American College of Radiology
ACR Appropriateness Criteria®
Nontraumatic and Binocular Diplopia

Variant 1: **Ophthalmoplegia or diplopia. Initial imaging.**

Procedure	Appropriateness Category	RRL
MRI head without and with IV contrast	Usually Appropriate	O
MRI orbits without and with IV contrast	Usually Appropriate	O
CT orbits with IV contrast	Usually Appropriate	☢☢☢
MRI orbits without IV contrast	Usually Appropriate	O
CT orbits without IV contrast	May Be Appropriate	☢☢☢
CTA head and neck with IV contrast	May Be Appropriate	☢☢☢
MRA head and neck without and with IV contrast	May Be Appropriate	O
MRA head and neck without IV contrast	May Be Appropriate	O
MRI head without IV contrast	May Be Appropriate	O
CT head with IV contrast	May Be Appropriate	☢☢☢
CT head without IV contrast	May Be Appropriate	☢☢☢
Arteriography cervicocerebral	Usually Not Appropriate	☢☢☢
CT head without and with IV contrast	Usually Not Appropriate	☢☢☢
CT orbits without and with IV contrast	Usually Not Appropriate	☢☢☢
X-ray orbit	Usually Not Appropriate	☢

Expert Panel on Neurologic Imaging: Tabassum A. Kennedy, MD[a]; Amanda S. Corey, MD[b]; Bruno Policeni, MD[c]; Vikas Agarwal, MD[d]; Judah Burns, MD[e]; H. Benjamin Harvey, MD, JD[f]; Jenny Hoang, MBBS[g]; Christopher H. Hunt, MD[h]; Amy F. Juliano, MD[i]; William Mack, MD[j]; Gul Moonis, MD[k]; Gregory J. A. Murad, MD[l]; Jeffrey S. Pannell, MD[m]; Matthew S. Parsons, MD[n]; William J. Powers, MD[o]; Jason W. Schroeder, MD[p*]; Gavin Setzen, MD[q]; Matthew T. Whitehead, MD[r]; Julie Bykowski, MD.[s]

Summary of Literature Review

Introduction/Background

Ophthalmoplegia is paralysis of one or more extraocular muscles. This may be caused by impaired motility of the muscles, disrupted nerve conduction along the neuromuscular junction, or from denervation of the affected cranial nerve or brainstem nucleus. Ophthalmoplegia may also be related to granulomatous, inflammatory, neoplastic, and traumatic abnormalities that primarily affect the extraocular muscles.

This topic is currently undergoing revision and an updated variant description for Nontraumatic and Binocular Diplopia is expected to be released in the second half of 2026.

It is important to note the overlap of visual loss and other conditions addressed by independent ACR Appropriateness Criteria. For vision loss see the ACR Appropriateness Criteria® topic on "Vision Loss" [1].

Acute ischemic or hemorrhagic stroke should be emergently excluded in the setting of sudden onset, painless visual loss and it is important to remember that patients presenting with acute onset of diplopia may be presenting with deficits related to a posterior circulation stroke.is extensively reviewed in the ACR Appropriateness Criteria® topics on "Cerebrovascular Diseases-Aneurysm, Vascular Malformation, and Subarachnoid Hemorrhage" [2] and "Cerebrovascular Diseases-Stroke and Stroke-Related Conditions" [3]. The ACR Appropriateness Criteria® "Headache" [4] addresses the need for immediate evaluation in the setting of papilledema [5], as well as imaging of suspected giant-cell arteritis and posterior reversible encephalopathy, which may have associated visual symptoms.

CT and MRI are often complementary when assessing visual loss [6,7]. The inherent contrast provided by orbital fat allows for excellent anatomic definition with either technique. Ultrasound (US) and fluorescein angiography are also important diagnostic tools, however, these unique procedures are most often performed by the ophthalmologist and are beyond the scope of this article.

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 (i.e., only one procedure will be ordered to provide the clinical information to effectively manage the patient's care)

OR

[a]Principal Author, University of Wisconsin Hospital and Clinic, Madison, Wisconsin. [b]Panel Chair, Emory University, Atlanta, Georgia. [c]Panel Vice-Chair, University of Iowa Hospitals and Clinics, Iowa City, Iowa. [d]University of Pittsburgh Medical Center, Pittsburgh, Pennsylvania. [e]Montefiore Medical Center, Bronx, New York. [f]Massachusetts General Hospital, Boston, Massachusetts. [g]Duke University Medical Center, Durham, North Carolina. [h]Mayo Clinic, Rochester, Minnesota. [i]Massachusetts Eye and Ear Infirmary, Massachusetts General Hospital, Harvard Medical School, Boston, Massachusetts. [j]University of Southern California, Los Angeles, California; neurosurgical consultant. [k]Columbia University Medical Center, New York, New York. [l]University of Florida, Gainesville, Florida; neurosurgical consultant. [m]University of California San Diego Medical Center, San Diego, California. [n]Mallinckrodt Institute of Radiology, Saint Louis, Missouri. [o]University of North Carolina School of Medicine, Chapel Hill, North Carolina; American Academy of Neurology. [p]Walter Reed National Military Medical Center, Bethesda, Maryland. [q]Albany ENT & Allergy Services, PC, Albany, New York; American Academy of Otolaryngology-Head and Neck Surgery. [r]Children's National Medical Center, Washington, District of Columbia. [s]Specialty Chair, UC San Diego Health, San Diego, California.

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

Discussion of Procedures by Variant

Variant 1: Ophthalmoplegia or diplopia. Initial imaging.

A patient presenting with diplopia or disconjugate gaze may have an abnormality that involves the globe; the extraocular muscles; neuromuscular junction; cranial nerves III, IV and/or VI; or their respective fascicles, nuclei or connecting tracts within the brain stem. A broad differential including developmental, neoplastic, granulomatous, infectious, inflammatory, demyelinating, vascular, and traumatic causes can be considered in patients with diplopia. This broad differential can be narrowed when one considers the age of the patient, the onset of symptoms, and the presence of associated findings. The pattern of involvement can usually lead to the anatomical localization of the offending lesion.

Patients with isolated cranial nerve III palsies can be divided into pupil-involving or pupil-sparing, suggesting vascular compression versus vasculopathic etiologies, respectively. Isolated cranial nerve IV palsies are most often caused by trauma [8] and rarely nerve sheath tumors. Isolated cranial nerve VI palsies may be caused by lesions within the prepontine cistern, skull base, cavernous sinus, or sella. Isolated cranial nerve VI palsies may also be seen in the setting of increased intracranial pressure without direct compression of the nerve [9]. Multiple ipsilateral cranial nerve palsies that affect cranial nerves III, IV, and VI suggest a lesion at the cavernous sinus or orbital apex [10] and can occur with pathology in the basilar subarachnoid space, as seen in infectious meningitis (TB, fungal, Lyme disease) or noninfectious causes (sarcoid, neoplasm, perineural, or leptomeningeal tumor spread). In patients with internuclear ophthalmoplegia, a brain-stem lesion affecting the medial longitudinal fasciculus should be suspected. A demyelinating plaque in the setting of multiple sclerosis is a primary consideration in younger patients and stroke in older patients presenting with an acute internuclear ophthalmoplegia [11]. Other likely considerations include tumor, hemorrhage, and infection [11].

MRI

MRI of the orbits without and with contrast is preferred [12] if ophthalmoplegia is felt to be related to a primary disease process within the orbit affecting the extraocular muscles or if there is history of trauma, enophthalmos, proptosis, orbital inflammation, or chemosis. An MRI of the orbits with the globes imaged during different gaze positions may aid in identifying a potential muscular slip or pulley abnormality [13].

If the disease process is felt to involve the brain stem, brain, or cisternal segments of the cranial nerves, an MRI of the head without and with contrast including additional small field-of-view high-resolution T2-weighted images of the cranial nerves is the preferred imaging modality to evaluate for an underlying abnormality of the brain, brain stem, and cranial nerves [5,14,15]. This dedicated MRI of the cranial nerves primarily focuses on the nuclear, cisternal, and skull-base cranial nerve segments and can be centered upon cranial nerves III–IV, including the cavernous sinuses. For example, patients with isolated pupil-sparing third-nerve palsies, which primarily involve the oculomotor fibers, vasculopathic considerations are the primary differential consideration and are best evaluated with an MRI examination of the head with special attention to the cranial nerves.

CT

In patients with ophthalmoplegia or diplopia with associated secondary signs of proptosis, orbital inflammation, or trauma, a dedicated orbit CT is typically indicated to evaluate the extraocular muscles. Contrast is often indicated in the setting of orbital inflammation assessment but not indicated in the acute traumatic setting, as specified in Variant 1. CT is superior to MRI for foreign body assessment, calcification detection, and osseous evaluation [15]. Although CT imaging of the orbits is preferred, CT imaging of the head may be appropriate if an intracranial abnormality is suspected. Precontrast and postcontrast imaging of the orbits is typically not necessary in evaluating these patients as the precontrast images do not add significant diagnostic information in this scenario.

CTA, MRA, Arteriography

Isolated, pupil-involving third-nerve palsy suggests external compression of the parasympathetic nerves that surround the oculomotor fibers in the third-nerve fascicles. As the primary consideration is vascular compression from an adjacent aneurysm, vascular imaging either with CTA or MRA is indicated [16]. This assessment is not performed in isolation but rather as a complement to anatomic cross-sectional imaging. Please refer to the ACR

Appropriateness Criteria® topics on "Cerebrovascular Diseases-Aneurysm, Vascular Malformation, and Subarachnoid Hemorrhage" [2] and "Cerebrovascular Diseases-Stroke and Stroke-Related Conditions" [3] for imaging in this context. There is a limited role for digital subtraction angiography in the initial evaluation of patients with diplopia. However, if an aneurysm is detected in cross-sectional evaluation, digital subtraction angiography may be indicated for further assessment and treatment.

Radiography

Orbital or skull radiographs are insufficient to detect pathology in patients presenting with proptosis and have primarily been supplanted by CT.

Summary of Recommendations

- Diplopia or ophthalmoplegia can be evaluated with contrast-enhanced MRI of the head, contrast-enhanced MRI of the orbits, contrast-enhanced CT of the orbits, or noncontrast MRI of the orbits, which are complementary in their roles. Whether to focus the assessment on the orbits and/or head will depend on suspected anatomic localization and differential diagnosis related to the patient's specific clinical presentation.

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, click here.

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 [17].

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 [18].

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 (eg, 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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18. American College of Radiology. ACR Appropriateness Criteria® Radiation Dose Assessment Introduction. Available at: https://edge.sitecorecloud.io/americancoldf5f-acrorgf92a-productioncb02-3650/media/ACR/Files/Clinical/Appropriateness-Criteria/ACR-Appropriateness-Criteria-Radiation-Dose-Assessment-Introduction.pdf.