which is dilated because of obstruction of the nasolacrimal duct. Associated preseptal inflammation (arrowhead) also is visible.

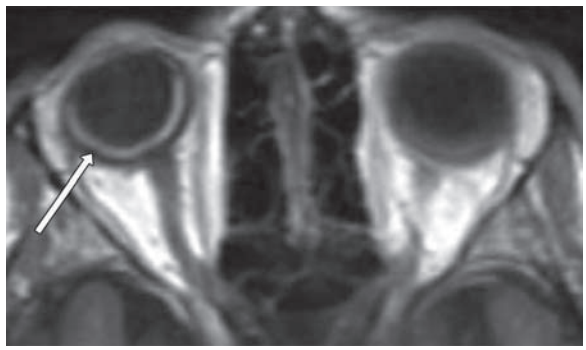


**Figure 6.** CMV-induced retinitis. Axial contrast-enhanced T1-weighted MR image obtained in a 56-year-old man with AIDS shows asymmetric enhancement of the right uvea (arrow) in comparison with the left.

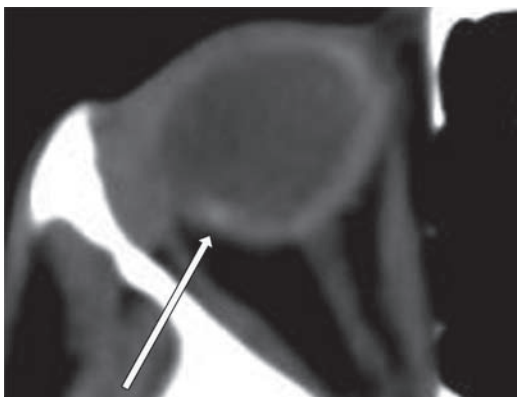


**Figure 7.** CMV-induced retinitis. Axial nonenhanced CT image obtained in a 66-year-old man with AIDS demonstrates a small peripheral calcification in the retina (arrow).

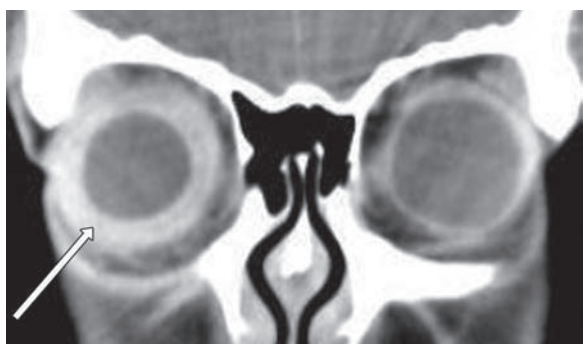
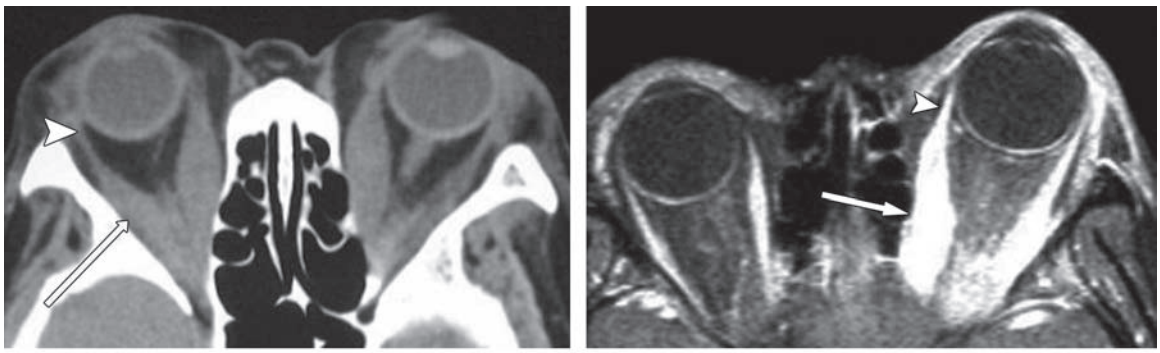


**Figure 8.** Panophthalmitis secondary to a postoperative infection. Coronal contrast-enhanced CT image, obtained in a 41-year-old man with right eye pain, swelling, and decreased visual acuity after scleral buckle placement, demonstrates diffuse thickening of the right sclera (arrow).

Dacryocystitis is inflammation and dilatation of the lacrimal sac, which is located along the inner canthus (7). Although the diagnosis of dacryocystitis is based on clinical manifestations, imaging may be requested to exclude orbital cellulitis. The typical imaging finding is a well-circumscribed round lesion that is centered at the lacrimal fossa and that demonstrates peripheral enhancement (Fig 5) (7). Treatment options include medical and surgical methods, with the method selected depending on the clinical signs and symptoms (7).

Cytomegalovirus (CMV)-induced retinitis occurs in approximately one-third of patients with acquired immunodeficiency syndrome (AIDS) who are not receiving highly active antiretroviral therapy (HAART) and accounts for more than 90% of cases of blindness related to human immunodeficiency virus infection (8). CMV-induced retinitis is usually diagnosed ophthalmologically; however, it may be an important incidental finding at imaging in the population with AIDS. Radiologically, it manifests as uveal enhancement, retinal detachment, and calcifications in the retina (Figs 6, 7) (9). CMV-induced retinitis most commonly begins in one eye and progresses to involve the contralateral eye. Before the availability of HAART in Western countries, patients with CMV-induced retinitis developed retinal detachment at a rate of 33% per eye per year (10). Without treatment, CMV-induced retinitis causes permanent blindness in most patients within 3–6 months (11).

Panophthalmitis and endophthalmitis are caused by an acute suppurative infection of the globe, which may occur after trauma or an ophthalmologic procedure (Fig 8). Panophthalmitis may lead to globe rupture and blindness and,



9. 10.

**Figures 9, 10.** Graves ophthalmopathy. **(9)** Axial nonenhanced CT image obtained in a 41-year-old woman with bilateral proptosis shows bilateral exophthalmos with extraocular muscle enlargement (arrow) that spares the tendinous insertion (arrowhead). **(10)** Axial contrast-enhanced fat-saturated T1-weighted MR image obtained in a 28-year-old woman with unilateral left exophthalmos demonstrates extraocular muscle swelling (arrow) with sparing of the tendinous insertion (arrowhead).

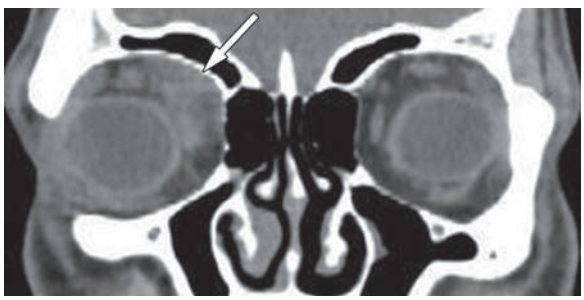


**Figure 11.** Idiopathic orbital inflammatory syndrome. Coronal reformatted image from nonenhanced CT in a 50-year-old woman with acute unilateral eye pain depicts enlargement of the right medial rectus and superior oblique muscles with adjacent fat stranding (arrow).

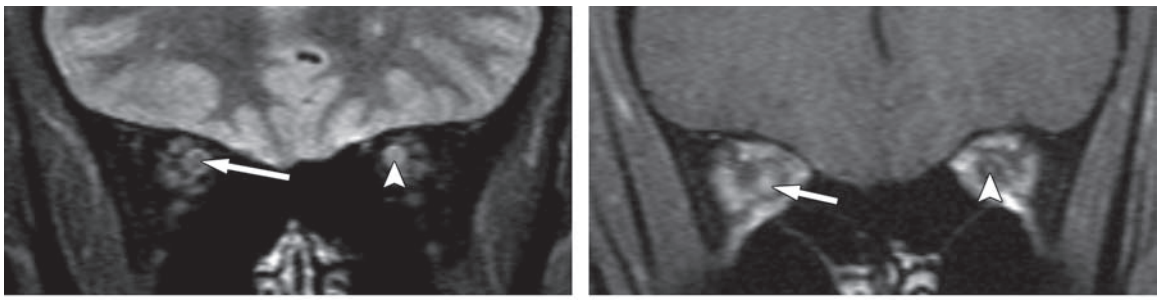
thus, requires aggressive treatment with intraocular, intravenous, and topical antibiotics. If antibiotic therapy fails, enucleation may be the only remaining option (12).

## Inflammation

Graves ophthalmopathy is the most common cause of exophthalmos in adults. Graves ophthalmopathy usually occurs 5 years after the onset of Graves thyroid disease and is postulated to be an autoimmune condition unrelated to thyroid function (2,13). Orbital findings include lid retraction, proptosis, ophthalmoplegia, conjunctivitis, and chemosis (2,13). In Graves ophthalmopathy, classically spindle-shaped enlargement of the extraocular muscles is observed, with sparing of the tendinous insertion (Figs 9, 10). The inferior, medial, superior, and lateral rectus muscles (listed in order of decreasing frequency of involvement) may be involved (2). These findings are usually bilateral and symmetric; however, they also may be unilateral (Fig 10) (2). Additional imaging findings include increased orbital fat, lacrimal gland enlargement, eyelid edema, stretching of the optic nerve, and tenting of the posterior globe. The presence of chronic extraocular muscle atrophy, fibrosis, and intramuscular fat deposition may be helpful in diagnosing Graves ophthalmopathy (2). Treatment is primarily conservative, with surgery and radiation therapy reserved for alleviating tension on the optic nerve (2,14).

Teaching Point

Idiopathic orbital inflammatory syndrome, also known as orbital pseudotumor, is the second most common cause of exophthalmos (2). A nongranulomatous orbital inflammatory process with no known local or systemic cause (3), this syndrome is diagnosed by excluding other possible causes of exophthalmos. Diagnosis is based on the medical history, clinical course, results of laboratory testing, and response to steroids (2). The symptoms include unilateral painful proptosis and eyelid swelling, typically with a sudden onset, and, occasionally, associated diplopia and decreased vision (3). The radiographic features of idiopathic orbital inflammatory syndrome vary widely and include orbital fat stranding, myositis (Fig 11), a focal intraorbital mass, lacrimal gland inflammation and enlargement, diffuse orbital involvement, and involvement of the optic nerve sheath complex, uvea, and sclera. In idiopathic orbital inflammatory syndrome, unlike Graves ophthalmopathy, there is tendinous involvement of the extraocular muscles (3). Steroid therapy classically results in rapid improvement (2).



a. b.

**Figure 12.** Optic neuritis. **(a)** Coronal short inversion time inversion recovery (STIR) MR image obtained in a 35-year-old woman with an acute decrease in visual acuity of the right eye demonstrates increased signal intensity in the right optic nerve (arrow), as well as increased signal intensity and atrophy of the left optic nerve (arrowhead). **(b)** Coronal contrast-enhanced fat suppressed T1-weighted MR image shows enhancement of the right optic nerve (arrow) but no significant enhancement of the left optic nerve (arrowhead). These findings are consistent with acute right and chronic left optic neuritis.

Optic neuritis, which involves inflammation or demyelination of the optic nerve, often manifests with unilateral eye pain and visual loss (15). At T2-weighted MR imaging, acute optic neuritis typically is manifested as hyperintense signal in an enlarged, enhancing optic nerve, whereas chronic optic neuritis is classically characterized by T2 signal hyperintensity in an atrophic, nonenhancing optic nerve (Fig 12) (2). Optic neuritis is often associated with multiple sclerosis, but some occurrences have been described as idiopathic or as associated with other processes (including systemic lupus erythematosus, viral infection, and radiation therapy) (2,15). In addition, optic neuritis may be a secondary result of infection or inflammation of adjacent structures such as the sinuses (2). Perineuritis, which is defined as inflammation of the optic nerve sheath, may mimic optic neuritis clinically with orbital pain, decreased visual acuity, and optic disc edema (2). At imaging, perineuritis is characterized by thickening and enhancement of the optic nerve sheath (Fig 13) (2). Because similar imaging findings may be seen in patients with dissemination of tumor cells in the cerebrospinal fluid along the optic nerve sheath, a careful clinical evaluation is essential for accurate diagnosis.

## Vascular Abnormalities

A carotid cavernous fistula is an abnormal connection between the carotid arterial system and the cavernous venous sinuses. This aberrant connection may result from trauma, surgery, or dural sinus thrombosis; however, a cause is not always identifiable, and some cases are idiopathic.

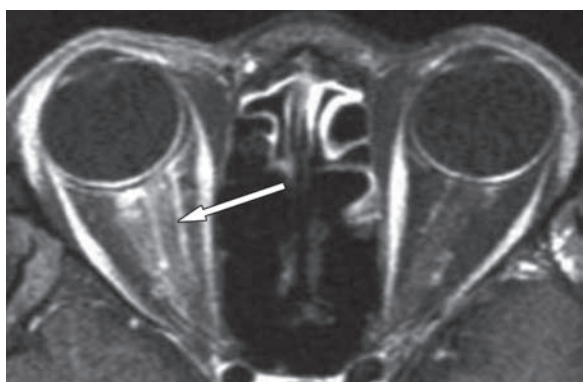
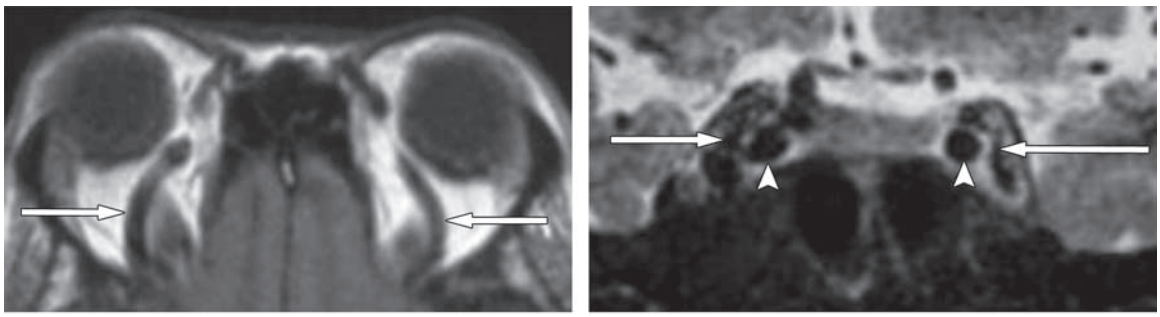


**Figure 13.** Perineuritis of the right optic nerve. Axial contrast-enhanced fat-suppressed T1-weighted MR image obtained in a 58-year-old man with right eye pain demonstrates a thickened, enhancing optic nerve sheath (arrow) with sparing of the optic nerve proper, findings characteristic of perineuritis.

Spontaneous development of a carotid cavernous fistula has been reported in the setting of atherosclerotic disease, Ehlers-Danlos syndrome, and osteogenesis imperfecta (2). The cavernous sinus transmits arterial pressure to the ophthalmic veins, producing pulsatile exophthalmos with an auscultable bruit, conjunctival chemosis, venous engorgement, optic nerve stretching, cranial nerve deficits, and visual disturbances (16). Imaging findings include proptosis, engorgement of the superior ophthalmic vein (Fig 14a), cavernous sinus distention, and abnormal flow voids within the cavernous sinuses on MR images (Fig 14b) (17,18). These flow voids at MR imaging correlate with the classic angiographic finding of filling of the cavernous sinus as the contrast material reaches the cavernous segment of the internal carotid artery. Conventional angiography



a. b.

**Figure 14.** Carotid cavernous fistula of unknown cause. **(a)** Axial nonenhanced T1-weighted MR image obtained in a 69-year-old woman depicts enlargement of the right superior ophthalmic vein in comparison with the left superior ophthalmic vein (arrows). **(b)** Coronal STIR MR image demonstrates enlarged cavernous sinuses filled with abnormal turbulent flow voids (arrows), findings consistent with arterialized flow. Arrowheads denote the normal internal carotid artery flow voids within the cavernous sinuses.

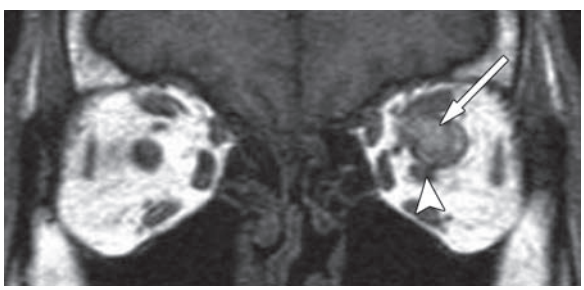


**Figure 15.** Superior ophthalmic vein thrombosis. Coronal nonenhanced T1-weighted MR image obtained in a 60-year-old man with left proptosis demonstrates hyperintense signal in the enlarged left superior ophthalmic vein (arrow), a finding suggestive of thrombosis. The arrowhead indicates the inferiorly displaced left optic nerve.

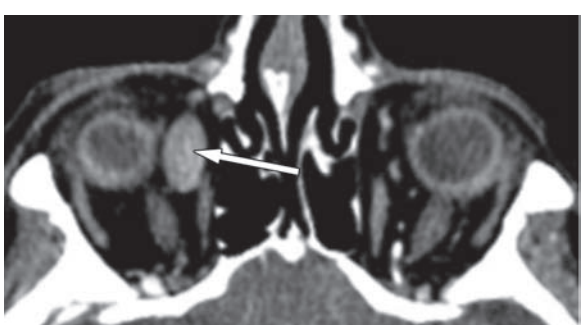
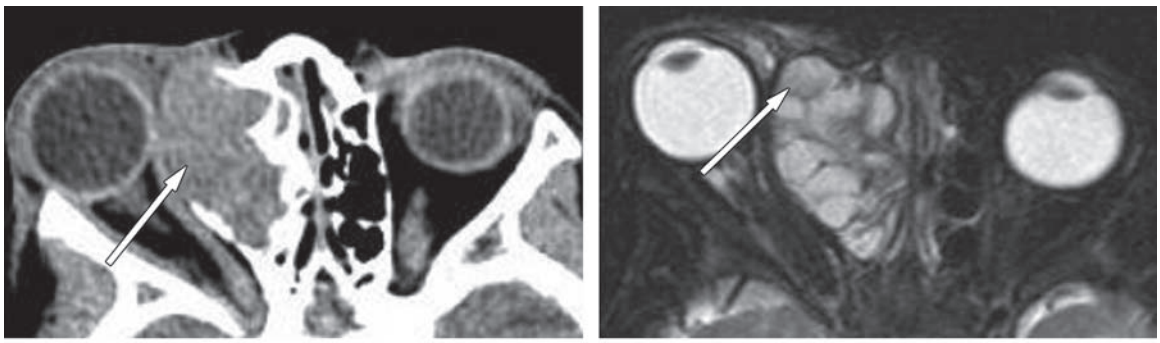


**Figure 16.** Orbital varix observed incidentally. Axial contrast-enhanced CT image obtained in an 84-year-old woman demonstrates an enhancing extraconal right orbital varix (arrow).

is necessary to identify the exact location of the carotid cavernous fistula so as to plan definitive treatment (2,17). Complications include vision loss and, in rare cases, ischemic ocular necrosis (2,16).

Superior ophthalmic vein thrombosis is most commonly associated with an infectious process such as paranasal sinusitis. Symptoms include orbital pain, proptosis, visual disturbances, periorbital edema, chemosis, cranial nerve palsy, and headache. Contrast-enhanced CT and MR images demonstrate filling defects within the superior ophthalmic vein, often with associated enlargement of both the superior ophthalmic vein (Fig 15) and the cavernous sinus, engorgement of the extraocular muscles, exophthalmos, and periorbital edema (2). Because venous thrombosis often is secondary to infection, the standard treatment includes both antibiotics and anticoagulation drugs. Potentially devastating complications of superior ophthalmic vein thrombosis include vision loss (19), thrombosis of the cavernous sinuses, and, if the cause of thrombosis is infection, sepsis (2).

Orbital varices, the most common cause of spontaneous orbital hemorrhage, are slow-flow congenital venous malformations characterized by the proliferation of venous elements and by massive dilatation of one or more orbital veins (Fig 16) (2). Most orbital varices have a large communication with the venous system, resulting in orbital varix distention and increased proptosis during the Valsalva maneuver or postural change (2,18). Orbital varices that have small communications with the venous system are prone to thrombosis and hemorrhage (2). Imaging findings of orbital varices may be subtle, and imaging during the Valsalva maneuver may be necessary to elicit the characteristic appearance. The lesions usually enhance intensely after a contrast material is administered (18).



a. b.

**Figure 17.** Venous lymphatic malformation. **(a)** Axial nonenhanced CT image obtained in a 2-year-old girl with worsening right proptosis depicts a mass with soft-tissue attenuation (arrow) arising from the right ethmoid air cell and causing remodeling of the surrounding bone as well as proptosis. **(b)** Axial T2-weighted MR image shows that the lesion is multiloculated, with internal areas of T2 shading suggestive of blood products (arrow).

Venous lymphatic malformations are low-flow vascular abnormalities that usually manifest in childhood (20). They appear as unencapsulated, multilobulated masses consisting of vascular and lymphatic channels. The masses may have intraconal and extraconal components and may cause bone remodeling (Fig 17a) (18). A venous lymphatic malformation often is first noticed after it hemorrhages, causing a rapid onset of proptosis, restricted eye movement, optic nerve compression, or a combination of these (18). Recurrent hemorrhage within such malformations produces the classic MR imaging appearance of multiple cysts containing fluid-fluid levels or T2 shading (Fig 17b) from blood products in various stages of degradation (21). Of note, these lesions have a reported association with intracranial developmental venous anomalies (22). Observations of an absence of communication with the systemic circulation and presence of lesional stability during postural changes help differentiate venous lymphatic malformations from orbital varices (18). Treatment options include observation, surgery, and alternative therapies such as intralesional injections with sclerosing agents or steroids (18).

Although a cavernous hemangioma may not constitute an emergent orbital finding, it is an important entity because it is the most common benign orbital tumor in adults, especially in women (60%–70% of cases) (18). Lesions are usually solitary and intraconal (2,18). They demonstrate slow, progressive enlargement over time, often manifesting clinically with progressive painless proptosis (23). Imaging findings include a well-defined, smoothly marginated mass surrounded by a fibrous pseudocapsule that demonstrates peripheral to central enhancement (Fig 18) (2,23).

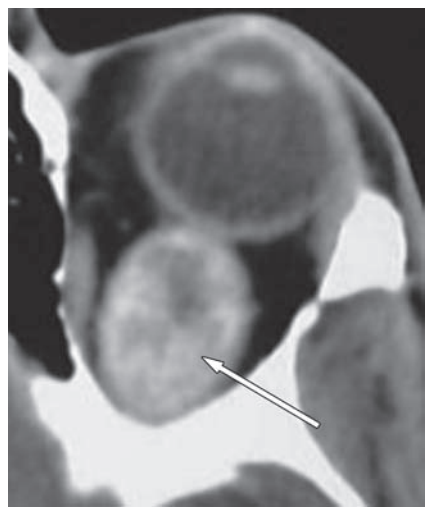


**Figure 18.** Cavernous hemangioma. Axial contrast-enhanced CT image obtained in a 47-year-old woman demonstrates a well-circumscribed peripherally enhancing intraconal mass (arrow).

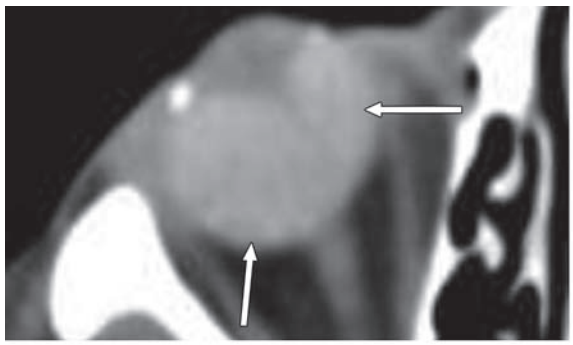
Conservative management is preferred in most cases, with surgical excision being reserved for lesions that cause severe proptosis or optic nerve compression (23).

## Retinal and Choroidal Detachments

Teaching Point

Recognition of retinal and choroidal detachments encountered in the emergent setting is crucial to patient care, not for the evaluation of the detachment itself but rather for the detection of a more ominous underlying cause such as an intraocular tumor.

Retinal detachment, or separation of the sensory retina from the retinal pigment epithelium, may be either rhegmatogenous or nonrhegmatogenous. A rhegmatogenous retinal detachment is a full-thickness tear of the retina with subsequent



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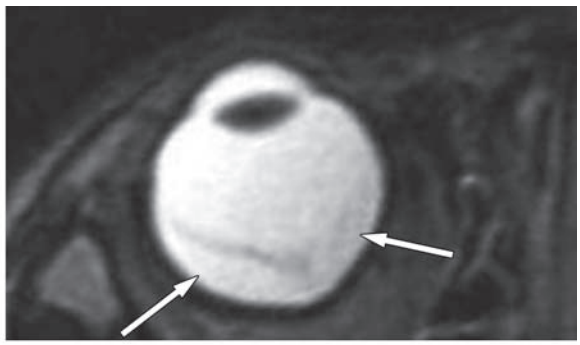

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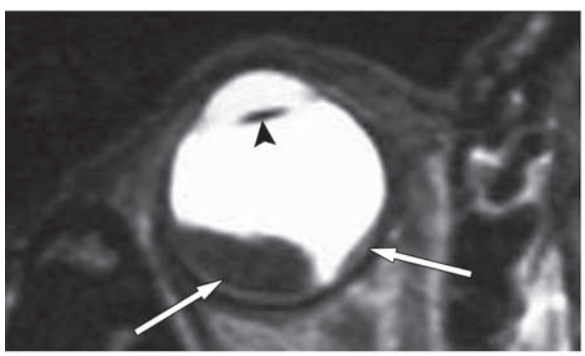


21.

**Figures 19–21.** Retinal detachments with the classic V shape, with the apex at the site of the optic nerve. **(19)** Axial nonenhanced CT image obtained in a 57-year-old woman depicts near complete obliteration of the vitreous body by a hemorrhagic or proteinaceous retinal detachment (arrows). **(20)** Axial T2-weighted MR image obtained in a 19-year-old man demonstrates a serous retinal detachment (arrows). **(21)** Axial nonenhanced T1-weighted MR image obtained in a 55-year-old man shows a hemorrhagic retinal detachment (arrows). A lens implant (arrowhead) also is depicted.

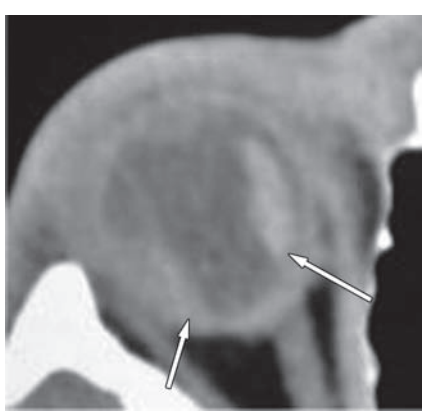


**Figure 22.** Choroidal detachment. Axial nonenhanced CT image obtained in an 81-year-old woman depicts a proteinaceous or hemorrhagic choroidal detachment that spares the posterior third of the globe (arrows)—the classic imaging feature that distinguishes this entity from a retinal detachment.

movement of liquefied vitreous into the subretinal space (24). Nonrhegmatogenous retinal detachment is often the result of traction on the retina and is more commonly seen in children with ocular diseases (24). Conditions that predispose the retina to rhegmatogenous detachment include diabetic retinopathy, trauma, high myopia, congenital cataract, surgery, congenital glaucoma, sickle cell disease, leukemia, systemic lupus erythematosus, and metastases (24).

Retinal detachments have a characteristic V shape, with the apex of the detachment at the optic disc on cross-sectional images (Figs 19–21). In a complete retinal detachment, the leaves of the retina may be so closely opposed that they are imperceptible, and the entire vitreous cavity may be ablated (Fig 19) (24). The excellent tissue contrast resolution at MR imaging allows a distinction among serous (Fig 20), proteinaceous, and hemorrhagic (Fig 21) retinal detachments by providing a clue to the underlying cause. Treatment options for retinal detachment include scleral buckle placement, pneumatic retinopexy, laser therapy, cryotherapy, and vitrectomy. If retinal detachment progresses to involve the macula, vision loss occurs—a potentially devastating sequela (24).

Choroidal detachment is defined as fluid accumulation in the subchoroidal space, a condition that may occur after ocular surgery, trauma, or an inflammatory choroidal process (uveitis) (24). Choroidal detachment spares the region of the optic disc, in the posterior third of the globe, because of the anchoring effect of short posterior ciliary arteries, veins, and nerves in the ciliary body. The sparing of this region gives choroidal detachment its characteristic imaging appearance (Fig 22) (24).

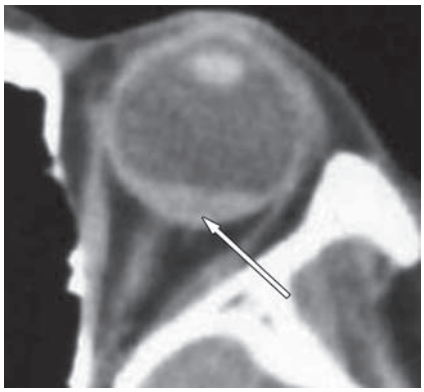


**Figure 23.** Choroidal metastasis from breast cancer. Axial nonenhanced CT image obtained in a 50-year-old woman depicts posterior choroidal thickening, a finding representative of a metastasis (arrow).

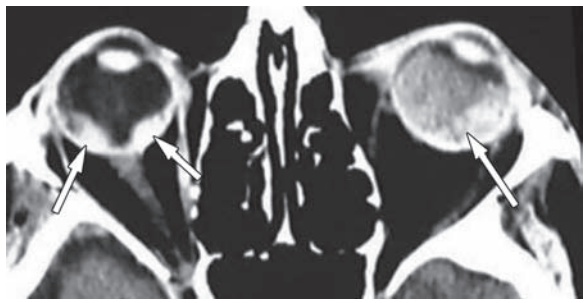


**Figure 24.** Bilateral choroidal metastases from lung cancer. Axial contrast-enhanced CT image obtained in a 64-year-old man demonstrates bilateral retinal detachments (arrows) due to choroidal metastases from lung cancer. The left retinal detachment is more severe than the right.

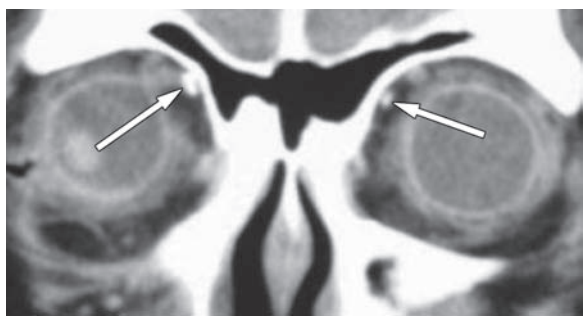


**Figure 25.** Trochlear calcification. Coronal nonenhanced CT image obtained in a 45-year-old woman demonstrates bilateral foci of high attenuation in the superomedial aspect of the orbits (arrows), the typical location of trochlear calcifications.

The possible presence of an underlying ocular mass (eg, retinoblastoma in children, uveal melanoma in adults) should be considered when a retinal or choroidal detachment is detected. Choroidal metastases are the most common ocular malignancies in adults and often are secondary to lung and breast cancer (24). Malignant cells gain access to the globe via the short posterior ciliary arteries; thus, most metastases are found in the posterior half of the globe (Fig 23) (24). Choroidal metastases extend along the plane of the choroid (bilaterally, in an estimated 30% of those affected), causing a relatively small increase in choroidal thickness (24). Patients with choroidal metastases may present with visual loss due to retinal detachment (Fig 24). However, these lesions often are asymptomatic unless they involve the fovea (24).

## Calcifications

Orbital calcifications are common incidental findings that occur in characteristic locations, which helps distinguish them from radiopaque intraorbital foreign bodies. Frequently encountered calcifications include trochlear calcifications, scleral plaques, optic drusen, and phthisis bulbi.

Trochlear calcifications may occur in adults as aging-related normal variants or may be seen in young patients with diabetes mellitus (Fig 25) (25). They typically have a superomedial location within the orbit. Scleral plaques are most commonly seen in elderly patients and are located at the insertion sites of the medial and lateral rectus muscles (Fig 26) (9). Optic drusen, which appear as punctate calcifications near the optic disc on cross-sectional images, are a cause

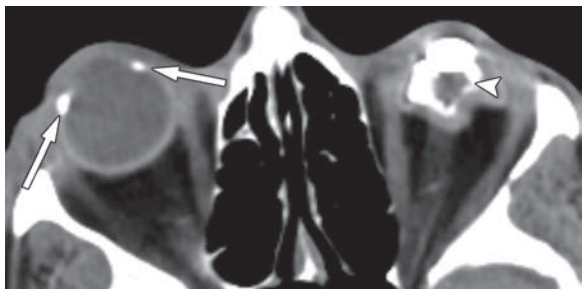


**Figure 26.** Scleral plaques and phthisis bulbi. Axial nonenhanced CT image obtained in a 74-year-old man depicts calcified scleral plaques in the right globe (arrows), in characteristic positions at the insertion sites of the medial and lateral rectus muscles. The left globe (arrowhead) is calcified and shrunken, an appearance indicative of phthisis bulbi.

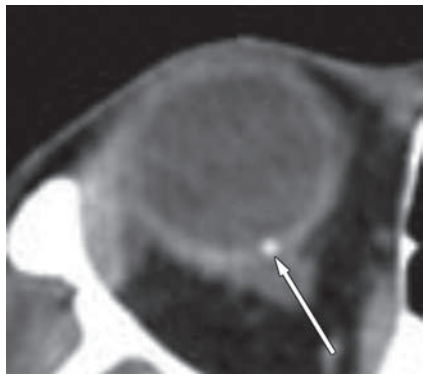
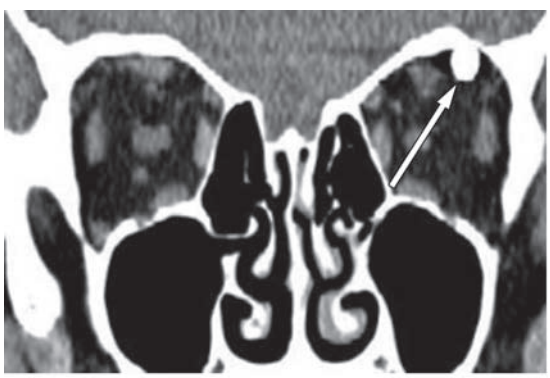


**Figure 27.** Optic drusen. Axial nonenhanced CT image obtained in a 47-year-old woman shows a punctate calcification near the right optic disc (arrow).



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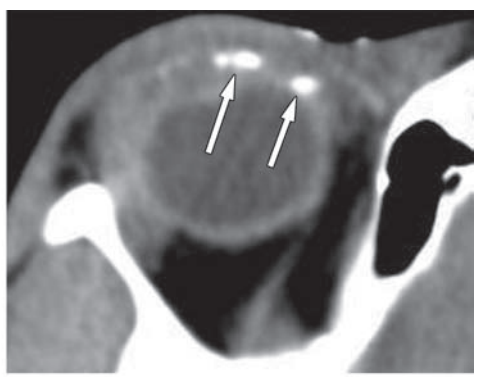

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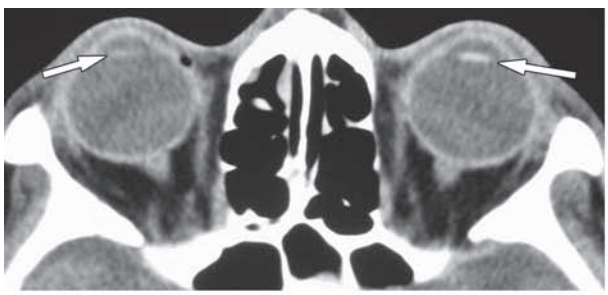
**Figures 28, 29.** Foreign bodies. **(28)** Coronal reformatted image from nonenhanced CT in a 25-year-old man demonstrates an extraocular radiopaque foreign body in the superior aspect of the left orbit (arrow). In a more medial location, the object might be mistaken for a trochlear calcification (cf Fig 25). **(29)** Axial nonenhanced CT image obtained in a 26-year-old man shows multiple foreign bodies (arrows) anterior to the globe. If these high-attenuation foci were located at the insertion sites of the medial and lateral rectus muscles, they might be mistaken for scleral plaques (cf Fig 26).

of benign (and usually bilateral) pseudopapilledema (Fig 27). Optic drusen are typically seen in patients with age-related macular degeneration; however, they also may be seen in relatively young patients (24). Phthisis bulbi, a shrunken globe with ocular calcification or ossification, is the sequela of a wide variety of pathologic ocular processes, including infection, inflammation, and trauma (Fig 26) (24).

These common orbital calcifications should not be confused with radiopaque foreign bodies (Figs 28, 29).

**Figures 30–34.** Appearance of posttherapeutic changes on axial nonenhanced CT images. **(30)** Image obtained in a 65-year-old man demonstrates bilateral lens implants (arrows) for the treatment of cataracts. **(31)** Image obtained in a 75-year-old woman depicts radiopaque and radiolucent scleral buckles (arrows) placed for the treatment of retinal detachment. **(32)** Image obtained in a 79-year-old man shows an area of high attenuation in the left globe (arrow), a finding indicative of silicone oil injected to treat retinal detachment. **(33)** Image obtained in an 82-year-old man demonstrates hypoattenuation similar to that of air within the left globe (arrow), a characteristic finding after pneumatic retinopexy for the treatment of retinal detachment. **(34)** Image obtained in a 60-year-old woman shows a two-piece left globe prosthesis (arrow).



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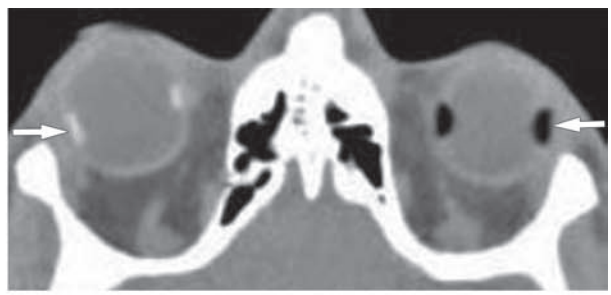

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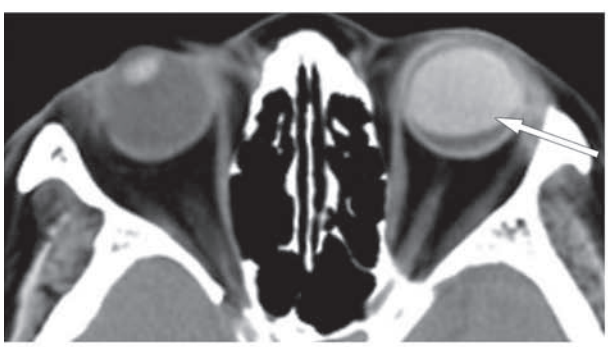

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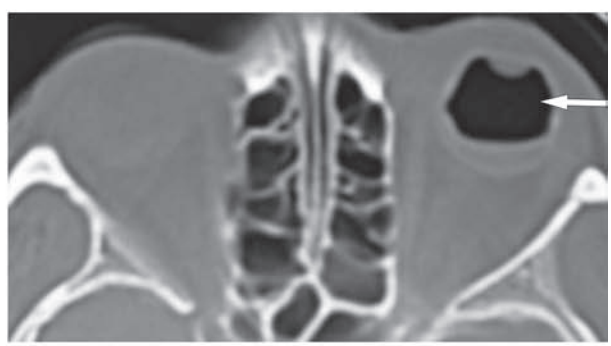

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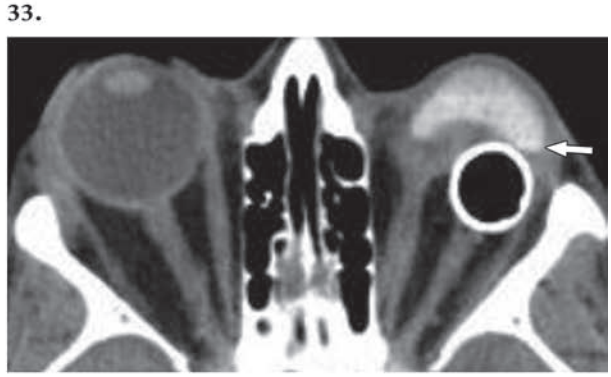

34.

## Posttherapeutic Changes and Devices

Teaching Point

Familiarity with posttherapeutic changes and orbital devices is important because they may be misinterpreted as acute pathologic conditions caused by trauma or infection. Among these posttherapeutic changes and devices are lens replacements (Figs 21, 30), scleral buckles (Fig 31), intraocular silicone oil injections (Fig 32), pneumatic retinopexy (Fig 33), and globe prostheses (Fig 34). An intraocular silicone injection may be differentiated from an intraocular hemorrhage by measuring the CT attenuation numbers (that of silicone is >100 HU; that of blood, <90 HU) or by detecting a silicone-related chemical shift artifact on MR images, particularly T2-weighted spin-echo images (26). Familiarity with the imaging appearances of therapy-related complications such as infection and device failure also is important for appropriate management.

## Summary

CT is the first-line modality for radiologic evaluation of the orbit in the acute setting, with MR

imaging serving as a useful secondary diagnostic tool because of its excellent tissue contrast resolution. Understanding the imaging findings of common emergent nontraumatic orbital conditions such as inflammation, infection, and retinal and choroidal detachment is crucial for their accurate diagnosis and optimal treatment, to avoid permanent visual loss and other potentially devastating consequences. The ability to distinguish between these important disease entities and benign conditions such as calcifications and therapeutic devices also helps avoid unnecessary diagnostic work-up and treatment.

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# Nontraumatic Orbital Conditions: Diagnosis with CT and MR Imaging in the Emergent Setting

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**RadioGraphics 2008;** 28:1741–1753 • **Published online** 10.1148/rg.286085515 • **Content Codes:** CT ER HN MR

**Page 1742**
The location of an orbital infection is described with respect to the orbital septum, as either preseptal (periorbital) or postseptal (orbital).

**Page 1743**
Development of an orbital subperiosteal abscess is most commonly associated with ethmoid sinusitis. Drainage of the abscess may be necessary to avoid a rapid elevation of intraorbital pressure and resultant visual impairment.

**Page 1745**
In Graves ophthalmopathy, classically spindle-shaped enlargement of the extraocular muscles is observed, with sparing of the tendinous insertion. The inferior, medial, superior, and lateral rectus muscles (listed in order of decreasing frequency of involvement) may be involved.

**Page 1748**
Recognition of retinal and choroidal detachments encountered in the emergent setting is crucial to patient care, not for the evaluation of the detachment itself but rather for the detection of a more ominous underlying cause such as an intraocular tumor.

**Page 1752**
Familiarity with posttherapeutic changes and orbital devices is important because they may be misinterpreted as acute pathologic conditions caused by trauma or infection.