American College of Radiology
ACR Appropriateness Criteria®
Vision Loss

Variant: 1 Adult. Acute posttraumatic visual defect. Suspect orbital injury. Initial imaging.

Procedure	Appropriateness Category	Relative Radiation Level
CT maxillofacial without IV contrast	Usually Appropriate	☢☢
CT orbits without IV contrast	Usually Appropriate	☢☢☢
CT head without IV contrast	May Be Appropriate	☢☢☢
Radiography face	Usually Not Appropriate	☢
Radiography orbit	Usually Not Appropriate	☢
Arteriography cerebral	Usually Not Appropriate	☢☢☢
MRA head and neck with IV contrast	Usually Not Appropriate	O
MRA head and neck without and with IV contrast	Usually Not Appropriate	O
MRA head and neck without IV contrast	Usually Not Appropriate	O
MRA head with IV contrast	Usually Not Appropriate	O
MRA head without and with IV contrast	Usually Not Appropriate	O
MRA head without IV contrast	Usually Not Appropriate	O
MRI head with IV contrast	Usually Not Appropriate	O
MRI head without and with IV contrast	Usually Not Appropriate	O
MRI head without IV contrast	Usually Not Appropriate	O
MRI orbits with IV contrast	Usually Not Appropriate	O
MRI orbits without and with IV contrast	Usually Not Appropriate	O
MRI orbits without IV contrast	Usually Not Appropriate	O
CT maxillofacial with IV contrast	Usually Not Appropriate	☢☢
CT head with IV contrast	Usually Not Appropriate	☢☢☢
CT head without and with IV contrast	Usually Not Appropriate	☢☢☢
CT maxillofacial without and with IV contrast	Usually Not Appropriate	☢☢☢
CT orbits with IV contrast	Usually Not Appropriate	☢☢☢
CT orbits without and with IV contrast	Usually Not Appropriate	☢☢☢
CTA head and neck with IV contrast	Usually Not Appropriate	☢☢☢
CTA head with IV contrast	Usually Not Appropriate	☢☢☢

Variant: 2 Adult. Acute vision loss. Infection or inflammatory disorder suspected. Initial imaging.

Procedure	Appropriateness Category	Relative Radiation Level
MRI orbits without and with IV contrast	Usually Appropriate	O
CT maxillofacial with IV contrast	Usually Appropriate	☢☢
CT orbits with IV contrast	Usually Appropriate	☢☢☢
MRI head without and with IV contrast	May Be Appropriate	O
CT orbits without IV contrast	May Be Appropriate	☢☢☢
Arteriography cerebral	Usually Not Appropriate	☢☢☢
MRA head and neck with IV contrast	Usually Not Appropriate	O

MRA head and neck without and with IV contrast	Usually Not Appropriate	O
MRA head and neck without IV contrast	Usually Not Appropriate	O
MRA head with IV contrast	Usually Not Appropriate	O
MRA head without and with IV contrast	Usually Not Appropriate	O
MRA head without IV contrast	Usually Not Appropriate	O
MRI head with IV contrast	Usually Not Appropriate	O
MRI head without IV contrast	Usually Not Appropriate	O
MRI orbits with IV contrast	Usually Not Appropriate	O
MRI orbits without IV contrast	Usually Not Appropriate	O
MRV head with IV contrast	Usually Not Appropriate	O
MRV head without and with IV contrast	Usually Not Appropriate	O
MRV head without IV contrast	Usually Not Appropriate	O
CT maxillofacial without IV contrast	Usually Not Appropriate	☢☢
CT head with IV contrast	Usually Not Appropriate	☢☢☢
CT head without and with IV contrast	Usually Not Appropriate	☢☢☢
CT head without IV contrast	Usually Not Appropriate	☢☢☢
CT maxillofacial without and with IV contrast	Usually Not Appropriate	☢☢☢
CT orbits without and with IV contrast	Usually Not Appropriate	☢☢☢
CTA head and neck with IV contrast	Usually Not Appropriate	☢☢☢
CTA head with IV contrast	Usually Not Appropriate	☢☢☢
CTV head with IV contrast	Usually Not Appropriate	☢☢☢

Variant: 3 Adult. Chronic or progressive unilateral vision loss. Intraorbital mass-like lesion suspected or vascular lesion suspected. Initial imaging.

Procedure	Appropriateness Category	Relative Radiation Level
MRI orbits without and with IV contrast	Usually Appropriate	O
MRI head without and with IV contrast	May Be Appropriate	O
CT orbits with IV contrast	May Be Appropriate	☢☢☢
Arteriography cerebral	Usually Not Appropriate	☢☢☢
MRA head and neck with IV contrast	Usually Not Appropriate	O
MRA head and neck without and with IV contrast	Usually Not Appropriate	O
MRA head and neck without IV contrast	Usually Not Appropriate	O
MRA head with IV contrast	Usually Not Appropriate	O
MRA head without and with IV contrast	Usually Not Appropriate	O
MRA head without IV contrast	Usually Not Appropriate	O
MRI head with IV contrast	Usually Not Appropriate	O
MRI head without IV contrast	Usually Not Appropriate	O
MRI orbits with IV contrast	Usually Not Appropriate	O
MRI orbits without IV contrast	Usually Not Appropriate	O
CT maxillofacial with IV contrast	Usually Not Appropriate	☢☢
CT maxillofacial without IV contrast	Usually Not Appropriate	☢☢
CT head with IV contrast	Usually Not Appropriate	☢☢☢
CT head without and with IV contrast	Usually Not Appropriate	☢☢☢
CT head without IV contrast	Usually Not Appropriate	☢☢☢

CT maxillofacial without and with IV contrast	Usually Not Appropriate	☢☢☢
CT orbits without and with IV contrast	Usually Not Appropriate	☢☢☢
CT orbits without IV contrast	Usually Not Appropriate	☢☢☢
CTA head with IV contrast	Usually Not Appropriate	☢☢☢
FDG-PET/CT skull base to mid-thigh	Usually Not Appropriate	☢☢☢☢

Variant: 4 Adult. Acute vision loss, retinal structural abnormality suspected. Initial imaging.

Procedure	Appropriateness Category	Relative Radiation Level
MRA head and neck with IV contrast	Usually Not Appropriate	O
MRA head and neck without and with IV contrast	Usually Not Appropriate	O
MRA head and neck without IV contrast	Usually Not Appropriate	O
MRA head with IV contrast	Usually Not Appropriate	O
MRA head without and with IV contrast	Usually Not Appropriate	O
MRA head without IV contrast	Usually Not Appropriate	O
MRI head with IV contrast	Usually Not Appropriate	O
MRI head without and with IV contrast	Usually Not Appropriate	O
MRI head without IV contrast	Usually Not Appropriate	O
MRI orbits with IV contrast	Usually Not Appropriate	O
MRI orbits without and with IV contrast	Usually Not Appropriate	O
MRI orbits without IV contrast	Usually Not Appropriate	O
CT maxillofacial with IV contrast	Usually Not Appropriate	☢☢
CT maxillofacial without IV contrast	Usually Not Appropriate	☢☢
CT head with IV contrast	Usually Not Appropriate	☢☢☢
CT head without and with IV contrast	Usually Not Appropriate	☢☢☢
CT head without IV contrast	Usually Not Appropriate	☢☢☢
CT maxillofacial without and with IV contrast	Usually Not Appropriate	☢☢☢
CT orbits with IV contrast	Usually Not Appropriate	☢☢☢
CT orbits without and with IV contrast	Usually Not Appropriate	☢☢☢
CT orbits without IV contrast	Usually Not Appropriate	☢☢☢
CTA head with IV contrast	Usually Not Appropriate	☢☢☢

Variant: 5 Adult. Acute or chronic vision loss, optic nerve abnormality suspected. Initial imaging.

Procedure	Appropriateness Category	Relative Radiation Level
MRI orbits without and with IV contrast	Usually Appropriate	O
MRI head without and with IV contrast	May Be Appropriate	O
MRA head and neck with IV contrast	Usually Not Appropriate	O
MRA head and neck without and with IV contrast	Usually Not Appropriate	O
MRA head and neck without IV contrast	Usually Not Appropriate	O
MRA head with IV contrast	Usually Not Appropriate	O
MRA head without and with IV contrast	Usually Not Appropriate	O
MRA head without IV contrast	Usually Not Appropriate	O
MRI head with IV contrast	Usually Not Appropriate	O
MRI head without IV contrast	Usually Not Appropriate	O

MRI orbits with IV contrast	Usually Not Appropriate	O
MRI orbits without IV contrast	Usually Not Appropriate	O
CT maxillofacial with IV contrast	Usually Not Appropriate	☢☢
CT maxillofacial without IV contrast	Usually Not Appropriate	☢☢
CT head with IV contrast	Usually Not Appropriate	☢☢☢
CT head without and with IV contrast	Usually Not Appropriate	☢☢☢
CT head without IV contrast	Usually Not Appropriate	☢☢☢
CT maxillofacial without and with IV contrast	Usually Not Appropriate	☢☢☢
CT orbits with IV contrast	Usually Not Appropriate	☢☢☢
CT orbits without and with IV contrast	Usually Not Appropriate	☢☢☢
CT orbits without IV contrast	Usually Not Appropriate	☢☢☢
CTA head and neck with IV contrast	Usually Not Appropriate	☢☢☢
CTA head with IV contrast	Usually Not Appropriate	☢☢☢

Variant: 6 Adult. Bitemporal hemianopia or junctional scotoma. Sellar or parasellar mass suspected. Initial imaging.

Procedure	Appropriateness Category	Relative Radiation Level
MRI sella without and with IV contrast	Usually Appropriate	O
MRI head without and with IV contrast	May Be Appropriate	O
Arteriography cerebral	Usually Not Appropriate	☢☢☢
MRA head and neck with IV contrast	Usually Not Appropriate	O
MRA head and neck without and with IV contrast	Usually Not Appropriate	O
MRA head and neck without IV contrast	Usually Not Appropriate	O
MRA head with IV contrast	Usually Not Appropriate	O
MRA head without and with IV contrast	Usually Not Appropriate	O
MRA head without IV contrast	Usually Not Appropriate	O
MRI head with IV contrast	Usually Not Appropriate	O
MRI head without IV contrast	Usually Not Appropriate	O
MRI orbits with IV contrast	Usually Not Appropriate	O
MRI orbits without and with IV contrast	Usually Not Appropriate	O
MRI orbits without IV contrast	Usually Not Appropriate	O
MRI sella with IV contrast	Usually Not Appropriate	O
MRI sella without IV contrast	Usually Not Appropriate	O
CT head with IV contrast	Usually Not Appropriate	☢☢☢
CT head without and with IV contrast	Usually Not Appropriate	☢☢☢
CT head without IV contrast	Usually Not Appropriate	☢☢☢
CT orbits with IV contrast	Usually Not Appropriate	☢☢☢
CT orbits without and with IV contrast	Usually Not Appropriate	☢☢☢
CT orbits without IV contrast	Usually Not Appropriate	☢☢☢
CT sella with IV contrast	Usually Not Appropriate	☢☢☢
CT sella without and with IV contrast	Usually Not Appropriate	☢☢☢
CT sella without IV contrast	Usually Not Appropriate	☢☢☢
CTA head and neck with IV contrast	Usually Not Appropriate	☢☢☢
CTA head with IV contrast	Usually Not Appropriate	☢☢☢

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Summary of Literature Review

Introduction/Background

Vision loss is a common medical issue with a myriad of potential etiologies. Based on a meta-analysis of 2017 data, more than 7 million people in the United States are estimated to have vision loss, as defined by visual acuity ≤20/40 in the better-seeing eye [1]. The necessity for imaging in the diagnosis of vision loss and the choice of modality and examination type are dependent on the acuity of symptoms, the suspected region of insult along the visual pathway, and potential underlying etiologies as determined by clinical presentation. Insults to specific regions of the visual pathway lead to characteristic visual field defects. Appropriate localization of the offending lesion along the visual pathway directs appropriate imaging workup and differential diagnosis generation [2].

Most nontraumatic pathology of the globe is evaluated by ophthalmologic examination and does not require cross-sectional imaging for diagnosis and treatment planning in the absence of suspected complications [3]. Cross-sectional imaging can be accomplished by CT or MRI, and imaging recommendations are subsequently discussed in this document for each variant. CT is the optimal imaging modality for evaluating bones as well as for delineating calcifications and radio-opaque foreign bodies. MRI provides superior soft tissue resolution. Vascular etiologies related to vision loss can be evaluated by angiographic imaging including CT angiography (CTA), MR angiography (MRA), and digital subtraction angiography (DSA), with DSA being the reference standard [4].

Vision loss can overlap with other conditions, some of which are addressed in separate ACR Appropriateness Criteria documents. This document is focused on clinical presentations in which vision loss is the primary presenting symptom. Nontraumatic causes of diplopia and their recommended initial imaging workup will be addressed in a separate ACR Appropriateness Criteria document to be subsequently published. The appropriate initial workup of headache, including intracranial hypertension and associated papilledema, is discussed in the ACR Appropriateness Criteria® topic on "Headache" [5]. Conditions associated with posttraumatic vision loss (Variant 1) overlap with head injury, which is extensively discussed in the ACR Appropriateness Criteria® topic on "Head Trauma" [6].

In patients presenting with a homonymous hemianopia, a retrochiasmatic lesion involving the optic tracts, lateral geniculate nucleus, optic radiations, or primary visual cortex in the occipital lobe is suspected. Visual acuity is usually relatively intact with lesions of the retrochiasmatic visual pathways [7]. The most common cause of homonymous hemianopia is infarction. Other causes of homonymous hemianopia include parenchymal hematoma, trauma, and brain tumor, as well as

less common causes, including neurosurgical procedures and demyelinating disease [8]. Occipital lobe hemianopia is most commonly caused by ischemic stroke in the posterior cerebral artery distribution, whereas the most frequent pathology affecting the optic radiations is infarction in the middle cerebral artery territory [7]. Venous infarctions, which are often hemorrhagic, can occur secondary to dural venous sinus or cerebral vein thrombosis. Thrombosis of the posterior portion of the superior sagittal sinus can cause a venous infarct in the occipital cortex. Acuity of symptoms should alert the clinician to the possibility of stroke, although patients may not be immediately aware of a hemianopia [9]. It is important to identify pathology involving the occipital lobes, optic radiations, optic tracts, or lateral geniculate nucleus in patients presenting with homonymous hemianopia visual field defects. Appropriate imaging can identify the presence of retrochiasmal pathology resulting in complete or incomplete homonymous hemianopia and guide suitable treatment.

The complete imaging guidelines for manifestations of transient ischemic attack or stroke and acute cerebrovascular pathologies are discussed in the ACR Appropriateness Criteria® topics on "Cerebrovascular Diseases-Aneurysm, Vascular Malformation, and Subarachnoid Hemorrhage" [10] and "Cerebrovascular Diseases-Stroke and Stroke-Related Conditions" [11]. Imaging guidelines for brain tumor will be addressed in the ACR Appropriateness Criteria® topic on "Brain Tumors," currently in development.

Special Imaging Considerations

CT maxillofacial and CT orbits are imaging options for the ordering clinician. The imaging parameters, including reconstruction slice thickness and field of view, will vary by institution. CT maxillofacial will typically include from the frontal bone above the frontal sinuses through the mandible. A CT orbits often focuses on a smaller field of view centered at the orbits and may not include the entirety of the facial bones.

Specifics of MRI orbital protocols vary by institution but typically include a combination of axial and coronal T1-weighted imaging without fat suppression, coronal T2-weighted imaging with fat suppression to assess the optic nerve, axial T2-weighted imaging with or without fat suppression and diffusion-weighted imaging (DWI), with a small field of view centered on the orbits. Postcontrast imaging of the orbits should be performed with fat suppression so that the orbital fat does not obscure enhancement [12]. Although ultrasound (US) is not listed on the variant table, diseases of the globe and retrobulbar region can be assessed with ocular US. US is a procedure usually performed by an ophthalmologist and at times by physicians trained in advanced emergency medicine US and is beyond the scope of this article. US is capable of diagnosing many of the acute orbital conditions associated with vision loss, including lens dislocation, vitreous hemorrhage, retinal detachment, foreign body, retrobulbar hematoma, and papilledema [13]. US is also capable of detecting orbital floor fractures but in a much more limited fashion compared with CT, which can offer complete osseous assessment of the orbit [14]. In addition to emergent conditions, US can diagnose disorders of the optic nerve and extraocular muscles and evaluate orbital masses [15]. Color Doppler adds the ability to detect ocular and retinal vascular pathologies. Ocular US should be avoided in cases of known or suspected globe rupture [13,16].

Optical coherence tomography is an imaging modality used by ophthalmologists whereby light waves from the near infrared spectrum are used to provide high resolution cross-sectional imaging of the retina. In addition to its widespread applications in the evaluation of retinal pathologies,

optical coherence tomography has also been used to diagnose disorders of the optic nerve such as optic neuritis (ON) [17].

Initial Imaging Definition

Initial imaging is defined as imaging at the beginning of the care episode for the medical condition defined by the variant. More than one procedure can be considered usually appropriate in the initial imaging evaluation when:

- There are procedures that are equivalent alternatives (ie, only one procedure will be ordered to provide the clinical information to effectively manage the patient's care)

OR

- There are complementary procedures (ie, more than one procedure is ordered as a set or simultaneously wherein each procedure provides unique clinical information to effectively manage the patient's care).

Discussion of Procedures by Variant

Variant 1: Adult. Acute posttraumatic visual defect. Suspect orbital injury. Initial imaging.

Orbital fractures are most commonly the result of assault or direct impact from a projectile or object, motor vehicle accidents, falls, and sports-related injuries [18,19]. In the setting of facial trauma, orbital fractures may occur in isolation or in combination with midface fractures including zygomaticomaxillary complex, Le Fort II and III fractures, and nasoethmoidal complex fractures [20].

Diplopia may be seen when there are depressed orbital floor fractures, particularly fractures affecting the anterior or middle thirds of the floor, and small- to medium-sized fractures with soft tissue herniation [21]. Orbital floor fractures >2 cm in size are more likely to be associated with enophthalmos [22]. Orbital blowout fractures may also affect the lamina papyracea; however, the incidence of extraocular muscle herniation and the seriousness of immediate complications is not as common as with orbital floor blowout fractures [23]. Whereas most orbital fractures can be repaired on a delayed basis after the acute swelling subsides, CT can detect features requiring more urgent intervention to preserve vision and function [24], including trapdoor fractures and orbital compartment syndrome.

Fractures of the lateral and superior orbital walls have been shown to be associated with an increased risk of traumatic optic neuropathy [25,26]. Owing to the anatomic design of the orbit, blunt trauma forces are transmitted toward the optic canal, exposing the optic nerve to potential shearing injury in this region [27]. In the setting of concomitant traumatic brain injuries or obtundation, afferent pupillary defect may be the only clinical clue for traumatic optic neuropathy. Expeditious diagnosis of traumatic optic neuropathy is important to permit timely intervention when necessary. Fractures involving the optic canal place the optic nerve at increased risk for injury; however, emergent surgical intervention for traumatic optic neuropathy is generally only performed in cases of bone fragment impingement on the nerve, hematoma within the canal, or expanding retrobulbar hematoma with proptosis [28,29]. Severe proptosis with posterior globe tenting requires emergent orbital decompression to preserve vision [20]. Fractures through the

orbital apex involving the superior orbital fissure can affect the multiple cranial nerves traversing this region [30].

Any process that increases mass effect in the orbit, such as retrobulbar hematoma or emphysema and blow-in fractures, can lead to orbital compartment syndrome with potential vision loss. Demonstration of retrobulbar hemorrhage by imaging is not sensitive for the subsequent development of orbital compartment syndrome, and this diagnosis should be made based on clinical findings of optic nerve compression [31,32]. Similarly, the diagnosis of extraocular muscle entrapment in orbital floor fractures is based on clinical findings, as extraocular muscle herniation and contour irregularity have low positive predictive values for entrapment [33].

The goal of imaging is the early diagnosis of orbital injuries and any associated complications to guide appropriate and timely management to prevent permanent vision loss.

Variant 1: Adult. Acute posttraumatic visual defect. Suspect orbital injury. Initial imaging. A. Arteriography cerebral

There is no relevant literature to support the use of cerebral arteriography in the initial imaging of posttraumatic vision loss. DSA may be used for diagnosis of posttraumatic vascular abnormalities such as carotid cavernous fistula; however, it is not a first-line imaging study.

Variant 1: Adult. Acute posttraumatic visual defect. Suspect orbital injury. Initial imaging. B. CT head with IV contrast

There is no relevant literature to support the use of CT head with intravenous (IV) contrast in the initial imaging of posttraumatic vision loss.

Variant 1: Adult. Acute posttraumatic visual defect. Suspect orbital injury. Initial imaging. C. CT head without and with IV contrast

There is no relevant literature to support the use of CT head without and with IV contrast in the initial imaging of posttraumatic vision loss.

Variant 1: Adult. Acute posttraumatic visual defect. Suspect orbital injury. Initial imaging. D. CT head without IV contrast

Depending on the mechanism of trauma, patients with orbital and facial fractures may be at increased risk for traumatic brain injury, intracranial hemorrhage, and skull fractures. In a study of more than 1,600 consecutive patients presenting to a single emergency department with a traumatic brain injury, 200 patients (12.1%) were found to have at least 1 facial fracture detected by CT, with 166 (83%) of these 200 patients requiring dedicated maxillofacial CT for diagnosis and 73 of these 166 patients (44%) requiring surgery. Patients with facial fractures were more likely to have initial loss of consciousness, positive head CT findings, positive physical examination, and lower Glasgow Coma Scale score [34]. In a study of 1,220 patients with orbital wall fractures and without known traumatic brain injury, 62 of 677 patients who received a head CT (9%) had an associated intracranial injury. Of these patients, orbital roof fracture, frontal bone fracture, and older age were independent risk factors for associated intracranial injury [35]. The entirety of the head and brain is not typically imaged with a routine maxillofacial or orbital CT, and a CT head may not include the entire orbits and does not usually image the whole lower face. In patients with known or suspected traumatic brain injury and facial trauma, concurrent head and maxillofacial CT scans without IV contrast are usually indicated for this clinical scenario.

Variant 1: Adult. Acute posttraumatic visual defect. Suspect orbital injury. Initial imaging.

E. CT maxillofacial with IV contrast

There is no relevant literature to support the use of CT maxillofacial with IV contrast in the initial imaging of posttraumatic vision loss.

Variant 1: Adult. Acute posttraumatic visual defect. Suspect orbital injury. Initial imaging. F. CT maxillofacial without and with IV contrast

There is no relevant literature to support the use of CT maxillofacial without and with IV contrast in the initial imaging of posttraumatic vision loss.

Variant 1: Adult. Acute posttraumatic visual defect. Suspect orbital injury. Initial imaging. G. CT maxillofacial without IV contrast

Multidetector CT (MDCT) is useful for following acute orbital trauma, as it can detect fractures and soft tissue injuries and can be acquired quickly, and multiplanar reformatted images can be generated from a single head position and imaging plane [30,36]. Additionally, imaging of multiple body parts can occur concurrently in the setting of polytrauma [24]. Orbital fractures in the setting of blunt facial trauma are commonly present in conjunction with fractures of the midface and possibly the mandible. The entirety of the lower face may not always be included within the orbital CT field of view. As such, depending on the mechanism of injury, either a maxillofacial CT or orbital CT without IV contrast may be useful for initial imaging of vision loss following orbital trauma, but the entirety of the suspected injury should be included in the imaging field of view. CT can localize radio-opaque intraorbital foreign bodies and displaced bone fragments. Additionally, CT can identify traumatic globe injuries including intraocular hemorrhage and detachments, lens dislocations, and open globe injuries, as well as retrobulbar soft tissue injuries including hematoma (retrobulbar and subperiosteal), extraocular muscle injury or herniation, and findings concerning for optic nerve injury [20,29].

Variant 1: Adult. Acute posttraumatic visual defect. Suspect orbital injury. Initial imaging. H. CT orbits with IV contrast

There is no relevant literature to support the use of CT orbits with IV contrast in the initial imaging of posttraumatic vision loss.

Variant 1: Adult. Acute posttraumatic visual defect. Suspect orbital injury. Initial imaging. I. CT orbits without and with IV contrast

There is no relevant literature to support the use of CT orbits without and with IV contrast in the initial imaging of posttraumatic vision loss.

Variant 1: Adult. Acute posttraumatic visual defect. Suspect orbital injury. Initial imaging. J. CT orbits without IV contrast

MDCT is useful for following acute orbital trauma, as it can detect fractures and soft tissue injuries and can be acquired quickly, and multiplanar reformatted images can be generated from a single head position and imaging plane [30,36]. Additionally, imaging of multiple body parts can occur concurrently in the setting of polytrauma [24]. Orbital fractures in the setting of blunt facial trauma are commonly present in conjunction with fractures of the midface and possibly the mandible. The entirety of the lower face may not be included within the orbital CT field of view. In cases of direct impact to the orbit without concern for additional facial fractures or in cases of penetrating injury to the orbit, the limited orbital field of view may suffice. However, if any clinical concern for additional facial injuries exists, the more comprehensive maxillofacial CT is more useful. CT can localize radio-opaque intraorbital foreign bodies and displaced bone fragments. Additionally, CT can identify traumatic globe injuries including intraocular hemorrhage and detachments, lens

dislocations, and open globe injuries, as well as retrobulbar soft tissue injuries including hematoma (retrobulbar and subperiosteal), extraocular muscle injury or herniation, and findings concerning for optic nerve injury [20,29].

Variant 1: Adult. Acute posttraumatic visual defect. Suspect orbital injury. Initial imaging. K. CTA head and neck with IV contrast

There is no relevant literature to support the use of CTA head and neck with IV contrast in the initial imaging of posttraumatic vision loss.

Variant 1: Adult. Acute posttraumatic visual defect. Suspect orbital injury. Initial imaging. L. CTA head with IV contrast

There is no relevant literature to support the use of CTA head with IV contrast in the initial imaging of posttraumatic vision loss. CTA head may be used for diagnosis of posttraumatic vascular abnormalities, such as carotid cavernous fistula, or in the setting of fractures extending to the skull base with concern for traumatic vascular injury.

Variant 1: Adult. Acute posttraumatic visual defect. Suspect orbital injury. Initial imaging. M. MRA head and neck with IV contrast

There is no relevant literature to support the use of MRA head and neck with IV contrast in the initial imaging of posttraumatic vision loss.

Variant 1: Adult. Acute posttraumatic visual defect. Suspect orbital injury. Initial imaging. N. MRA head and neck without and with IV contrast

There is no relevant literature to support the use of MRA head and neck without and with IV contrast in the initial imaging of posttraumatic vision loss.

Variant 1: Adult. Acute posttraumatic visual defect. Suspect orbital injury. Initial imaging. O. MRA head and neck without IV contrast

There is no relevant literature to support the use of MRA head and neck without IV contrast in the initial imaging of posttraumatic vision loss.

Variant 1: Adult. Acute posttraumatic visual defect. Suspect orbital injury. Initial imaging. P. MRA head with IV contrast

There is no relevant literature to support the use of MRA head with IV contrast in the initial imaging of posttraumatic vision loss.

Variant 1: Adult. Acute posttraumatic visual defect. Suspect orbital injury. Initial imaging. Q. MRA head without and with IV contrast

There is no relevant literature to support the use of MRA head without and with IV contrast in the initial imaging of posttraumatic vision loss.

Variant 1: Adult. Acute posttraumatic visual defect. Suspect orbital injury. Initial imaging. R. MRA head without IV contrast

There is no relevant literature to support the use of MRA head without IV contrast in the initial imaging of posttraumatic vision loss.

Variant 1: Adult. Acute posttraumatic visual defect. Suspect orbital injury. Initial imaging. S. MRI head with IV contrast

There is no relevant literature to support the use of MRI head with IV contrast in the initial imaging of posttraumatic vision loss.

Variant 1: Adult. Acute posttraumatic visual defect. Suspect orbital injury. Initial imaging. T. MRI head without and with IV contrast

There is no relevant literature to support the use of MRI head without and with IV contrast in the initial imaging of posttraumatic vision loss.

Variant 1: Adult. Acute posttraumatic visual defect. Suspect orbital injury. Initial imaging. U. MRI head without IV contrast

There is no relevant literature to support the use of MRI head without IV contrast in the initial imaging of posttraumatic vision loss. MRI head without IV contrast may be warranted to evaluate for associated intracranial injuries; however, this would be ordered after the initial head CT. MRI can detect subtle traumatic intracranial injuries, which may not be conspicuous on noncontrast CT. Routine head MRI protocols vary by institution, and some may contain a coronal T2 sequence, but this is usually performed with larger slice thickness compared with orbital MRI, and without fat suppression, and is therefore less preferable than high-resolution dedicated orbital MRI for the assessment of optic nerve T2 signal abnormalities.

Variant 1: Adult. Acute posttraumatic visual defect. Suspect orbital injury. Initial imaging. V. MRI orbits with IV contrast

There is no relevant literature to support the use of MRI orbits with IV contrast in the initial imaging of posttraumatic vision loss.

Variant 1: Adult. Acute posttraumatic visual defect. Suspect orbital injury. Initial imaging. W. MRI orbits without and with IV contrast

There is no relevant literature to support the use of MRI orbits without and with IV contrast in the initial imaging of posttraumatic vision loss.

Variant 1: Adult. Acute posttraumatic visual defect. Suspect orbital injury. Initial imaging. X. MRI orbits without IV contrast

MRI provides key information in the assessment of visual pathways, including traumatic optic neuropathy. MRI orbits is performed when traumatic optic neuropathy is suspected, and after any metallic foreign body is excluded in cases of penetrating injury [29]. High-resolution coronal T2-weighted imaging of the orbits, preferably with fat suppression, can detect abnormal signal in the optic nerve in traumatic optic neuropathy [13]. Although lacking sensitivity, restricted diffusion of the optic nerve is highly specific for traumatic optic neuropathy in the appropriate clinical setting [27]. CT is better for the assessment of fracture or bone fragments in the setting of traumatic optic neuropathy. MRI is more sensitive than CT for the detection of nonradiopaque foreign bodies, choroidal and retinal detachments, and open-globe injury [13]. CT maxillofacial or CT orbits without IV contrast is the first-line imaging test for acute posttraumatic vision loss, with MRI orbits typically performed as secondary imaging to evaluate traumatic optic neuropathy.

Variant 1: Adult. Acute posttraumatic visual defect. Suspect orbital injury. Initial imaging. Y. Radiography face

There is no relevant literature to support the use of radiography of the face in the initial imaging of posttraumatic vision loss. Radiography is not as sensitive for orbital and facial fractures as CT and does not provide evaluation of the soft tissues [24]. Radiography can identify radio-opaque foreign bodies in the orbits but cannot localize the foreign bodies relative to other soft tissues as CT can [30].

Variant 1: Adult. Acute posttraumatic visual defect. Suspect orbital injury. Initial imaging.

Z. Radiography orbit

There is no relevant literature to support the use of radiography of the orbits in the initial imaging of posttraumatic vision loss. Radiography is not as sensitive for orbital fractures as CT and does not provide evaluation of the soft tissues [24]. Radiography can identify radio-opaque foreign bodies in the orbits but cannot localize the foreign bodies relative to other soft tissues as CT can [30].

Variant 2: Adult. Acute vision loss. Infection or inflammatory disorder suspected. Initial imaging.

Orbital infection, which may manifest as cellulitis and/or subperiosteal or orbital abscess, is an ophthalmologic emergency due to the potential for vision loss or intracranial spread of disease including complications such as meningitis or cerebritis, intracranial abscess, and cavernous sinus thrombosis [37]. Clinically, patients may present with locoregional pain and swelling, decreased visual acuity, and ophthalmoplegia. Orbital infection most commonly results from spread from adjacent structures, often due to bacterial infection of the paranasal sinuses. Distinguishing periorbital from postseptal disease, by clinical findings and imaging, helps to determine the need for IV antibiotics as an inpatient. A subperiosteal abscess usually requires surgical drainage [37]. Orbital complications may also arise from acute invasive fungal sinusitis, an aggressive and high-mortality–associated infection typically affecting immunocompromised patients [30].

Orbital inflammatory disease may be idiopathic or may be secondary to a known granulomatous, inflammatory, or autoimmune etiology, such as sarcoidosis, IgG4-related disease, and Graves' disease, among other disease processes. The clinical manifestations and propensity for vision loss vary with the underlying etiology and orbital subsites affected [12,30]. The clinical presentation and imaging findings often overlap between cellulitis, orbital inflammatory syndrome, and lymphoproliferative lesions [38].

The goals of imaging in the early diagnosis and management of acute infectious or inflammatory pathologies of the orbit are to identify the extent of disease and any associated complications, such as orbital abscess, and to guide appropriate interventions to prevent permanent vision loss or additional sequelae such as intracranial extension or cavernous sinus thrombosis.

Variant 2: Adult. Acute vision loss. Infection or inflammatory disorder suspected. Initial imaging.
A. Arteriography cerebral

There is no relevant literature to support the use of cerebral arteriography in the initial imaging of infectious or inflammatory vision loss.

Variant 2: Adult. Acute vision loss. Infection or inflammatory disorder suspected. Initial imaging.
B. CT head with IV contrast

There is no relevant literature to support the use of CT head with IV contrast in the initial imaging of infectious or inflammatory vision loss. CT head may not include the entire orbit and is not the preferable examination for orbital evaluation. MRI is the preferred imaging test to assess for intracranial extension of inflammatory or infectious orbital disease.

Variant 2: Adult. Acute vision loss. Infection or inflammatory disorder suspected. Initial imaging.
C. CT head without and with IV contrast

There is no relevant literature to support the use of CT head without and with IV contrast in the initial imaging of infectious or inflammatory vision loss.

Variant 2: Adult. Acute vision loss. Infection or inflammatory disorder suspected. Initial imaging.
D. CT head without IV contrast

There is no relevant literature to support the use of CT head without IV contrast in the initial imaging of infectious or inflammatory vision loss.

Variant 2: Adult. Acute vision loss. Infection or inflammatory disorder suspected. Initial imaging.
E. CT maxillofacial with IV contrast

CT with IV contrast is a first-line study performed for acute vision loss due to infectious or inflammatory disease in the emergency setting. CT has high spatial resolution and can delineate periorbital versus postseptal infection, guiding the potential need for inpatient versus outpatient antibiotic treatment [12,37]. CT can demonstrate the presence of adjacent paranasal sinus disease and osseous erosions. CT with IV contrast can also detect abscesses requiring urgent surgical intervention [39]. CT with IV contrast can detect lack of enhancement and enlargement of the superior ophthalmic vein due to thrombosis [37]. MRI offers superior soft tissue contrast compared with CT and can more accurately delineate the extent of inflammatory change within the orbit as well as intracranial extension of disease and can depict even small abscesses [12]. CT orbits generally provide sufficient coverage; however, it may exclude the inferior aspect of the maxillary sinus as well as the maxillary dentition, so in cases in which the suspected cause of the infectious process or the extent of inflammation is outside the CT orbit field of view, a maxillofacial CT is warranted.

Variant 2: Adult. Acute vision loss. Infection or inflammatory disorder suspected. Initial imaging.
F. CT maxillofacial without and with IV contrast

There is no relevant literature to support the use of CT maxillofacial without and with IV contrast in the initial imaging of infectious or inflammatory vision loss.

Variant 2: Adult. Acute vision loss. Infection or inflammatory disorder suspected. Initial imaging.
G. CT maxillofacial without IV contrast

There is no relevant literature to support the use of CT maxillofacial without IV contrast in the initial imaging of infectious or inflammatory vision loss. CT imaging is preferably performed with IV contrast, however noncontrast CT may still provide some useful information. Noncontrast CT will demonstrate soft tissue inflammatory changes and document the presence of adjacent paranasal sinus disease as well as any osseous erosions but will be more limited in distinguishing an abscess from other inflammatory change.

Variant 2: Adult. Acute vision loss. Infection or inflammatory disorder suspected. Initial imaging.
H. CT orbits with IV contrast

CT orbits with IV contrast is a first-line study performed for acute vision loss due to infectious or inflammatory disease in the emergency setting. CT has a high spatial resolution and can delineate periorbital versus postseptal infection, guiding potential need for inpatient versus outpatient antibiotic treatment [12,37]. CT can demonstrate the presence of adjacent paranasal sinus disease

and osseous erosions. CT with IV contrast can also detect abscesses requiring urgent surgical intervention [39]. CT with IV contrast can detect lack of enhancement and enlargement of the superior ophthalmic vein due to thrombosis [37]. MRI offers superior soft tissue contrast compared with CT and can more accurately delineate the extent of inflammatory change within the orbit as well as intracranial extension of disease and can depict even small abscesses [12]. CT orbits protocol may exclude the inferior aspect of the maxillary sinus as well as the maxillary dentition, so in cases in which the suspected cause of the infectious process or the extent of inflammation is outside of the CT orbit field of view, a maxillofacial CT is warranted.

Variant 2: Adult. Acute vision loss. Infection or inflammatory disorder suspected. Initial imaging.
I. CT orbits without and with IV contrast

There is no relevant literature to support the use of CT orbits without and with IV contrast in the initial imaging of infectious or inflammatory vision loss.

Variant 2: Adult. Acute vision loss. Infection or inflammatory disorder suspected. Initial imaging.
J. CT orbits without IV contrast

CT imaging is preferably performed with IV contrast for suspected infectious or inflammatory orbital disease; however, noncontrast CT may still provide some useful information. Noncontrast CT will demonstrate soft tissue inflammatory changes and document the presence of adjacent paranasal sinus disease as well as any osseous erosions but will be more limited in distinguishing an abscess from other inflammatory change. Although MRI offers superior soft tissue resolution, in cases of suspected thyroid orbitopathy, noncontrast CT of the orbits is sufficient to demonstrate many characteristic imaging findings including extraocular muscle enlargement, lacrimal gland prolapse, increased orbital fat, and proptosis [40].

Variant 2: Adult. Acute vision loss. Infection or inflammatory disorder suspected. Initial imaging.
K. CTA head and neck with IV contrast

There is no relevant literature to support the use of CTA head and neck with IV contrast in the initial imaging of infectious or inflammatory vision loss.

Variant 2: Adult. Acute vision loss. Infection or inflammatory disorder suspected. Initial imaging.
L. CTA head with IV contrast

There is no relevant literature to support the use of CTA head with IV contrast in the initial imaging of infectious or inflammatory vision loss. Based on clinical presentation and initial radiological findings, suspected arterial complications of orbital cellulitis or orbital inflammatory disease such as internal carotid artery stenosis or occlusion can be evaluated with CTA head. Depending on the timing of imaging, CTA may be sufficient to diagnose venous abnormalities such as superior ophthalmic vein thrombosis.

Variant 2: Adult. Acute vision loss. Infection or inflammatory disorder suspected. Initial imaging.
M. CTV head with IV contrast

There is no relevant literature to support the use of CT venography (CTV) head with IV contrast in the initial imaging of infectious or inflammatory vision loss. Based on clinical presentation and initial radiological findings, suspected venous complications of orbital cellulitis or orbital

inflammatory disease such as superior ophthalmic vein or cavernous sinus thrombosis can be evaluated with venographic imaging such as CTV head.

Variant 2: Adult. Acute vision loss. Infection or inflammatory disorder suspected. Initial imaging.
N. MRA head and neck with IV contrast

There is no relevant literature to support the use of MRA head and neck with IV contrast in the initial imaging of infectious or inflammatory vision loss.

Variant 2: Adult. Acute vision loss. Infection or inflammatory disorder suspected. Initial imaging.
O. MRA head and neck without and with IV contrast

There is no relevant literature to support the use of MRA head and neck without and with IV contrast in the initial imaging of infectious or inflammatory vision loss.

Variant 2: Adult. Acute vision loss. Infection or inflammatory disorder suspected. Initial imaging.
P. MRA head and neck without IV contrast

There is no relevant literature to support the use of MRA head and neck without IV contrast in the initial imaging of infectious or inflammatory vision loss.

Variant 2: Adult. Acute vision loss. Infection or inflammatory disorder suspected. Initial imaging.
Q. MRA head with IV contrast

There is no relevant literature to support the use of MRA head with IV contrast in the initial imaging of infectious or inflammatory vision loss. MRA head may be performed when arterial complications from intracranial spread of infectious or inflammatory process are suspected, such as abnormalities of the internal carotid artery due to extension of the disease process into the cavernous sinus. Usually, the concern for arterial complications will arise after initial imaging with MRI orbits and/or head is performed. Noncontrast time-of-flight (TOF) MRA of the head has superior spatial resolution compared with contrast-enhanced MRA of the head [41]. In a retrospective study of 123 patients, TOF and contrast-enhanced MRA showed similar sensitivity for diagnosing intracranial arterial occlusion. With respect to the site of intracranial arterial occlusion, contrast-enhanced MRA was shown to more closely correlate with DSA findings for distal internal carotid artery occlusions compared with TOF MRA, but both techniques showed similar performance for other sites of intracranial occlusion [42].

Variant 2: Adult. Acute vision loss. Infection or inflammatory disorder suspected. Initial imaging.
R. MRA head without and with IV contrast

There is no relevant literature to support the use of MRA head without and with IV contrast in the initial imaging of infectious or inflammatory vision loss. MRA head may be performed when arterial complications from intracranial spread of infectious or inflammatory process are suspected, such as abnormalities of the internal carotid artery due to extension of the disease process into the cavernous sinus. Acquiring both MRA head without and with IV contrast is not necessary.

Variant 2: Adult. Acute vision loss. Infection or inflammatory disorder suspected. Initial imaging.
S. MRA head without IV contrast

There is no relevant literature to support the use of MRA head without IV contrast in the initial imaging of infectious or inflammatory vision loss. MRA head may be performed when arterial complications from intracranial spread of infectious or inflammatory process are suspected, such as abnormalities of the internal carotid artery due to extension of the disease process into the cavernous sinus. Usually, the concern for arterial complications will arise after initial imaging with MRI orbits and/or head is performed. Noncontrast TOF MRA of the head has superior spatial resolution compared with contrast-enhanced MRA of the head [41]. In a retrospective study of 123 patients, TOF and contrast-enhanced MRA showed similar sensitivity for diagnosing intracranial arterial occlusion. With respect to the site of intracranial arterial occlusion, contrast-enhanced MRA was shown to more closely correlate with DSA findings for distal internal carotid artery occlusions compared with TOF MRA, but both techniques showed similar performance for other sites of intracranial occlusion [42].

Variant 2: Adult. Acute vision loss. Infection or inflammatory disorder suspected. Initial imaging.
T. MRI head with IV contrast

There is no relevant literature to support the use of MRI head with IV contrast in the initial imaging of infectious or inflammatory vision loss.

Variant 2: Adult. Acute vision loss. Infection or inflammatory disorder suspected. Initial imaging.
U. MRI head without and with IV contrast

MRI head without and with IV contrast is useful to evaluate for intracranial extension of disease. MRI head without and with IV contrast may be performed concurrent with or subsequent to MRI orbital protocol when intracranial spread or complications of orbital infectious or inflammatory disease is suspected. The addition of postcontrast imaging detects meningeal disease and better delineates the extent of infectious or inflammatory process, improves diagnosis of cavernous sinus thrombosis, and complements DWI in distinguishing abscess from phlegmon [43]. Contrast-enhanced MRI of the head using a 3-D T1 gradient echo sequence has been shown to have a high sensitivity and specificity for the detection of dural venous sinus thrombosis [44]. MRI head without and with IV contrast is the preferred cross-sectional imaging modality to diagnose cavernous sinus thrombosis, which appears as engorgement of the cavernous sinus and lateral wall convexity, with filling defects on postcontrast imaging [41].

Variant 2: Adult. Acute vision loss. Infection or inflammatory disorder suspected. Initial imaging.
V. MRI head without IV contrast

There is no relevant literature to support the use of MRI head without IV contrast in the initial imaging of infectious or inflammatory vision loss. When performed to assess for intracranial extension of orbital infectious or inflammatory disease, MRI without and with IV contrast is preferred. The addition of postcontrast imaging detects meningeal disease and better delineates the extent of infectious or inflammatory process, enhances the ability to diagnose cavernous sinus thrombosis, and complements DWI in distinguishing abscess from phlegmon [43].

Variant 2: Adult. Acute vision loss. Infection or inflammatory disorder suspected. Initial imaging.
W. MRI orbits with IV contrast

There is no relevant literature to support the use of MRI orbits with IV contrast without precontrast imaging in the initial imaging of infectious or inflammatory vision loss.

Variant 2: Adult. Acute vision loss. Infection or inflammatory disorder suspected. Initial imaging.

X. MRI orbits without and with IV contrast

MRI is useful for evaluating orbital infection and inflammation and for delineating complications and extent of disease and is optimally performed without and with IV contrast. MRI orbits is the appropriate imaging test as opposed to MRI neck or face as the orbital protocol has the optimal field of view, slice thickness, and sequence selection to evaluate intraorbital abnormalities. Compared with other imaging modalities, MRI offers the highest level of soft tissue contrast while providing good anatomic resolution. Orbital MRI is preferred to routine head MRI in evaluation of infectious and inflammatory pathology of the orbit, due to its higher resolution thinner slice thickness and usefulness of fat-saturated T2 and postcontrast T1-weighted sequences. The various MRI pulse sequences including DWI provide the best imaging information for distinguishing between abscess and infection, inflammatory disease, and neoplastic masses. DWI and postcontrast imaging allow distinction of abscess from edema and phlegmon [12,43]. DWI and apparent diffusion coefficient values may help to distinguish orbital inflammatory syndrome, cellulitis, and lymphoproliferative disease, which have overlapping clinical and imaging features [38]. MRI orbits with IV contrast can detect absence of enhancement and enlargement of the superior ophthalmic vein due to thrombosis [35]. Concurrent head imaging can be performed to assess for intracranial complications as warranted.

Variant 2: Adult. Acute vision loss. Infection or inflammatory disorder suspected. Initial imaging.

Y. MRI orbits without IV contrast

MRI is the imaging modality of choice for evaluating orbital inflammation and for delineating complications and extent of disease. Compared with other imaging modalities, MRI offers the highest level of soft tissue contrast while providing good spatial resolution. Orbital MRI is preferred to routine head MRI in the evaluation of infectious and inflammatory pathology of the orbit, due to its higher resolution thinner slice thickness and usefulness of fat-saturated T2 sequence. Although noncontrast MRI can provide some useful information, imaging should be performed without and with IV contrast. The various MRI pulse sequences including DWI provide the best imaging information for distinguishing between abscess and infection, inflammatory disease, and neoplastic masses. DWI and postcontrast imaging allow distinction of abscess from edema and phlegmon. MRI orbits without IV contrast is less optimal. [12,43]. Concurrent head imaging can be performed to assess for intracranial complications as warranted.

Variant 2: Adult. Acute vision loss. Infection or inflammatory disorder suspected. Initial imaging.

Z. MRV head with IV contrast

There is no relevant literature to support the use of MR venography (MRV) head with IV contrast in the initial imaging of infectious or inflammatory vision loss. MRV head may be useful as follow-up imaging when intracranial venous complications are suspected, such as cavernous sinus thrombosis. Contrast-enhanced MRV of the head using a 3-D T1 gradient echo sequence has been shown to have the highest combination of sensitivity and specificity among MRI sequences for detection of dural venous sinus thrombosis [44]. As a practical matter, if a 3-D T1 postcontrast gradient echo sequence is included with an institution's MRI head without and with IV contrast protocol, further evaluation with a dedicated head MRV is unlikely to provide substantial additional information in the diagnosis of cavernous or dural venous sinus thrombosis.

Variant 2: Adult. Acute vision loss. Infection or inflammatory disorder suspected. Initial imaging.
[. MRV head without and with IV contrast

There is no relevant literature to support the use of MRV head without and with IV contrast in the initial imaging of infectious or inflammatory vision loss. MRV head without IV contrast is limited for detecting cavernous sinus thrombosis. Contrast-enhanced MRI/MRV demonstrates heterogeneous filling defects in cavernous sinus thrombosis [45].

Variant 2: Adult. Acute vision loss. Infection or inflammatory disorder suspected. Initial imaging.
\. MRV head without IV contrast

There is no relevant literature to support the use of MRV head without IV contrast in the initial imaging of infectious or inflammatory vision loss. MRV head without IV contrast is limited for detecting cavernous sinus thrombosis. Contrast-enhanced MRI/MRV demonstrates heterogeneous filling defects in cavernous sinus thrombosis [45].

Variant 3: Adult. Chronic or progressive unilateral vision loss. Intraorbital mass-like lesion suspected or vascular lesion suspected. Initial imaging.

Owing to the variety of structures that reside in the orbit, a wide range of tumors and tumor-like entities can arise within the orbits, as well as involvement by systemic disease processes and metastatic disease [46]. Essentially, the whole gamut of high- and low-flow vascular malformations can affect the orbit, and distinguishing vascular from nonvascular pathologies is important for determining further workup and management. Given the limited confines of the orbit, mass lesions, whether soft tissue neoplasm or vascular etiology, can present with proptosis [47,48]. Masses or inflammatory lesions affecting the orbital apex characteristically present with vision loss and ophthalmoplegia [49].

Orbital masses can be defined based on an anatomic compartmental approach (globe, optic nerve sheath complex, intraconal, extraconal, bone, and multicompartmental). Imaging appearance varies with the specific pathologic entity and structures involved [50]. Benign masses are more common, with malignant tumors increasing in prevalence in adults older than 60 years of age. Excluding cysts, of which dermoid cysts are the most common, cavernous venous malformation is the most common benign orbital mass encountered in adults. Non-Hodgkin lymphoma is the most common malignant orbital mass in adults [51]. Carotid cavernous fistulas will specifically be discussed in the ACR Appropriateness Criteria® topic on "Nontraumatic and Binocular Diplopia," currently in development.

The goal of imaging is to identify and characterize a mass or vascular lesion in the orbit causing chronic or progressive vision loss. Appropriate imaging can confirm the presence of a mass lesion in the orbit, guide management, and, in some cases, provide a specific diagnosis.

Variant 3: Adult. Chronic or progressive unilateral vision loss. Intraorbital mass-like lesion suspected or vascular lesion suspected. Initial imaging.
A. Arteriography cerebral

There is no relevant literature to support the use of cerebral angiography in the initial imaging of chronic or progressive unilateral vision loss.

Variant 3: Adult. Chronic or progressive unilateral vision loss. Intraorbital mass-like lesion suspected or vascular lesion suspected. Initial imaging.

B. CT head with IV contrast

There is no relevant literature to support the use of CT head with IV contrast in the initial imaging of chronic or progressive unilateral vision loss.

Variant 3: Adult. Chronic or progressive unilateral vision loss. Intraorbital mass-like lesion suspected or vascular lesion suspected. Initial imaging.
C. CT head without and with IV contrast

There is no relevant literature to support the use of CT head without and with IV contrast in the initial imaging of chronic or progressive unilateral vision loss.

Variant 3: Adult. Chronic or progressive unilateral vision loss. Intraorbital mass-like lesion suspected or vascular lesion suspected. Initial imaging.
D. CT head without IV contrast

There is no relevant literature to support the use of CT head without IV contrast in the initial imaging of chronic or progressive unilateral vision loss.

Variant 3: Adult. Chronic or progressive unilateral vision loss. Intraorbital mass-like lesion suspected or vascular lesion suspected. Initial imaging.
E. CT maxillofacial with IV contrast

There is no relevant literature to support the use of CT maxillofacial with IV contrast in the initial imaging of chronic or progressive unilateral vision loss. When CT is used to evaluate a mass lesion originating from and centered at the orbit, CT orbits provides the necessary slice thickness and sufficient field of view. A large facial mass that secondarily invades the orbit would require a more inclusive maxillofacial CT field of view.

Variant 3: Adult. Chronic or progressive unilateral vision loss. Intraorbital mass-like lesion suspected or vascular lesion suspected. Initial imaging.
F. CT maxillofacial without and with IV contrast

There is no relevant literature to support the use of CT maxillofacial without and with IV contrast in the initial imaging of chronic or progressive unilateral vision loss.

Variant 3: Adult. Chronic or progressive unilateral vision loss. Intraorbital mass-like lesion suspected or vascular lesion suspected. Initial imaging.
G. CT maxillofacial without IV contrast

There is no relevant literature to support the use of CT maxillofacial without IV contrast in the initial imaging of chronic or progressive unilateral vision loss.

Variant 3: Adult. Chronic or progressive unilateral vision loss. Intraorbital mass-like lesion suspected or vascular lesion suspected. Initial imaging.
H. CT orbits with IV contrast

MRI without and with IV contrast is the first-line imaging examination performed for suspected orbital mass or vascular lesion. MRI has superior soft tissue contrast and can more accurately distinguish the various orbital compartments compared with CT. CT may be useful and can add complementary information in the evaluation of a suspected orbital mass or vascular lesion. CT is the imaging modality of choice for delineating calcifications and osseous masses of the orbit [50,52]. CT performed without and with Valsalva maneuver can be diagnostic for a venous varix of the orbit [48]. Dynamic postcontrast CT will demonstrate characteristic progressive enhancement of cavernous venous malformation [48]. CT may also be indicated as a first-line imaging test with rapidly progressive vision loss.

Variant 3: Adult. Chronic or progressive unilateral vision loss. Intraorbital mass-like lesion suspected or vascular lesion suspected. Initial imaging.
I. CT orbits without and with IV contrast

There is no relevant literature to support the use of CT orbits without and with IV contrast in the initial imaging of chronic or progressive unilateral vision loss. When CT is performed to evaluate an orbital mass, CT orbits with IV contrast is sufficient. MRI without and with IV contrast is generally the first-line imaging examination performed for suspected orbital mass or vascular lesion, owing to its superior soft tissue resolution [50,52].

Variant 3: Adult. Chronic or progressive unilateral vision loss. Intraorbital mass-like lesion suspected or vascular lesion suspected. Initial imaging.
J. CT orbits without IV contrast

There is no relevant literature to support the use of CT orbits without IV contrast in the initial imaging of chronic or progressive unilateral vision loss. MRI without and with IV contrast is the first-line imaging examination performed for suspected orbital mass or vascular lesion, owing to its superior soft tissue resolution [50,52]. CT is the imaging modality of choice for delineating calcifications [50]. CT is the preferred imaging modality to evaluate a mass of osseous origin [46]. If CT orbits is performed, it should be with IV contrast.

Variant 3: Adult. Chronic or progressive unilateral vision loss. Intraorbital mass-like lesion suspected or vascular lesion suspected. Initial imaging.
K. CTA head with IV contrast

There is no relevant literature to support the use of CTA head in the initial imaging of chronic or progressive unilateral vision loss. CTA head may be used in secondary imaging evaluation of high-flow vascular lesions of the orbit, such as arteriovenous malformation [48].

Variant 3: Adult. Chronic or progressive unilateral vision loss. Intraorbital mass-like lesion suspected or vascular lesion suspected. Initial imaging.
L. FDG-PET/CT skull base to mid-thigh

There is no relevant literature to support the use of fluorine-18-2-fluoro-2-deoxy-D-glucose (FDG)-PET/CT in the initial imaging of chronic or progressive unilateral vision loss. FDG-PET/CT does not provide a significant diagnostic advantage over the combination of clinical evaluation and CT/MRI in the diagnosis of primary orbital masses. It has limited spatial resolution, which is especially suboptimal for evaluation of the contents of a small anatomic area such as the orbit. FDG-PET/CT can identify metastatic lesions not delineated by other imaging modalities and is part of the staging workup for orbital lymphomas [50]. FDG-PET is not specific for malignancy and increased PET avidity can be seen in a number of benign masses and infectious or inflammatory processes. Pitfalls related to FDG-PET/CT include overlap in FDG uptake between malignant lesions and inflammatory disease, low uptake in small lesions, obscured delineation due to high uptake in extraocular muscles, or limited assessment at the margin of the field of view in standard skull to upper thigh scans [50,53].

Variant 3: Adult. Chronic or progressive unilateral vision loss. Intraorbital mass-like lesion suspected or vascular lesion suspected. Initial imaging.
M. MRA head and neck with IV contrast

There is no relevant literature to support the use of MRA head and neck with IV contrast in the initial imaging of chronic or progressive unilateral vision loss.

Variant 3: Adult. Chronic or progressive unilateral vision loss. Intraorbital mass-like lesion

suspected or vascular lesion suspected. Initial imaging.
N. MRA head and neck without and with IV contrast

There is no relevant literature to support the use of MRA head and neck without and with IV contrast in the initial imaging of chronic or progressive unilateral vision loss.

Variant 3: Adult. Chronic or progressive unilateral vision loss. Intraorbital mass-like lesion suspected or vascular lesion suspected. Initial imaging.
O. MRA head and neck without IV contrast

There is no relevant literature to support the use of MRA head and neck without IV contrast in the initial imaging of chronic or progressive unilateral vision loss.

Variant 3: Adult. Chronic or progressive unilateral vision loss. Intraorbital mass-like lesion suspected or vascular lesion suspected. Initial imaging.
P. MRA head with IV contrast

There is no relevant literature to support the use of MRA head with IV contrast in the initial imaging of chronic or progressive unilateral vision loss.

Variant 3: Adult. Chronic or progressive unilateral vision loss. Intraorbital mass-like lesion suspected or vascular lesion suspected. Initial imaging.
Q. MRA head without and with IV contrast

There is no relevant literature to support the use of MRA head without and with IV contrast in the initial imaging of chronic or progressive unilateral vision loss.

Variant 3: Adult. Chronic or progressive unilateral vision loss. Intraorbital mass-like lesion suspected or vascular lesion suspected. Initial imaging.
R. MRA head without IV contrast

There is no relevant literature to support the use of MRA head without IV contrast in the initial imaging of chronic or progressive unilateral vision loss.

Variant 3: Adult. Chronic or progressive unilateral vision loss. Intraorbital mass-like lesion suspected or vascular lesion suspected. Initial imaging.
S. MRI head with IV contrast

There is no relevant literature to support the use of MRI head with IV contrast in the initial imaging of chronic or progressive unilateral vision loss.

Variant 3: Adult. Chronic or progressive unilateral vision loss. Intraorbital mass-like lesion suspected or vascular lesion suspected. Initial imaging.
T. MRI head without and with IV contrast

MRI head may be useful to evaluate the extent of an intraorbital mass that extends intracranially. When ordered to evaluate a mass, MRI should be performed without and with IV contrast to provide the most information.

Variant 3: Adult. Chronic or progressive unilateral vision loss. Intraorbital mass-like lesion suspected or vascular lesion suspected. Initial imaging.
U. MRI head without IV contrast

There is no relevant literature to support the use of MRI head without IV contrast in the initial imaging of chronic or progressive unilateral vision loss. If an MRI head is ordered to evaluate intracranial extension of an orbital mass, the examination should be performed without and with IV contrast to provide the most information.

Variant 3: Adult. Chronic or progressive unilateral vision loss. Intraorbital mass-like lesion suspected or vascular lesion suspected. Initial imaging.
V. MRI orbits with IV contrast

There is no relevant literature to support the use of MRI orbits with IV contrast in the initial imaging of chronic or progressive unilateral vision loss. Protocol should include without and with IV contrast sequences being more comprehensive.

Variant 3: Adult. Chronic or progressive unilateral vision loss. Intraorbital mass-like lesion suspected or vascular lesion suspected. Initial imaging.
W. MRI orbits without and with IV contrast

MRI of the orbits without and with IV contrast is the modality of choice for initial imaging of patients with chronic or progressive unilateral vision loss for which orbital mass or vascular lesion is suspected. MRI provides superior soft tissue contrast compared with CT and can accurately assess lesion extent. Orbital MRI is preferred to routine head MRI in the evaluation of intraorbital mass lesions because of its higher resolution thinner slice thickness and usefulness of fat-saturated T2 and postcontrast T1-weighted sequences. Complete evaluation of a suspected orbital mass or vascular lesion requires sequences performed without and with IV contrast [46,50].

Variant 3: Adult. Chronic or progressive unilateral vision loss. Intraorbital mass-like lesion suspected or vascular lesion suspected. Initial imaging.
X. MRI orbits without IV contrast

There is no relevant literature to support the use of MRI orbits without IV contrast in the initial imaging of chronic or progressive unilateral vision loss. MRI provides superior soft tissue contrast compared with CT and can accurately assess lesion extent. Orbital MRI is preferred to routine head MRI in evaluation of intraorbital mass lesions because of its higher resolution thinner slice thickness and usefulness of fat-saturated T2-weighted sequence. Complete evaluation of a suspected orbital mass or vascular lesion requires sequences performed without and with IV contrast [46,50].

Variant 4: Adult. Acute vision loss, retinal structural abnormality suspected. Initial imaging.

Acute vision loss secondary to retinal detachment represents an emergency that, if not treated promptly, can lead to permanent vision loss. The most common form of retinal detachment is rhegmatogenous retinal detachment, which results from a tear or discontinuity in the neurosensory retina allowing vitreous fluid to accumulate in the potential space between the sensory and pigmented retina [54]. Diagnosis of retinal detachment is made based on clinical presentation and dilated funduscopic examination. Imaging is not typically necessary in establishing the diagnosis of retinal detachment. In some instances when the posterior portion of the eye is obscured on funduscopy, such as in the case of vitreous hemorrhage, ocular US can establish the diagnosis [55]. Exudative (serous) retinal detachment involves fluid accumulation in the subretinal space without a break in the neurosensory epithelium. A number of pathologic entities, including various inflammatory, infectious, neoplastic, vascular, and degenerative conditions, can cause breakdown of the blood-retinal barrier, which leads to exudative retinal detachment [56].

Central retinal artery occlusion manifests as sudden, painless monocular vision loss and an afferent pupillary defect. Diagnosis is made based on clinical presentation and funduscopic examination [57]. Radiologic imaging is not involved in the initial diagnosis. IV fibrinolytic therapy may be performed for patients within the designated treatment window [58].

Although retinal detachments are typically diagnosed based on clinical and ophthalmologic examination, imaging may identify associated findings in exudative (nonrhegmatogenous) retinal detachments. With exudative retinal detachments, imaging can be performed to identify the underlying cause of the detachment, such as a choroidal mass or uveomeningeal syndrome. Prompt treatment of acute retinal detachment is often necessary to prevent permanent vision loss.

Variant 4: Adult. Acute vision loss, retinal structural abnormality suspected. Initial imaging. A. CT head with IV contrast

There is no relevant literature to support the use of CT head with IV contrast in the initial imaging of acute vision loss, retinal structural abnormality suspected.

Variant 4: Adult. Acute vision loss, retinal structural abnormality suspected. Initial imaging. B. CT head without and with IV contrast

There is no relevant literature to support the use of CT head without and with IV contrast in the initial imaging of acute vision loss, retinal structural abnormality suspected.

Variant 4: Adult. Acute vision loss, retinal structural abnormality suspected. Initial imaging. C. CT head without IV contrast

There is no relevant literature to support the use of CT head without IV contrast in the initial imaging of acute vision loss, retinal structural abnormality suspected. CT head without IV contrast may be performed before IV fibrinolytic therapy in the setting of acute central retinal artery occlusion to exclude intracranial hemorrhage prior to initiating treatment.

Variant 4: Adult. Acute vision loss, retinal structural abnormality suspected. Initial imaging. D. CT maxillofacial with IV contrast

There is no relevant literature to support the use of CT maxillofacial with IV contrast in the initial imaging of acute vision loss, retinal structural abnormality suspected.

Variant 4: Adult. Acute vision loss, retinal structural abnormality suspected. Initial imaging. E. CT maxillofacial without and with IV contrast

There is no relevant literature to support the use of CT maxillofacial without and with IV contrast in the initial imaging of acute vision loss, retinal structural abnormality suspected.

Variant 4: Adult. Acute vision loss, retinal structural abnormality suspected. Initial imaging. F. CT maxillofacial without IV contrast

There is no relevant literature to support the use of CT maxillofacial without IV contrast in the initial imaging of acute vision loss, retinal structural abnormality suspected.

Variant 4: Adult. Acute vision loss, retinal structural abnormality suspected. Initial imaging. G. CT orbits with IV contrast

There is no relevant literature to support the use of CT orbits with IV contrast in the initial imaging of acute vision loss, retinal structural abnormality suspected.

Variant 4: Adult. Acute vision loss, retinal structural abnormality suspected. Initial imaging. H. CT orbits without and with IV contrast

There is no relevant literature to support the use of CT orbits without and with IV contrast in the initial imaging of acute vision loss, retinal structural abnormality suspected.

Variant 4: Adult. Acute vision loss, retinal structural abnormality suspected. Initial imaging. I. CT orbits without IV contrast

There is no relevant literature to support the use of CT orbits without IV contrast in the initial imaging of acute vision loss, retinal structural abnormality suspected.

Variant 4: Adult. Acute vision loss, retinal structural abnormality suspected. Initial imaging. J. CTA head with IV contrast

There is no relevant literature to support the use of CTA head with IV contrast in the initial imaging of acute vision loss, retinal structural abnormality suspected.

Variant 4: Adult. Acute vision loss, retinal structural abnormality suspected. Initial imaging. K. MRA head and neck with IV contrast

There is no relevant literature to support the use of MRA head and neck with IV contrast in the initial imaging of acute vision loss, retinal structural abnormality suspected.

Variant 4: Adult. Acute vision loss, retinal structural abnormality suspected. Initial imaging. L. MRA head and neck without and with IV contrast

There is no relevant literature to support the use of MRA head and neck without and with IV contrast in the initial imaging of acute vision loss, retinal structural abnormality suspected.

Variant 4: Adult. Acute vision loss, retinal structural abnormality suspected. Initial imaging. M. MRA head and neck without IV contrast

There is no relevant literature to support the use of MRA head and neck without IV contrast in the initial imaging of acute vision loss, retinal structural abnormality suspected.

Variant 4: Adult. Acute vision loss, retinal structural abnormality suspected. Initial imaging. N. MRA head with IV contrast

There is no relevant literature to support the use of MRA head with IV contrast in the initial imaging of acute vision loss, retinal structural abnormality suspected.

Variant 4: Adult. Acute vision loss, retinal structural abnormality suspected. Initial imaging. O. MRA head without and with IV contrast

There is no relevant literature to support the use of MRA head without and with IV contrast in the initial imaging of acute vision loss, retinal structural abnormality suspected.

Variant 4: Adult. Acute vision loss, retinal structural abnormality suspected. Initial imaging. P. MRA head without IV contrast

There is no relevant literature to support the use of MRA head without IV contrast in the initial imaging of acute vision loss, retinal structural abnormality suspected.

Variant 4: Adult. Acute vision loss, retinal structural abnormality suspected. Initial imaging. Q. MRI head with IV contrast

There is no relevant literature to support the use of MRI head with IV contrast in the initial imaging of acute vision loss, retinal structural abnormality suspected.

Variant 4: Adult. Acute vision loss, retinal structural abnormality suspected. Initial imaging. R. MRI head without and with IV contrast

There is no relevant literature to support the use of MRI head without and with IV contrast in the initial imaging of acute vision loss, retinal structural abnormality suspected.

Variant 4: Adult. Acute vision loss, retinal structural abnormality suspected. Initial imaging. S. MRI head without IV contrast

There is no relevant literature to support the use of MRI head without IV contrast in the initial imaging of acute vision loss, retinal structural abnormality suspected.

Variant 4: Adult. Acute vision loss, retinal structural abnormality suspected. Initial imaging. T. MRI orbits with IV contrast

There is no relevant literature to support the use of MRI orbits with IV contrast in the initial imaging of acute vision loss, retinal structural abnormality suspected.

Variant 4: Adult. Acute vision loss, retinal structural abnormality suspected. Initial imaging. U. MRI orbits without and with IV contrast

There is no relevant literature to support the use of MRI orbits without and with IV contrast in the initial imaging of acute vision loss, retinal structural abnormality suspected. Although not a part of the initial diagnostic evaluation, MRI orbits without and with IV contrast may be selectively performed to evaluate an underlying mass or other pathologic condition causing an exudative retinal detachment [56].

Variant 4: Adult. Acute vision loss, retinal structural abnormality suspected. Initial imaging. V. MRI orbits without IV contrast

There is no relevant literature to support the use of MRI orbits without IV contrast in the initial imaging of acute vision loss, retinal structural abnormality suspected.

Variant 5: Adult. Acute or chronic vision loss, optic nerve abnormality suspected. Initial imaging.

A wide range of pathologies can affect the optic nerve and optic nerve sheath and can be associated with acute, subacute, or chronic vision loss. These include neoplastic, inflammatory, ischemic, and demyelinating diseases, as well as traumatic optic neuropathy, which has been discussed in Variant 1.

Neoplasms will typically exhibit a more chronic, slowly progressive onset of visual loss compared with optic neuropathies. Optic nerve gliomas, the most common primary neoplasm of the optic nerve, may present incidentally, such as in younger patients with neurofibromatosis type 1 or with visual changes or proptosis. Gliomas presenting in adults are more likely to be malignant. Meningiomas in the orbit can arise primary from the optic nerve sheath or result from orbital extension of an intracranial mass. Symptomatic meningiomas involving the optic nerve sheath classically present with chronic painless, progressive vision loss [52].

Inflammatory and demyelinating ON can have overlapping clinical and imaging appearances. The presence of optic nerve enhancement is considered reflective of changes related to edema, inflammation, and demyelination. Demyelinating ON may be caused by multiple different etiologies, including multiple sclerosis (MS) and antibody-mediated disorders such as neuromyelitis optica (NMO) and myelin oligodendrocyte glycoprotein antibody disease (MOGAD). In addition, ON can be due to chronic relapsing-remitting inflammatory ON, a steroid-dependent, recurrent ON, or secondary to systemic inflammatory disease or infectious etiologies [59]. Although overlap exists in the imaging appearance of etiologies of ON, certain trends in optic nerve enhancement patterns have been noted. Bilateral simultaneous optic nerve enhancement and longer segment involvement is more frequently seen with MOGAD and NMO than with MS, which characteristically shows shorter segment unilateral optic nerve involvement. Optic nerve sheath and perioptic enhancement is more distinctive of MOGAD. Anterior optic nerve

involvement is more characteristic of MS or MOGAD, whereas NMO trends to the posterior optic nerves, chiasm, or tracts. Concomitant MRI of the brain and spine may be performed to detected associated abnormalities [59-61]. Detection of asymptomatic optic nerve lesions can also help distinguish relapsing-remitting MS and clinically isolated syndrome from NMO and MOGAD [62,63].

Optic perineuritis, which may be secondary to idiopathic orbital inflammation, autoimmune disease, and infectious or other inflammatory etiologies, may clinically overlap with acute demyelinating ON, with symptoms of vision loss and pain exacerbated with eye movement. Patients with optic perineuritis tend to be older and are more likely to have central vision sparing [64].

Ischemic optic neuropathy can be divided into anterior (anterior ischemic optic neuropathy [AION]) and posterior (posterior ischemic optic neuropathy [PION]) varieties depending on whether the ischemia occurs at the optic nerve head or in the retrobulbar optic nerve. AION classically presents with optic disc edema and altitudinal visual field defects. Both AION and PION are divided into nonarteritic (patients with underlying vascular risk factors such as hypertension and diabetes) and arteritic (most commonly giant cell arteritis) types.

The goal of imaging is to identify demyelinating, inflammatory, ischemic, or neoplastic pathology affecting the optic nerve. Different pathologies affecting the optic nerve can have overlapping clinical presentation. Proper imaging can identify the cause or at least delineate findings to generate an appropriate differential diagnosis, and guide management.

Variant 5: Adult. Acute or chronic vision loss, optic nerve abnormality suspected. Initial imaging.
A. CT head with IV contrast

There is no relevant literature to support the use of CT head with IV contrast in the initial imaging of acute or chronic vision loss, optic nerve abnormality suspected.

Variant 5: Adult. Acute or chronic vision loss, optic nerve abnormality suspected. Initial imaging.
B. CT head without and with IV contrast

There is no relevant literature to support the use of CT head without and with IV contrast in the initial imaging of acute or chronic vision loss, optic nerve abnormality suspected.

Variant 5: Adult. Acute or chronic vision loss, optic nerve abnormality suspected. Initial imaging.
C. CT head without IV contrast

There is no relevant literature to support the use of CT head without IV contrast in the initial imaging of acute or chronic vision loss, optic nerve abnormality suspected.

Variant 5: Adult. Acute or chronic vision loss, optic nerve abnormality suspected. Initial imaging.
D. CT maxillofacial with IV contrast

There is no relevant literature to support the use of CT maxillofacial with IV contrast in the initial imaging of acute or chronic vision loss, optic nerve abnormality suspected.

Variant 5: Adult. Acute or chronic vision loss, optic nerve abnormality suspected. Initial

imaging.
E. CT maxillofacial without and with IV contrast

There is no relevant literature to support the use of CT maxillofacial without and with IV contrast in the initial imaging of acute or chronic vision loss, optic nerve abnormality suspected.

Variant 5: Adult. Acute or chronic vision loss, optic nerve abnormality suspected. Initial imaging.
F. CT maxillofacial without IV contrast

There is no relevant literature to support the use of CT maxillofacial without IV contrast in the initial imaging of acute or chronic vision loss, optic nerve abnormality suspected.

Variant 5: Adult. Acute or chronic vision loss, optic nerve abnormality suspected. Initial imaging.
G. CT orbits with IV contrast

There is no relevant literature to support the use of CT orbits with IV contrast in the initial imaging of acute or chronic vision loss, optic nerve abnormality suspected. Postcontrast CT may demonstrate the characteristic tram track enhancement of optic nerve sheath meningiomas, as well as nerve sheath calcifications, which may be present in up to half of cases, but MRI with its superior soft tissue resolution is considered the first-line imaging modality for suspected optic nerve or sheath disorders [52].

Variant 5: Adult. Acute or chronic vision loss, optic nerve abnormality suspected. Initial imaging.
H. CT orbits without and with IV contrast

There is no relevant literature to support the use of CT orbits without and with IV contrast in the initial imaging of acute or chronic vision loss, optic nerve abnormality suspected.

Variant 5: Adult. Acute or chronic vision loss, optic nerve abnormality suspected. Initial imaging.
I. CT orbits without IV contrast

There is no relevant literature to support the use of CT orbits without IV contrast in the initial imaging of acute or chronic vision loss, optic nerve abnormality suspected. CT will demonstrate optic nerve sheath calcifications present in up to half of optic nerve sheath meningiomas, favoring the diagnosis, but MRI with its superior soft tissue resolution is considered the first-line imaging modality for suspected optic nerve or sheath disorders [52].

Variant 5: Adult. Acute or chronic vision loss, optic nerve abnormality suspected. Initial imaging.
J. CTA head and neck with IV contrast

There is no relevant literature to support the use of CTA head and neck with IV contrast in the initial imaging of acute or chronic vision loss, optic nerve abnormality suspected. In cases of ischemic optic neuropathy, vascular imaging of the head and neck may be subsequently performed to assess for vascular disease.

Variant 5: Adult. Acute or chronic vision loss, optic nerve abnormality suspected. Initial imaging.
K. CTA head with IV contrast

There is no relevant literature to support the use of CTA head with IV contrast in the initial imaging of acute or chronic vision loss, optic nerve abnormality suspected. In cases of ischemic optic

neuropathy, vascular imaging may be subsequently performed to assess for vascular disease. Complete vascular assessment includes evaluation of the neck.

Variant 5: Adult. Acute or chronic vision loss, optic nerve abnormality suspected. Initial imaging.
L. MRA head and neck with IV contrast

There is no relevant literature to support the use of MRA head and neck with IV contrast in the initial imaging of acute or chronic vision loss, optic nerve abnormality suspected. In cases of ischemic optic neuropathy, vascular imaging of the head and neck may be subsequently performed to assess for vascular disease.

Variant 5: Adult. Acute or chronic vision loss, optic nerve abnormality suspected. Initial imaging.
M. MRA head and neck without and with IV contrast

There is no relevant literature to support the use of MRA head and neck without and with IV contrast in the initial imaging of acute or chronic vision loss, optic nerve abnormality suspected. In cases of ischemic optic neuropathy, vascular imaging of the head and neck may be subsequently performed to assess for vascular disease.

Variant 5: Adult. Acute or chronic vision loss, optic nerve abnormality suspected. Initial imaging.
N. MRA head and neck without IV contrast

There is no relevant literature to support the use of MRA head and neck without IV contrast in the initial imaging of acute or chronic vision loss, optic nerve abnormality suspected. In cases of ischemic optic neuropathy, vascular imaging of the head and neck may be subsequently performed to assess for vascular disease.

Variant 5: Adult. Acute or chronic vision loss, optic nerve abnormality suspected. Initial imaging.
O. MRA head with IV contrast

There is no relevant literature to support the use of MRA head with IV contrast in the initial imaging of acute or chronic vision loss, optic nerve abnormality suspected. In cases of ischemic optic neuropathy, vascular imaging may be subsequently performed to assess for vascular disease. Complete vascular assessment includes evaluation of the head and neck.

Variant 5: Adult. Acute or chronic vision loss, optic nerve abnormality suspected. Initial imaging.
P. MRA head without and with IV contrast

There is no relevant literature to support the use of MRA head without and with IV contrast in the initial imaging of acute or chronic vision loss, optic nerve abnormality suspected. In cases of ischemic optic neuropathy, vascular imaging may be subsequently performed to assess for vascular disease. Complete vascular assessment includes evaluation of the head and neck.

Variant 5: Adult. Acute or chronic vision loss, optic nerve abnormality suspected. Initial imaging.
Q. MRA head without IV contrast

There is no relevant literature to support the use of MRA head without IV contrast in the initial imaging of acute or chronic vision loss, optic nerve abnormality suspected. In cases of ischemic optic neuropathy, vascular imaging may be subsequently performed to assess for vascular disease.

Complete vascular assessment includes evaluation of the head and neck.

Variant 5: Adult. Acute or chronic vision loss, optic nerve abnormality suspected. Initial imaging.
R. MRI head with IV contrast

There is no relevant literature to support the use of MRI head with IV contrast in the initial imaging of acute or chronic vision loss, optic nerve abnormality suspected.

Variant 5: Adult. Acute or chronic vision loss, optic nerve abnormality suspected. Initial imaging.
S. MRI head without and with IV contrast

MRI of the head without and with IV contrast may be performed concurrent with or subsequent to MRI orbits. Dedicated MRI of the orbits without and with IV contrast is the best initial imaging modality to evaluate a suspected abnormality of the optic nerve. If inflammatory optic neuropathy or demyelinating ON is suspected, MRI of the head can evaluate for intracranial manifestations. MRI brain features and number of lesions can predict the risk of development of MS after the first episode of acute ON [65]. Postcontrast 3-D Cube T1-weighted whole brain MRI has been shown to demonstrate high sensitivity and accuracy for detection of optic nerve enhancement in acute ON [66]. On its own, however, a nonoptimized routine brain MRI protocol has lower sensitivity for ON detection compared with dedicated orbital MRI, although institutional protocol variation would affect this sensitivity [67]. The combination of optic nerve enhancement pattern and distribution of white matter lesions in the brain has been shown to be highly accurate for distinguishing between AION and ON [68].

Variant 5: Adult. Acute or chronic vision loss, optic nerve abnormality suspected. Initial imaging.
T. MRI head without IV contrast

There is no relevant literature to support the use of MRI head without IV contrast in the initial imaging of acute or chronic vision loss, optic nerve abnormality suspected. MRI orbits without and with IV contrast is the recommended imaging examination to evaluate a suspected abnormality of the optic nerve or sheath. Noncontrast MRI of the head has been advocated by some as an efficient modality to follow-up patients with known demyelinating disease or history of ON while avoiding repeated IV gadolinium administration. Noncontrast imaging is unable to delineate enhancing lesions, which may be seen in acute disease. MRI head acquired with a standard MS protocol does not have the same sensitivity as a coronal short tau inversion recovery (STIR) sequence for the detection of T2 hyperintense optic nerve lesions, particularly those involving the intraorbital segment [69]. Sensitivity of routine brain MRI sequences for detecting optic nerve signal abnormalities will vary depending on the specific sequences acquired and technical factors including slice thickness of the institutional protocol.

Variant 5: Adult. Acute or chronic vision loss, optic nerve abnormality suspected. Initial imaging.
U. MRI orbits with IV contrast

There is no relevant literature to support the use of MRI orbits with IV contrast in the initial imaging of acute or chronic vision loss, optic nerve abnormality suspected.

Variant 5: Adult. Acute or chronic vision loss, optic nerve abnormality suspected. Initial imaging.
V. MRI orbits without and with IV contrast

MRI orbits without and with IV contrast is the imaging test of choice for differentiating the underlying pathogenesis of visual loss due to an optic nerve disorder. Optic pathway gliomas and optic nerve sheath meningiomas have characteristic imaging appearances on MRI. Optic pathway gliomas in adults can be malignant and enhancing; as such, the administration of IV contrast is important for delineating areas of enhancement, a feature suggesting a higher-grade neoplasm. Postcontrast imaging offers the best resolution to demonstrate the extent of meningioma, including intracranial and orbital apex involvement [52].

Dedicated orbital MRI protocol offers higher sensitivity for T2 hyperintense optic pathway lesion detection compared with routine head MRI. Compared with routine head MRI, orbital MRI offers higher resolution thinner slice thickness and fat-saturated T2 and postcontrast T1-weighted sequences [69]. Coronal 2-D STIR sequences are commonly used to evaluate for T2 hyperintense optic nerve lesions. Three-dimensional double inversion recovery and 3-D STIR have been shown to have a high sensitivity for optic nerve lesion detection [62,63]. Contrast-enhanced fluid-attenuated inversion recovery sequences can detect even trace volumes of subarachnoid gadolinium and as such have been shown to be sensitive for detection of perioptic enhancement, which in some cases may be the only pathologic finding noted on imaging [70]. A 3T MRI has been shown to be more sensitive than 1.5T MRI for ON lesion detection [71]. Enhancement suggests acute lesions in ON. The pattern of optic nerve enhancement can aid in distinguishing among potential etiologies of ON, which is especially helpful before laboratory tests results and antibody status are known [60]. MRI with IV contrast is useful in distinguishing acute ON, which has enhancement centered in the optic nerve, from optic perineuritis, which has indistinctly marginated enhancement along the nerve sheath, and which may possibly be associated with other areas of retrobulbar or orbital enhancement [64,72].

Contrast enhancement of the optic nerve head has been more consistently shown than restricted diffusion in AION, particularly of the arteritic type [73,74]. Delay in imaging and lack of a dedicated orbital DWI sequence may account for the lower-than-expected cases that have restricted diffusion reported in the literature for ischemic optic neuropathy [73]. In a study of patients with AION, restricted diffusion of the optic disc was observed in 71% of patients imaged within 5 days of symptom onset compared with approximately 4% in patients imaged later [75]. Enhancement of the optic nerve head can be seen in both arteritic and nonarteritic AION but is more consistently seen in the former group [74]. The combination of optic nerve enhancement pattern and distribution of white matter lesions in the brain has been shown to be highly accurate for distinguishing between AION and ON [68].

Variant 5: Adult. Acute or chronic vision loss, optic nerve abnormality suspected. Initial imaging.

W. MRI orbits without IV contrast

There is no relevant literature to support the use of MRI orbits without IV contrast in the initial imaging of acute or chronic vision loss, optic nerve abnormality suspected. Noncontrast MRI sequences provide some diagnostic information; however, postcontrast MRI sequences are necessary to provide the most complete initial evaluation for a suspected optic nerve abnormality. Compared with routine head MRI, orbital MRI offers higher resolution thinner slice thickness and fat-saturated T2-weighted sequence. Although an expansile mass indistinguishable from the optic nerve in a patient with chronic progressive visual loss can be fairly confidently diagnosed as an optic nerve glioma, given that gliomas in adults can be malignant, contrast is needed to assess for areas of enhancement, a feature suggestive of higher-grade neoplasm [52]. Enhancement involving

the optic nerve and/or sheath is important to distinguish optic neuropathy and demyelinating ON from perioptic neuritis, which may present with similar clinical features [64,72]. Noncontrast MRI can detect lesions of ON but cannot reliably distinguish acute from chronic lesions [62]. Contrast enhancement in an optic nerve segment in a patient with ON suggests acute inflammation [60]. Contrast enhancement of the optic nerve head has been more consistently shown than restricted diffusion in AION, particularly of the arteritic type [73,74].

Variant 6: Adult. Bitemporal hemianopia or junctional scotoma. Sellar or parasellar mass suspected. Initial imaging.

Bitemporal hemianopia and junctional scotoma result from extrinsic compression or pathology intrinsic to the optic chiasm or junction of the optic nerve and chiasm, respectively [76]. Pituitary macroadenomas can grow into the suprasellar cistern and compress the optic chiasm and adjacent optic nerves or tracts. Meningiomas represent only a small proportion of sellar region masses but may involve the sellar, suprasellar, or parasellar regions and can exert mass effect on the optic nerves or chiasm. Sellar/suprasellar region meningiomas are most commonly homogenously enhancing, and a dural tail is common but not universal. In cases in which the site of origin distinct from the pituitary gland cannot be conclusively determined, distinction of a sellar meningioma from a pituitary adenoma is not always possible radiographically [77]. Craniopharyngiomas are suprasellar masses, which commonly compress the optic chiasm. Unlike the mixed cystic and solid, frequently calcified, and heterogeneously enhancing adamantinomatous type seen more frequently in children, the papillary type seen in adults is usually diffusely solid and enhancing and rarely calcifies [76,78]. Hypophysitis or large Rathke cleft cysts, as well as any mass involving the suprasellar cistern, can potentially compress the chiasm or posterior segments of the optic nerves [76]. Most neoplastic etiologies present with gradual progressive visual symptoms [9]. Pituitary apoplexy, most commonly from hemorrhagic infarction of a preexisting adenoma, can result in rapid enlargement of the adenoma with headache and vision changes [2].

Large aneurysms of the internal carotid artery or Circle of Willis vessels may compress the optic nerves or chiasm. Optic pathway gliomas and inflammatory and demyelinating disorders as discussed in Variant 5 may also affect the optic chiasm. Granulomatous disease or lymphoma can infiltrate the pituitary infundibulum, optic nerves, or chiasm [9].

The goal of imaging is to identify a sellar or suprasellar mass in patients presenting with bitemporal hemianopia visual field defects. Appropriate imaging can identify the presence of a sellar or suprasellar mass compressing the optic chiasm and guide management.

Variant 6: Adult. Bitemporal hemianopia or junctional scotoma. Sellar or parasellar mass suspected. Initial imaging.
A. Arteriography cerebral

There is no relevant literature to support the use of cerebral arteriography in the initial imaging of bitemporal hemianopia or junctional scotoma. Angiography may be employed for aneurysm treatment or in the pretreatment characterization of aneurysms to evaluate morphology and other anatomic considerations, but CTA or MRA are the initial imaging examinations to diagnose an aneurysm compressing the optic chiasm.

Variant 6: Adult. Bitemporal hemianopia or junctional scotoma. Sellar or parasellar mass suspected. Initial imaging.
B. CT head with IV contrast

There is no relevant literature to support the use of CT head with IV contrast in the initial imaging of bitemporal hemianopia or junctional scotoma.

Variant 6: Adult. Bitemporal hemianopia or junctional scotoma. Sellar or parasellar mass suspected. Initial imaging.
C. CT head without and with IV contrast

There is no relevant literature to support the use of CT head without and with IV contrast in the initial imaging of bitemporal hemianopia or junctional scotoma.

Variant 6: Adult. Bitemporal hemianopia or junctional scotoma. Sellar or parasellar mass suspected. Initial imaging.
D. CT head without IV contrast

There is no relevant literature to support the use of CT head without IV contrast in the initial imaging of bitemporal hemianopia or junctional scotoma.

Variant 6: Adult. Bitemporal hemianopia or junctional scotoma. Sellar or parasellar mass suspected. Initial imaging.
E. CT orbits with IV contrast

There is no relevant literature to support the use of CT orbits with IV contrast in the initial imaging of bitemporal hemianopia or junctional scotoma.

Variant 6: Adult. Bitemporal hemianopia or junctional scotoma. Sellar or parasellar mass suspected. Initial imaging.
F. CT orbits without and with IV contrast

There is no relevant literature to support the use of CT orbits without and with IV contrast in the initial imaging of bitemporal hemianopia or junctional scotoma.

Variant 6: Adult. Bitemporal hemianopia or junctional scotoma. Sellar or parasellar mass suspected. Initial imaging.
G. CT orbits without IV contrast

There is no relevant literature to support the use of CT orbits without IV contrast in the initial imaging of bitemporal hemianopia or junctional scotoma.

Variant 6: Adult. Bitemporal hemianopia or junctional scotoma. Sellar or parasellar mass suspected. Initial imaging.
H. CT sella with IV contrast

There is no relevant literature to support the use of CT sella with IV contrast in the initial imaging of bitemporal hemianopia or junctional scotoma. CT will demonstrate a sellar or suprasellar mass lesion and compression of the optic chiasm; however, MRI, with its superior soft tissue resolution, is the preferred imaging modality to characterize masses of the sellar and suprasellar regions as well as diseases intrinsic to the optic nerves or chiasm. CT can provide complementary information, such as confirming the presence of calcifications or invasion of adjacent osseous structures [79]. CT is useful in evaluating masses of osseous origin.

Variant 6: Adult. Bitemporal hemianopia or junctional scotoma. Sellar or parasellar mass suspected. Initial imaging.
I. CT sella without and with IV contrast

There is no relevant literature to support the use of CT sella without and with IV contrast in the initial imaging of bitemporal hemianopia or junctional scotoma.

Variant 6: Adult. Bitemporal hemianopia or junctional scotoma. Sellar or parasellar mass suspected. Initial imaging.
J. CT sella without IV contrast

There is no relevant literature to support the use of CT sella without IV contrast in the initial imaging of bitemporal hemianopia or junctional scotoma. CT will demonstrate a sellar or suprasellar mass lesion and compression of the optic chiasm; however, MRI, with its superior soft tissue resolution, is the preferred imaging modality to characterize masses of the sellar and suprasellar regions as well as diseases intrinsic to the optic nerves or chiasm. CT can provide complementary information, such as confirming the presence of calcifications or invasion of adjacent osseous structures [79]. CT is recommended in evaluating masses of osseous origin. Noncontrast CT may show hyperattenuation from acute hemorrhage in pituitary apoplexy; however, MRI is more sensitive for the diagnosis and can also evaluate for underlying pituitary mass, which may not have been previously detected [2]. CT is recommended in evaluating masses of osseous origin.

Variant 6: Adult. Bitemporal hemianopia or junctional scotoma. Sellar or parasellar mass suspected. Initial imaging.
K. CTA head and neck with IV contrast

There is no relevant literature to support the use of CTA head and neck with IV contrast in the initial imaging of bitemporal hemianopia or junctional scotoma.

Variant 6: Adult. Bitemporal hemianopia or junctional scotoma. Sellar or parasellar mass suspected. Initial imaging.
L. CTA head with IV contrast

Large aneurysms arising from the internal carotid artery or Circle of Willis vessels can extrinsically compress on the optic chiasm or junctional zone, causing visual symptoms [9,76]. If initial imaging by MRI suggests an aneurysm, subsequent evaluation is performed by CTA or MRA to establish the diagnosis.

Variant 6: Adult. Bitemporal hemianopia or junctional scotoma. Sellar or parasellar mass suspected. Initial imaging.
M. MRA head and neck with IV contrast

There is no relevant literature to support the use of MRA head and neck with IV contrast in the initial imaging of bitemporal hemianopia or junctional scotoma.

Variant 6: Adult. Bitemporal hemianopia or junctional scotoma. Sellar or parasellar mass suspected. Initial imaging.
N. MRA head and neck without and with IV contrast

There is no relevant literature to support the use of MRA head and neck without and with IV contrast in the initial imaging of bitemporal hemianopia or junctional scotoma.

Variant 6: Adult. Bitemporal hemianopia or junctional scotoma. Sellar or parasellar mass suspected. Initial imaging.
O. MRA head and neck without IV contrast

There is no relevant literature to support the use of MRA head and neck without IV contrast in the initial imaging of bitemporal hemianopia or junctional scotoma.

Variant 6: Adult. Bitemporal hemianopia or junctional scotoma. Sellar or parasellar mass suspected. Initial imaging.

P. MRA head with IV contrast

There is no relevant literature to support the use of MRA head with IV contrast in the initial imaging of bitemporal hemianopia or junctional scotoma. Large aneurysms arising from the internal carotid artery or Circle of Willis vessels can extrinsically compress on the optic chiasm or junctional zone, causing visual symptoms [9,76]. If initial imaging by MRI suggests an aneurysm, subsequent evaluation is performed by CTA or MRA to establish the diagnosis. The use of contrast in the initial diagnosis of intracranial aneurysm may vary with institutional preference. Contrast-enhanced MRA has been shown to compare favorably to DSA to determine aneurysm size and morphological characteristics [80].

Variant 6: Adult. Bitemporal hemianopia or junctional scotoma. Sellar or parasellar mass suspected. Initial imaging.

Q. MRA head without and with IV contrast

There is no relevant literature to support the use of MRA head without and with IV contrast in the initial imaging of bitemporal hemianopia or junctional scotoma. Large aneurysms arising from the internal carotid artery or Circle of Willis vessels can extrinsically compress on the optic chiasm or junctional zone, causing visual symptoms [9,76]. If initial imaging by MRI suggests an aneurysm, subsequent evaluation is performed by CTA or MRA to establish the diagnosis. The use of contrast in the initial diagnosis of intracranial aneurysm may vary with institutional preference. A large meta-analysis showed a high sensitivity of TOF MRA for the detection of intracranial aneurysms >3 mm [81]. TOF and contrast-enhanced MRA compare similarly in aneurysm detection; however, contrast-enhanced MRA has been shown to more reliably demonstrate morphologic features of the aneurysm [80].

Variant 6: Adult. Bitemporal hemianopia or junctional scotoma. Sellar or parasellar mass suspected. Initial imaging.

R. MRA head without IV contrast

There is no relevant literature to support the use of MRA head without IV contrast in the initial imaging of bitemporal hemianopia or junctional scotoma. Large aneurysms arising from the internal carotid artery or Circle of Willis vessels can extrinsically compress on the optic chiasm or junctional zone, causing visual symptoms [9,76]. If initial imaging by MRI suggests an aneurysm, subsequent evaluation is performed by CTA or MRA to establish the diagnosis. The use of contrast in the initial diagnosis of intracranial aneurysm may vary with institutional preference. A large meta-analysis showed a high sensitivity of TOF MRA for detection of intracranial aneurysms >3 mm [81]. TOF and contrast-enhanced MRA compare similarly in aneurysm detection; however, contrast-enhanced MRA has been shown to more reliably demonstrate morphologic features of the aneurysm [80].

Variant 6: Adult. Bitemporal hemianopia or junctional scotoma. Sellar or parasellar mass suspected. Initial imaging.

S. MRI head with IV contrast

There is no relevant literature to support the use of MRI head with IV contrast in the initial imaging of bitemporal hemianopia or junctional scotoma.

Variant 6: Adult. Bitemporal hemianopia or junctional scotoma. Sellar or parasellar mass suspected. Initial imaging.

T. MRI head without and with IV contrast

MRI head is generally sufficient to diagnose a large pituitary macroadenoma that compresses the

optic chiasm, causing visual field deficits. Routine MRI head will use a larger slice thickness than an MRI sella protocol, and the type of coronal sequences will vary by institution. MRI sella without and with IV contrast with small field of view and thin section images along with MRI sequence selection optimized for evaluation of the sellar and parasellar region provides greater depiction of anatomic detail and higher resolution than a routine MRI of the head [79]. MRI head without and with IV contrast is useful for pathologies that may not be confined to the sellar region, such as granulomatous or metastatic disease or lymphoma.

Variant 6: Adult. Bitemporal hemianopia or junctional scotoma. Sellar or parasellar mass suspected. Initial imaging.
U. MRI head without IV contrast

There is no relevant literature to support the use of MRI head without IV contrast in the initial imaging of bitemporal hemianopia or junctional scotoma. Imaging is preferably performed without and with IV contrast.

Variant 6: Adult. Bitemporal hemianopia or junctional scotoma. Sellar or parasellar mass suspected. Initial imaging.
V. MRI orbits with IV contrast

There is no relevant literature to support the use of MRI orbits with IV contrast in the initial imaging of bitemporal hemianopia or junctional scotoma.

Variant 6: Adult. Bitemporal hemianopia or junctional scotoma. Sellar or parasellar mass suspected. Initial imaging.
W. MRI orbits without and with IV contrast

There is no relevant literature to support the use of MRI orbits without and with IV contrast in the initial imaging of bitemporal hemianopia or junctional scotoma.

Variant 6: Adult. Bitemporal hemianopia or junctional scotoma. Sellar or parasellar mass suspected. Initial imaging.
X. MRI orbits without IV contrast

There is no relevant literature to support the use of MRI orbits without IV contrast in the initial imaging of bitemporal hemianopia or junctional scotoma.

Variant 6: Adult. Bitemporal hemianopia or junctional scotoma. Sellar or parasellar mass suspected. Initial imaging.
Y. MRI sella with IV contrast

There is no relevant literature to support the use of MRI sella with IV contrast in the initial imaging of bitemporal hemianopia or junctional scotoma.

Variant 6: Adult. Bitemporal hemianopia or junctional scotoma. Sellar or parasellar mass suspected. Initial imaging.
Z. MRI sella without and with IV contrast

MRI sella without and with IV contrast is the initial imaging test of choice to evaluate suspected sellar or suprasellar region pathology causing bitemporal hemianopia or junctional scotoma. Coronal and sagittal thin section pre- and postcontrast T1-weighted imaging and T2-weighted imaging with a small field of view centered at the sellar and suprasellar regions provides the best delineation of anatomy and pathologic processes involving the sellar and parasellar regions, cavernous sinuses, and posterior optic nerves and optic chiasm [78,79]. MRI sella without and with IV contrast is the best imaging modality to characterize the imaging features of masses as well as

inflammatory and other disease processes involving the sellar and suprasellar regions, and to delineate mass extent and relationship to adjacent structures including the optic chiasm and cavernous sinus [9,79].

Variant 6: Adult. Bitemporal hemianopia or junctional scotoma. Sellar or parasellar mass suspected. Initial imaging.
[. MRI sella without IV contrast

There is no relevant literature to support the use of MRI sella without IV contrast in the initial imaging of bitemporal hemianopia or junctional scotoma. Sellar and suprasellar masses and their relationship to the optic chiasm can be diagnosed on noncontrast imaging; however, MRI sella without and with IV contrast is the best imaging modality to characterize the imaging features of masses involving the sellar and suprasellar regions as well as to delineate mass extent and relationship to adjacent structures including the optic chiasm and cavernous sinus [9,79]. Noncontrast MRI can detect T2 hyperintensity from inflammatory or demyelinating disease affecting the optic chiasm but cannot distinguish acute from chronic lesions [62].

Summary of Highlights

This is a summary of the key recommendations from the variant tables. Refer to the complete narrative document for more information.

- **Variant 1**: For acute posttraumatic visual defect, CT orbits without IV contrast and CT maxillofacial without IV contrast are the recommended initial imaging studies to assess for fractures and soft tissue injuries of the orbit that may be causing the visual defect. These are alternative procedures. CT orbits have a field of view confined to the orbital region and are indicated for direct blunt or penetrating trauma to the orbital region. CT maxillofacial images from the frontal sinus through the mandible and are indicated when additional facial injuries are suspected. CT head without IV contrast may be indicated as a complementary procedure if concomitant traumatic brain injury or intracranial hemorrhage is suspected.
- **Variant 2**: For acute vision loss with suspicion of underlying infection or inflammatory disorder, CT orbits with IV contrast, CT maxillofacial with IV contrast, and MRI orbits without and with IV contrast are the recommended initial imaging studies. Contrast-enhanced CT is the first-line imaging study performed in the emergency setting because it will delineate the extent of the infectious or inflammatory process as well as any abscess that may require surgical intervention. CT orbits and CT maxillofacial are alternative procedures and the choice depends on whether the infection or inflammation is suspected to be confined to or might extend outside of the CT orbits' field of view; an example of the latter is a process involving or arising from the maxillary region or dentition. MRI orbits without and with IV contrast is a complementary procedure that offers the highest level of soft tissue contrast and can differentiate between pathologies such as abscess and phlegmon. MRI head without and with IV contrast may be indicated if intracranial extension of the infectious or inflammatory process is suspected.
- **Variant 3**: For chronic or progressive vision loss when an orbital mass or vascular lesion is suspected, MRI orbits without and with IV contrast is the imaging test of choice. MRI with its various sequences provides the best soft tissue contrast to differentiate between various mass lesions of the orbit. MRI head without and with IV contrast may be indicated for the assessment of an orbital mass that extends intracranially. CT orbits with IV contrast may be indicated as a complementary procedure especially for delineating calcifications, osseous

involvement, or primary bone lesions in the orbital region.

- **Variant 4**: For acute vision loss suspected to be caused by a retinal structural abnormality, no imaging is indicated in the initial workup. Retinal detachments are diagnosed by ophthalmologic examination and possibly ocular US. After the initial diagnosis, MRI orbits without and with IV contrast may be indicated to further characterize a mass or other pathology causing an exudative retinal detachment.
- **Variant 5**: For acute or chronic vision loss in which an optic nerve abnormality is suspected, MRI orbits without and with IV contrast is the recommended initial imaging study. MRI with its superior soft tissue resolution accurately identifies the presence and extent of disease involving the nerve and/or nerve sheath; signal changes and enhancement characteristics permit differentiation of different pathologies. MRI head without and with IV contrast may be indicated as a complementary procedure when concurrent intracranial/brain disease is a possibility, such as in the case of demyelinating diseases.
- **Variant 6**: For bitemporal hemianopia or junctional scotoma in which a sellar or parasellar abnormality is suspected, MRI sella without and with IV contrast is the recommended initial imaging study. This study provides superior contrast resolution and allows accurate characterization and delineation of a mass as well as its effects on or involvement of adjacent structures. MRI head without and with IV contrast may be indicated for disease processes not limited to the sellar region, such as granulomatous diseases, metastasis, or lymphoma.

Supporting Documents

The evidence table, literature search, and appendix for this topic are available at https://acsearch.acr.org/list. The appendix includes the strength of evidence assessment and the final rating round tabulations for each recommendation.

For additional information on the Appropriateness Criteria methodology and other supporting documents, please go to the ACR website at https://www.acr.org/Clinical-Resources/Clinical-Tools-and-Reference/Appropriateness-Criteria.

Gender Equality and Inclusivity Clause

The ACR acknowledges the limitations in applying inclusive language when citing research studies that predates the use of the current understanding of language inclusive of diversity in sex, intersex, gender, and gender-diverse people. The data variables regarding sex and gender used in the cited literature will not be changed. However, this guideline will use the terminology and definitions as proposed by the National Institutes of Health.

Appropriateness Category Names and Definitions

Appropriateness Category Name	Appropriateness Rating	Appropriateness Category Definition
Usually Appropriate	7, 8, or 9	The imaging procedure or treatment is indicated in the specified clinical scenarios at a favorable risk-benefit ratio for patients.
May Be Appropriate	4, 5, or 6	The imaging procedure or treatment may be indicated in the specified clinical scenarios as an alternative to imaging procedures or treatments with

		a more favorable risk-benefit ratio, or the risk-benefit ratio for patients is equivocal.
May Be Appropriate (Disagreement)	5	The individual ratings are too dispersed from the panel median. The different label provides transparency regarding the panel's recommendation. "May be appropriate" is the rating category and a rating of 5 is assigned.
Usually Not Appropriate	1, 2, or 3	The imaging procedure or treatment is unlikely to be indicated in the specified clinical scenarios, or the risk-benefit ratio for patients is likely to be unfavorable.

Relative Radiation Level Information

Potential adverse health effects associated with radiation exposure are an important factor to consider when selecting the appropriate imaging procedure. Because there is a wide range of radiation exposures associated with different diagnostic procedures, a relative radiation level (RRL) indication has been included for each imaging examination. The RRLs are based on effective dose, which is a radiation dose quantity that is used to estimate population total radiation risk associated with an imaging procedure. Patients in the pediatric age group are at inherently higher risk from exposure, because of both organ sensitivity and longer life expectancy (relevant to the long latency that appears to accompany radiation exposure). For these reasons, the RRL dose estimate ranges for pediatric examinations are lower as compared with those specified for adults (see Table below). Additional information regarding radiation dose assessment for imaging examinations can be found in the ACR Appropriateness Criteria® Radiation Dose Assessment Introduction document.

Relative Radiation Level Designations

Relative Radiation Level*	Adult Effective Dose Estimate Range	Pediatric Effective Dose Estimate Range
O	0 mSv	0 mSv
☢	<0.1 mSv	<0.03 mSv
☢☢	0.1-1 mSv	0.03-0.3 mSv
☢☢☢	1-10 mSv	0.3-3 mSv
☢☢☢☢	10-30 mSv	3-10 mSv
☢☢☢☢☢	30-100 mSv	10-30 mSv

*RRL assignments for some of the examinations cannot be made, because the actual patient doses in these procedures vary as a function of a number of factors (e.g., region of the body exposed to ionizing radiation, the imaging guidance that is used). The RRLs for these examinations are designated as "Varies."

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Disclaimer

The ACR Committee on Appropriateness Criteria and its expert panels have developed criteria for determining appropriate imaging examinations for diagnosis and treatment of specified medical condition(s). These criteria are intended to guide radiologists, radiation oncologists and referring physicians in making decisions regarding radiologic imaging and treatment. Generally, the complexity and severity of a patient's clinical condition should dictate the selection of appropriate imaging procedures or treatments. Only those examinations generally used for evaluation of the patient's condition are ranked. Other imaging studies necessary to evaluate other co-existent diseases or other medical consequences of this condition are not considered in this document. The availability of equipment or personnel may influence the selection of appropriate imaging procedures or treatments. Imaging techniques classified as investigational by the FDA have not been considered in developing these criteria; however, study of new equipment and applications should be encouraged. The ultimate decision regarding the appropriateness of any specific radiologic examination or treatment must be made by the referring physician and radiologist in light of all the circumstances presented in an individual examination.

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