

Table 17-2 Signal Characteristics of Normal Ocular Structures in Different Imaging Sequences

Ocular Structure	Signal Intensity on T1-Weighted Images ^a	Signal Intensity on T2-Weighted Images ^a	Enhancement on Postcontrast Images ^a	Additional Comments
Sclera, choroid, retina (seen as a single coat)	Hyperintense (bright/white)	Hypointense (dark/black)	None	The 3 coats cannot be distinguished separately on routine imaging
Aqueous	Hypointense (dark/black)	Hyperintense (bright/white)	None	
Lens	Hyperintense (bright/white)	Low (gray)	None	Typically has a biconvex appearance
Vitreous	Hypointense (dark/black)	Hyperintense (bright/white)	None	
Extraocular muscles	Intermediate (gray)	Intermediate (gray)	Enhances brightly	
Orbital fat	Hyperintense (bright/white)	Intermediate (gray)	None	Typically has a homogeneous appearance
Optic nerve	Isointense to cerebral white matter (gray)	Isointense to cerebral white matter (gray)	Does not typically enhance; it can be compared with the extraocular muscles	
Optic nerve sheath with cerebral spinal fluid around the optic nerve	Hypointense (dark/black)	Hyperintense (bright/white)	None	
Lacrimal gland	Isointense with gray matter (gray)	Isointense with gray matter (gray)	Enhances brightly	
Bone	Signal void (dark)	Signal void (dark)	None	Better studied with computed tomography
Cerebral spinal fluid	Hypointense (dark/black)	Hyperintense (bright/white)	None	

^aSignal intensity (hypointense/hyperintense) is described in comparison with the reference tissue. Intracranially, the reference tissue is the gray matter of the brain; extracranially, it is the skeletal muscle.

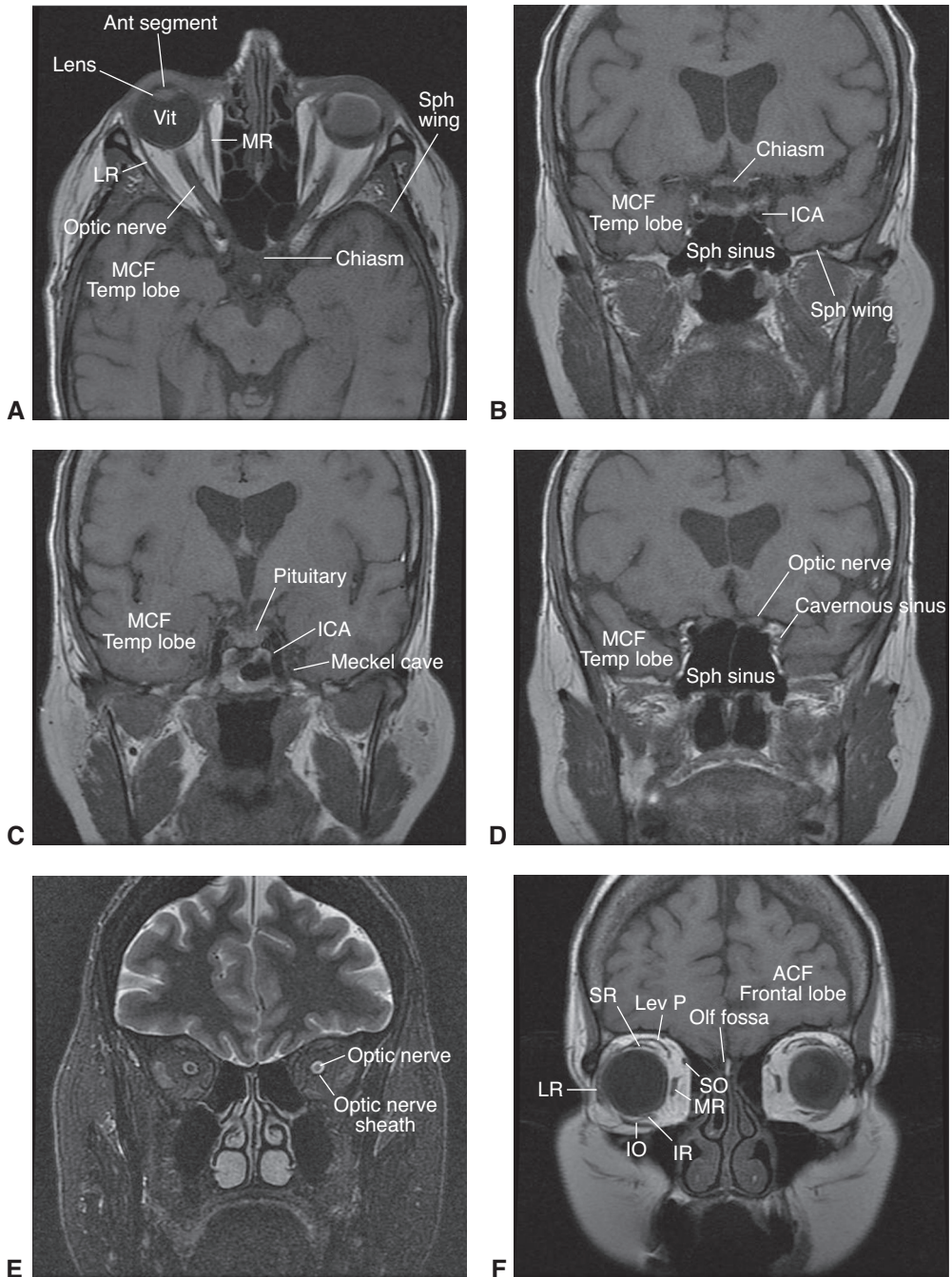


Figure 17-2 Magnetic resonance imaging (MRI) scans of the brain and orbit show the anatomy of visual and orbital structures from the chiasm to the anterior orbit. (Note: The left-globe abnormality is not pertinent to this figure's objective.) **A**, T1-weighted axial image. **B–D**, T1-weighted coronal images. **E**, T2-weighted coronal image with fat suppression. **F**, T1-weighted coronal image. ACF=anterior cranial fossa; Ant segment=anterior segment; ICA=internal carotid artery; IO=inferior oblique muscle; IR=inferior rectus muscle; LR=lateral rectus muscle; Lev P=levator palpebrae superioris muscle; MCF=middle cranial fossa; MR=medial rectus muscle; Olf fossa=olfactory fossa; SO=superior oblique muscle; Sph sinus=sphenoid sinus; Sph wing=sphenoid wing; SR=superior rectus muscle; Temp lobe=temporal lobe; Vit=vitreous. (Courtesy of M. Tariq Bhatti, MD.)

not zero. This is an important consideration when counseling patients before their scans. Patients are also screened at the imaging center before MRI. Stents used in microinvasive glaucoma surgery (MIGS) are MR-conditional, and a review of the specific device directions for use is recommended. These stents are safe to use in 3 Tesla (3T) MRI.

The following box highlights general and ophthalmic concerns in patients scheduled to undergo MRI. The reader is also directed to the ACR safety guidelines (see the reference list at the end of this section) for further details.

Considerations When Ordering an MRI

- Metal in the body, including metallic intraocular or orbital foreign bodies
 - Screening radiography or CT may be helpful in detecting intraocular and orbital foreign bodies.
 - Consultation with a diagnostic radiologist is advised regarding the safety of some metals (eg, MRI-compatible aneurysm clips).
 - Gold weight and titanium mesh orbital floor implants have shown no movement when placed in a magnetic field. Some clinicians prefer to wait for fibrosis to secure the implant before obtaining an MRI.
- Cardiac pacemaker or defibrillator
 - Consultation with a diagnostic radiologist regarding all implantable devices is advised.
- Allergy to gadolinium-based contrast media
- Consideration and risk-analysis of sedation in children, depending on age and length of scan

Activities 17-1 and 17-2 demonstrate normal structures identified on axial and coronal orbital imaging, respectively, with CT and MRI.



ACTIVITY 17-1 Axial imaging of the normal orbit with computed tomography and magnetic resonance imaging.

Developed by Vikram S. Brar, MD. Figures reproduced with permission from Dutton JJ. Atlas of Clinical and Surgical Orbital Anatomy. 2nd ed. Elsevier/Saunders; 2011:Figs 11-1 to 11-6.



ACTIVITY 17-2 Coronal imaging of the normal orbit with computed tomography and magnetic resonance imaging.

Developed by Vikram S. Brar, MD. Figures reproduced with permission from Dutton JJ. Atlas of Clinical and Surgical Orbital Anatomy. 2nd ed. Elsevier/Saunders; 2011:Figs 11-7 to 11-12.



Expert Panel on MR Safety; Kanal E, Barkovich AJ, Bell C, et al. ACR guidance document on MR safe practices: 2013. *J Magn Reson Imaging*. 2013;37(3):501–530.

Lawrence DA, Lipman AT, Gupta SK, Nacey NC. Undetected intraocular metallic foreign body causing hyphema in a patient undergoing MRI: a rare occurrence demonstrating the limitations of pre-MRI safety screening. *Magn Reson Imaging*. 2015;33(3):358–361.