



## Guideline Summary NGC-7784

### Guideline Title

ACR Appropriateness Criteria® vertigo and hearing loss.

### Bibliographic Source(s)

Turski PA, Wippold FJ II, Cornelius RS, Brunberg JA, Davis PC, De La Paz RL, Dormont D, Gray L, Jordan JE, Mukherji SK, Nussenbaum B, Seidenwurm DJ, Sloan MA, Zimmerman RD, Expert Panel on Neurologic Imaging. ACR Appropriateness Criteria® vertigo and hearing loss. [online publication]. Reston (VA): American College of Radiology (ACR); 2008. 7 p. [61 references]

### Guideline Status


This is the current release of the guideline.

This guideline updates a previous version: Turski PA, Seidenwurm DJ, Davis PC, Brunberg JA, De La Paz RL, Dormont D, Hackney DB, Jordan JE, Karis JP, Mukherji SK, Wippold FJ II, Zimmerman RD, McDermott MW, Sloan MA, Expert Panel on Neurologic Imaging. Vertigo and hearing loss. [online publication]. Reston (VA): American College of Radiology (ACR); 2006. 8 p. [53 references]

The appropriateness criteria are reviewed annually and updated by the panels as needed, depending on introduction of new and highly significant scientific evidence.

### FDA Warning/Regulatory Alert

**Note from the National Guideline Clearinghouse:** This guideline references a drug(s) for which important revised regulatory and/or warning information has been released.

- [September 9, 2010 – Gadolinium-based Contrast Agents](#) : The U.S. Food and Drug Administration (FDA) is requiring changes in the professional labeling for gadolinium-based contrast agents (GBCAs) to minimize the risk of nephrogenic systemic fibrosis (NSF), a rare, but serious, condition associated with the use of GBCAs in certain patients with kidney dysfunction.

## Scope

### Disease/Condition(s)

- Vertigo
- Hearing loss

### Guideline Category

Diagnosis

Evaluation

### Clinical Specialty

Family Practice

Internal Medicine

Neurology

Oncology

Otolaryngology

Pediatrics

Radiology

### Intended Users

Health Plans

Hospitals

Managed Care Organizations

Physicians

Utilization Management

### Guideline Objective(s)

To evaluate the appropriateness of initial radiologic examinations for patients with vertigo and hearing loss

## Target Population

Patients with vertigo and hearing loss

## Interventions and Practices Considered

1. Magnetic resonance imaging (MRI), head and internal auditory canal, without and with contrast
2. Computed tomography (CT)
  - Head, without and with contrast
  - Temporal bone, without contrast
3. MR angiography (MRA), head, with or without contrast
4. CT angiography (CTA), head

## Major Outcomes Considered

Utility of radiologic examinations in differential diagnosis

## Methodology

---

### Methods Used to Collect/Select the Evidence

Searches of Electronic Databases

### Description of Methods Used to Collect/Select the Evidence

#### Literature Search Procedure

The Medline literature search is based on keywords provided by the topic author. The two general classes of keywords are those related to the condition (e.g., ankle pain, fever) and those that describe the diagnostic or therapeutic intervention of interest (e.g., mammography, MRI).

The search terms and parameters are manipulated to produce the most relevant, current evidence to address the American College of Radiology Appropriateness Criteria (ACR AC) topic being reviewed or developed. Combining the clinical conditions and diagnostic modalities or therapeutic procedures narrows the search to be relevant to the topic. Exploding the term "diagnostic imaging" captures relevant results for diagnostic topics.

The following criteria/limits are used in the searches.

1. Articles that have abstracts available and are concerned with humans.
2. Restrict the search to the year prior to the last topic update or in some cases the author of the topic may specify which year range to use in the search. For new topics, the year range is restricted to the last 5 years unless the topic author provides other instructions.
3. May restrict the search to Adults only or Pediatrics only.
4. Articles consisting of only summaries or case reports are often excluded from final results.

The search strategy may be revised to improve the output as needed.

### Number of Source Documents

The total number of source documents identified as the result of the literature search is not known.

### Methods Used to Assess the Quality and Strength of the Evidence

Weighting According to a Rating Scheme (Scheme Given)

### Rating Scheme for the Strength of the Evidence

#### Strength of Evidence Key

Category 1 - The conclusions of the study are valid and strongly supported by study design, analysis, and results.

Category 2 - The conclusions of the study are likely valid, but study design does not permit certainty.

Category 3 - The conclusions of the study may be valid, but the evidence supporting the conclusions is inconclusive or equivocal.

Category 4 - The conclusions of the study may not be valid because the evidence may not be reliable given the study design or analysis.

### Methods Used to Analyze the Evidence

Systematic Review with Evidence Tables

### Description of the Methods Used to Analyze the Evidence

The topic author drafts or revises the narrative text summarizing the evidence found in the literature. American College of Radiology (ACR) staff draft an evidence table based on the analysis of the selected literature. These tables rate the strength of the evidence for all articles included in the narrative text.

The expert panel reviews the narrative text, evidence table, and the supporting literature for each of the topic-variant combinations and assigns an appropriateness rating for each procedure listed in the table. Each individual panel

member forms his/her own opinion based on his/her interpretation of the available evidence.

More information about the evidence table development process can be found in the ACR Appropriateness Criteria® Evidence Table Development document (see "Availability of Companion Documents" field).

## Methods Used to Formulate the Recommendations

Expert Consensus (Delphi)

### Description of Methods Used to Formulate the Recommendations

#### Modified Delphi Technique

When the data available from existing scientific studies are insufficient, the American College of Radiology Appropriateness Criteria (ACR AC) employs systematic consensus techniques to determine appropriateness. The ACR AC panels use a modified Delphi technique to determine the rating for a specific procedure. A series of surveys are conducted to elicit each individual panelist's expert opinion of the appropriateness of an imaging or therapeutic procedure for a specific clinical scenario based on the available data. ACR staff distributes surveys to the panelists along with the evidence table and narrative. Each panelist interprets the available evidence and rates each procedure. Voting surveys are completed by panelists without consulting other panelists. The ratings are integers on a scale between 1 and 9, where 1 means the panel member feels the procedure is "least appropriate" and 9 means the panel member feels the procedure is "most appropriate." Each panel member has one vote per round to assign a rating. The surveys are collected and de-identified and the results are tabulated and redistributed after each round. A maximum of three rounds are conducted. The modified Delphi technique enables each panelist to express individual interpretations of the evidence and his or her expert opinion without excessive bias from fellow panelists in a simple, standardized, and economical process.

Consensus among the panel members must be achieved to determine the final rating for each procedure. If eighty percent (80%) of the panel members agree on a single rating or one of two consecutive ratings, the final rating is determined by the rating that is closest to the median of all the ratings. Up to three voting rounds are conducted to achieve consensus.

If consensus is not reached through the modified Delphi technique, the panel is convened by conference call. The strengths and weaknesses of each imaging examination or procedure are discussed and a final rating is proposed. If the panelists on the call agree, the rating is accepted as the panel's consensus. The document is circulated to all the panelists to make the final determination. If consensus cannot be reached, "No consensus" appears in the rating column and the reasons for this decision are added to the comment sections.

### Rating Scheme for the Strength of the Recommendations

Not applicable

### Cost Analysis

A formal cost analysis was not performed and published cost analyses were not reviewed.

### Method of Guideline Validation

Internal Peer Review

### Description of Method of Guideline Validation

Criteria developed by the Expert Panels are reviewed by the American College of Radiology (ACR) Committee on Appropriateness Criteria.

## Recommendations

### Major Recommendations

**Note from the American College of Radiology (ACR) and the National Guideline Clearinghouse (NGC):** ACR has updated its Relative Radiation Level categories and Rating Scale. The Rating Scale now includes categories (1,2,3 = Usually not appropriate; 4,5,6 = May be appropriate; 7,8,9 = Usually appropriate). See the original guideline document for details.

#### ACR Appropriateness Criteria®

##### Clinical Condition: Vertigo and Hearing Loss

##### Variant 1: Sensorineural hearing loss, acute and intermittent vertigo.

Radiologic Procedure	Rating	Comments	RRL*
MRI head and internal auditory canal without and with contrast	8	See statement regarding contrast in text under "Anticipated Exceptions."	None
MRI head and internal auditory canal without contrast	7		None
CT temporal bone without contrast	6	For possible cholesteatoma with labyrinthine fistula.	Med
CT head without and with contrast	3		Med
<b>Rating Scale:</b> 1=Least appropriate, 9=Most appropriate			<b>*Relative Radiation Level</b>

Note: Abbreviations used in the tables are listed at the end of the "Major Recommendations" field.

**Variant 2: Sensorineural hearing loss, no vertigo.**

Radiologic Procedure	Rating	Comments	RRL*
MRI head and internal auditory canal without and with contrast	8	See statement regarding contrast in text under "Anticipated Exceptions."	None
MRI head and internal auditory canal without contrast	7		None
CT temporal bone without contrast	5		Med
CT head without and with contrast	4		Med
<b>Rating Scale:</b> 1=Least appropriate, 9=Most appropriate			<b>*Relative Radiation Level</b>

Note: Abbreviations used in the tables are listed at the end of the "Major Recommendations" field.

**Variant 3: Conductive hearing loss, to rule out petrous bone abnormality.**

Radiologic Procedure	Rating	Comments	RRL*
CT temporal bone without contrast	8		Med
CT head without and with contrast	3		Med
MRI head and internal auditory canal without and with contrast	3		None
MRI head and internal auditory canal without contrast	3	MRI is superior to CT for detecting dural invasion and extradural extension.	None
<b>Rating Scale:</b> 1=Least appropriate, 9=Most appropriate			<b>*Relative Radiation Level</b>

Note: Abbreviations used in the tables are listed at the end of the "Major Recommendations" field.

**Variant 4: Total deafness, cochlear implant candidate, surgical planning.**

Radiologic Procedure	Rating	Comments	RRL*
CT temporal bone without contrast	9		Med
MRI head and internal auditory canal without and with contrast	5	See statement regarding contrast in text under "Anticipated Exceptions."	None
MRI head and internal auditory canal without contrast	5		None
CT head without and with contrast	3		Med
<b>Rating Scale:</b> 1=Least appropriate, 9=Most appropriate			<b>*Relative Radiation Level</b>

Note: Abbreviations used in the tables are listed at the end of the "Major Recommendations" field.

**Variant 5: Fluctuating hearing loss, history of meningitis or to rule out congenital anomaly.**

Radiologic Procedure	Rating	Comments	RRL*
CT temporal bone without contrast	8		Med
MRI head and internal auditory canal without contrast	7		None
MRI head and internal auditory canal without and with contrast	7	See statement regarding contrast in text under "Anticipated Exceptions."	None
CT head without and with contrast	4		Med
<b>Rating Scale:</b> 1=Least appropriate, 9=Most appropriate			<b>*Relative Radiation Level</b>

Note: Abbreviations used in the tables are listed at the end of the "Major Recommendations" field.

**Variant 6: Episodic vertigo, new onset (hours to days).**

Radiologic Procedure	Rating	Comments	RRL*
MRI head and internal auditory canal without and with contrast	7	See statement regarding contrast in text under "Anticipated Exceptions."	None
MRI head and internal auditory canal without contrast	6		None
MRA head with or without contrast	6	See statement regarding contrast in text under "Anticipated Exceptions."	None
CT head without and with contrast	5		Med
CTA head	5		Med
CT temporal bone without contrast	4		Med
<b>Rating Scale:</b> 1=Least appropriate, 9=Most appropriate			<b>*Relative Radiation Level</b>

Note: Abbreviations used in the tables are listed at the end of the "Major Recommendations" field.

**Variant 7: Vertigo, no hearing loss, normal neurological examination.**

Radiologic Procedure	Rating	Comments	RRL*
----------------------	--------	----------	------

MRI head and internal auditory canal without and with contrast	8	See statement regarding contrast in text under "Anticipated Exceptions."	None
MRI head and internal auditory canal without contrast	7		None
CT temporal bone without contrast	5		Med
CT head without and with contrast	4		Med
<b>Rating Scale:</b> 1=Least appropriate, 9=Most appropriate			<b>*Relative Radiation Level</b>

Note: Abbreviations used in the tables are listed at the end of the "Major Recommendations" field.

## Summary of Literature Review

### Dizziness and Vertigo

Dizziness is a common clinical complaint that accounts for 1% of visits to U.S. office-based physicians. Vertigo is a form of dizziness in which there is an illusion of movement (rotation, tilt, or linear translation). The mechanism for vertigo is an imbalance of tonic vestibular signals. Thus, vertigo is a hallucination of movement and is a symptom of a disturbed vestibular system.

The complete vestibular system comprises the end organs in the temporal bone, the vestibular components of the VIIIth cranial nerve, and the central connections in the brainstem. The end organs in the temporal bones are the cristae of the three semicircular canals that respond to movement of the head and the macula of the utricle, which records the position of the head. The semicircular canals record dynamic actions, and the utricle records static function. Vertigo is subdivided into peripheral vertigo (due to failure of the end organs) or central vertigo (due to failure of the vestibular nerves or central connections to the brainstem and cerebellum).

### Benign Positional Vertigo, Ménière's Disease, and Peripheral Vestibular Disorders

Patients with benign positional vertigo describe episodic vertigo lasting less than a minute, brought on by movements of the head, and without other associated symptoms. There are no radiological findings in patients with benign positional vertigo.

In Ménière's disease, paroxysmal attacks of whirling vertigo are usually accompanied by nausea and are transient, lasting a few hours but not days. The severe episodic vertigo is accompanied by tinnitus, fluctuating hearing loss, and a feeling of fullness in the affected ear or ears. Typically, hearing decreases and tinnitus increases during the attack. Hearing may improve between attacks in early stages of the disease. Generally, the hearing loss begins unilaterally and affects the lower frequencies primarily; mid and high frequencies are affected in later stages of the disease.

Ménière's disease is most common in middle age and may become bilateral in up to 50% of the affected patients. The etiology of Ménière's disease is a failure of the mechanism regulating the production and disposal of endolymph, resulting in recurrent attacks of endolymphatic hydrops. Since the endolymphatic duct and sac are the sites of resorption of endolymph, these structures play an important role in the pathogenesis of endolymphatic hydrops. The success of various surgical procedures in relieving Ménière's disease symptoms has led to great interest in using computed tomography (CT) or magnetic resonance imaging (MRI), or both, to evaluate the vestibular aqueduct, endolymphatic duct, and sac.

Unfortunately, there is no unanimity on the value of imaging in cases of Ménière's disease. Some investigators have used CT or MRI to predict results of shunt surgery, based on showing patency of the vestibular aqueduct. Other investigators, however, report that the size, shape, and patency of the vestibular aqueduct are of no value in predicting surgical results in shunt procedures or in predicting occurrence of bilateral disease. MRI, with its ability to detect the endolymphatic duct and sac separate from the bony vestibular aqueduct, may offer more useful information than CT. The value of CT and MRI rests in their ability to rule out associated infectious or neoplastic disease.

Vestibular neuritis is a clinical diagnosis based on an aggregate of symptoms. The disease is characterized by an acute onset of severe vertigo, lasting several days, followed by gradual improvement over several weeks. Hearing is typically unaffected. The history includes onset of vertigo following an illness such as an upper respiratory infection. Most patients become completely symptom free following resolution of the primary disease. Vestibular labyrinthitis is similar, because the disease presents with the acute symptoms of vertigo but is always associated with hearing loss. Labyrinthitis is usually viral in origin but may result from acute or chronic bacterial middle ear infections. Unlike viral labyrinthitis, labyrinthitis associated with suppurative ear disease may progress to partial or complete occlusion of the lumen of the affected labyrinth. Early on, the obstructed lumen may be detected on MRI because of loss of the signal intensity of the fluid contents. Later on, more complete obliteration and partial ossification of all the labyrinthine structures occurs, with an end result of labyrinthitis obliterans, which is readily diagnosed on high-resolution CT.

With MRI, there may be gadolinium enhancement of the labyrinthine structures or vestibular nerves during the acute or subacute stages of vestibular neuritis or labyrinthitis, or both. Such results must be interpreted with care, because sudden labyrinthine dysfunction may be caused by spontaneous hemorrhage or injury, which results in abnormal signal intensities within the labyrinthine structures secondary to the blood products.

Superior semicircular canal dehiscence syndrome is a pathologic condition in which sound or pressure transmitted to the inner ear may inappropriately activate the vestibular system. It can be diagnosed by high-resolution coronal CT imaging of the temporal bones.

Sound-induced vertigo or nystagmus has been reported in perilymphatic fistulas, syphilis, Ménière's disease, congenital deafness, chronic otitis, and Lyme disease.

Diseases of the internal auditory canal and cerebellopontine angle are generally not characterized by severe attacks of vertigo, but rather by intermittent dizziness or periods of exacerbated dizziness, or both. A variety of benign or malignant tumors of the petrous temporal bone, such as paragangliomas, carcinomas, or metastatic tumors, may directly involve the labyrinthine structures, causing vertigo. Such processes are readily evaluated with CT and MRI.

### Central Vestibular Disorders

Lesions of the brainstem or cerebellum that result in central vertigo can be readily diagnosed by MRI. Vascular insufficiency in the vertebrobasilar circulation is a common cause of vertigo in patients older than age 50. Thrombosis

of the labyrinthine artery or infarction of the lateral medulla from vertebral or posterior inferior cerebellar artery (PICA) insufficiency may cause severe vertigo. Subclavian steal syndrome can cause a variety of symptoms, including vertigo. Such conditions can be carefully evaluated with MR angiography or conventional angiography of the posterior fossa vasculature.

A variety of other central nervous diseases may produce vertigo or dizziness. These include seizure disorders, multiple sclerosis, ataxic diseases, head injuries, or any cause of increased intracranial pressure. Vertigo may result as a sequela of stroke, and transient ischemic attacks may present as episodic dizziness.

Various metabolic disorders may result in dizziness. These include thyroid disorders, hyperlipidemia, diabetes, and hypoglycemia. Autoimmune diseases or diseases that affect the proprioceptive system may cause vertigo. In many cases, the possibility of functional neurotic symptoms must be considered in patients in whom no disease can be found. Finally, cervical spondylosis is thought to cause vertigo by disc degeneration and narrowing of the disc space, which affects nearby nerves, or by osteophyte formation, which compresses the blood vessels. In such cases, CT may be helpful.

### **Hearing Loss**

Hearing loss is typically classified as conductive, sensorineural, or mixed. Conductive hearing loss results from pathologic changes of either the external or middle ear structures preventing the sound waves from reaching the endolymph of the inner ear. Sensorineural hearing loss (SNHL) results from the pathologic changes of inner-ear structures such as the cochlea or the auditory nerve and prevents neural impulses from being transmitted to the auditory cortex of the brain.

### **Sensorineural Hearing Loss**

SNHL may be sudden, fluctuating, or progressive. Sudden SNHL is a manifestation of viral infections, vascular occlusive diseases, or inner-ear membrane ruptures. Sudden SNHL can also be a manifestation of an acoustic neuroma. Vertigo may be associated with these conditions, which can help define whether the lesion is peripheral or central. To discriminate among idiopathic, viral, and other causes of SNHL, auditory brainstem responses and gadolinium-enhanced MRI are used. Patients with cochleitis or cochlear nerve neuritis typically have abnormal auditory brainstem responses and may be helped by a tapering course of oral corticosteroids. Whether or not gadolinium-enhanced MRI shows enhancement of the cochlear nerve or cochlea does not reliably guide corticosteroid therapy. However, some authors suggest that MRI-positive sudden deafness is more difficult to cure with steroid therapy than MRI-negative sudden deafness.

Fluctuating SNHL is difficult to evaluate. The audiometric examination would indicate the level of dysfunction, but not the likely cause. Patients who are noted to have large vestibular aqueducts (apertures greater than 4 mm), may have a congenital cause for fluctuating hearing loss. Such patients with large vestibular aqueducts have high-frequency loss more often than low-frequency loss. Fluctuating SNHL due to an enlarged vestibular aqueduct appears to be more common in children and young adults, an important point in differentiating this disease from Ménière's disease, in which most patients are middle aged or older. Of interest is that the vestibular aqueduct of patients with Ménière's disease may be small, rather than large.

There is speculation on the causes of a sudden drop in hearing in patients with large vestibular aqueducts. Two possible causes are reflux of hyperosmolar fluid from the endolymphatic sac to the inner ear and rupture of the membranous labyrinth or a perilymphatic fistula due to transmission of intracranial pressure to the inner ear through the enlarged vestibular aqueduct. It is well recognized that patients sustaining head trauma or who are subjected to extreme barotrauma (scuba diving) may aggravate their episodes of hearing loss. In such cases, it may be worthwhile to image the temporal bones to detect enlarged vestibular aqueducts and thus advise the patients or their parents of the dangers of contact sports or activities that entail extreme barometric pressure changes. The imaging findings must be correlated with audiometry, because the fluctuating SNHL of patients with large vestibular aqueducts does not resemble the low-frequency changes characteristic of Ménière's disease, which may also be associated with fluctuating hearing loss. Patients with isolated large vestibular aqueducts may have a different pathophysiologic basis than patients whose large aqueducts are associated with other inner ear malformations. Patients with complex inner ear malformations may be subject to recurrent episodes of meningitis or the "gusher" syndrome, or both, resulting in a dead ear at the time of surgical intervention such as a stapedectomy.

Asymmetric SNHL or gradually declining unilateral SNHL is a common symptom that may be ascribed to many different pathologic processes. Initial evaluation is geared to localizing the site of the lesion (i.e., cochlear or retrocochlear). Most retrocochlear lesions are associated with an abnormal auditory brainstem response, which is often obtained before an imaging study. Most clinicians will refer patients to MRI after preliminary audiometric or auditory brain response testing, or both.

Patients with retrocochlear localization should have a complete MRI study of the head in addition to the studies of the internal auditory canal and temporal bones. The MRI examination should include complete evaluation of the central nuclei in the brainstem as well as the auditory pathways extending upward into the cerebral hemispheres. Whether gadolinium contrast enhancement is routinely used depends on many factors, including coil size, field of view, field strength, and pulse sequences. CT is sometimes diagnostic in lesions 1.5 cm or greater in diameter when dedicated techniques are used, but it does not readily detect small brainstem lesions such as infarctions or demyelination.

In general, most cochlear disorders such as otosclerosis are evaluated by high-resolution CT imaging. Similarly, preoperative assessment for cochlear implants is usually best accomplished using thin-section CT with reformatted multiplanar images. In patients with congenital etiologies for hearing loss, recent reports suggest that high-resolution MRI is more useful for surgical planning.

### **Conductive Hearing Loss**

CT is an excellent technique for demonstrating even small abnormalities of the bony structures of the middle ear. For this reason, it is the modality of choice in the study of conductive hearing loss. However, not every patient complaining of conductive hearing loss requires a CT study. Established indications encompass conditions such as the complications of acute and chronic otomastoiditis, evaluation of the postoperative ear following surgery for chronic otomastoiditis, postoperative localization of prosthetic devices, and assessment of congenital or vascular anomalies. Particularly, the precise extent of bone erosion associated with cholesteatoma is correctly demonstrated by high-resolution CT. Conversely, although fistulization through the tegmen tympani of the temporal bone is usually detected by CT, the actual involvement of the meninges and veins is better assessed by MRI. MRI is also indicated when complicated

inflammatory lesions are suspected to extend into the inner ear or towards the sigmoid sinus or jugular vein. Neoplasms arising from or extending into the middle ear require the use of both techniques, as their combined data provide essential information. The most important data for surgical planning concern the destruction of thin bony structures and the relationships of the lesion to the dura and surrounding vessels. Vascular imaging should be performed when there is suspicion of a paraganglioma extending into the middle ear.

### Trauma

The effects of trauma can be divided into osseous and soft-tissue injuries. CT is used extensively to delineate fractures, ossicular dislocations, fistulous communications, and facial nerve injury and to evaluate post-traumatic hearing loss.

### Congenital and Childhood Hearing Loss

The ideal imaging method for children with unilateral or asymmetric sensory neural hearing loss is still controversial. Most reports suggest that children with unilateral or asymmetric SNHL should have a high-resolution temporal bone CT scan and that brain and temporal bone MRI be obtained in select cases. In general, high-resolution CT has been shown to be efficacious for the preoperative workup for congenital hearing loss due to aural dysplasia, congenital ossicular anomalies, large vestibular aqueduct syndrome, congenital absence of cochlear nerve, and labyrinthitis ossificans.

### Anticipated Exceptions

Nephrogenic systemic fibrosis (NSF) is a disorder with a scleroderma-like presentation and a spectrum of manifestations that can range from limited clinical sequelae to fatality. It appears to be related to both underlying severe renal dysfunction and the administration of gadolinium-based contrast agents. It has occurred primarily in patients on dialysis, rarely in patients with very limited glomerular filtration rate (GFR) (i.e.,  $<30\text{ mL/min/1.73 m}^2$ ), and almost never in other patients. There is growing literature regarding NSF. Although some controversy and lack of clarity remain, there is a consensus that it is advisable to avoid all gadolinium-based contrast agents in dialysis-dependent patients unless the possible benefits clearly outweigh the risk, and to limit the type and amount in patients with estimated GFR rates  $<30\text{ mL/min/1.73 m}^2$ . For more information, please see the ACR Manual on Contrast Media (see the "Availability of Companion Documents" field).

### Abbreviations

- CT, computed tomography
- CTA, computed tomography angiography
- Med, medium
- MRA, magnetic resonance angiography
- MRI, magnetic resonance imaging

Relative Radiation Level	Effective Dose Estimate Range
None	0
Minimal	$<0.1\text{ mSv}$
Low	$0.1\text{ - }1\text{ mSv}$
Medium	$1\text{ - }10\text{ mSv}$
High	$10\text{ - }100\text{ mSv}$

### Clinical Algorithm(s)

Algorithms were not developed from criteria guidelines.

## Evidence Supporting the Recommendations

### Type of Evidence Supporting the Recommendations

The recommendations are based on analysis of the current literature and expert panel consensus.

## Benefits/Harms of Implementing the Guideline Recommendations

### Potential Benefits

Selection of appropriate radiologic imaging procedures for evaluation of patients with vertigo and hearing loss

### Potential Harms

#### Gadolinium-based Contrast Agents

Nephrogenic systemic fibrosis (NSF) is a disorder with a scleroderma-like presentation and a spectrum of manifestations that can range from limited clinical sequelae to fatality. It appears to be related to both underlying severe renal dysfunction and the administration of gadolinium-based contrast agents. It has occurred primarily in patients on dialysis, rarely in patients with very limited glomerular filtration rate (GFR) (i.e.,  $<30\text{ mL/min/1.73 m}^2$ ), and almost never in other patients. Although some controversy and lack of clarity remain, there is a consensus that it is advisable to avoid all gadolinium-based contrast agents in dialysis-dependent patients unless the possible benefits clearly outweigh the risk, and to limit the type and amount in patients with estimated GFR rates  $<30\text{ mL/min/1.73 m}^2$ . For more information, please see the ACR Manual on Contrast Media (see the "Availability of Companion Documents" field).

### Relative Radiation Level (RRL)

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, an 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. Additional information regarding radiation dose assessment for imaging examinations can be found in the American College of Radiology (ACR) Appropriateness Criteria® Radiation Dose Assessment Introduction document (see "Availability of Companion Documents" field).

## Qualifying Statements

---

### Qualifying Statements

The American College of Radiology (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 exams 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 U.S. Food and Drug Administration (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.

## Implementation of the Guideline

---

### Description of Implementation Strategy

An implementation strategy was not provided.

### Implementation Tools

Personal Digital Assistant (PDA) Downloads

For information about availability, see the *Availability of Companion Documents* and *Patient Resources* fields below.

## Institute of Medicine (IOM) National Healthcare Quality Report Categories

---

### IOM Care Need

Getting Better

Living with Illness

### IOM Domain

Effectiveness

## Identifying Information and Availability

---

### Bibliographic Source(s)

Turski PA, Wippold FJ II, Cornelius RS, Brunberg JA, Davis PC, De La Paz RL, Dormont D, Gray L, Jordan JE, Mukherji SK, Nussenbaum B, Seidenwurm DJ, Sloan MA, Zimmerman RD, Expert Panel on Neurologic Imaging. ACR Appropriateness Criteria® vertigo and hearing loss. [online publication]. Reston (VA): American College of Radiology (ACR); 2008. 7 p. [61 references]

### Adaptation

Not applicable: The guideline was not adapted from another source.

### Date Released

1996 (revised 2008)

### Guideline Developer(s)

American College of Radiology - Medical Specialty Society

### Source(s) of Funding

The American College of Radiology (ACR) provided the funding and the resources for these ACR Appropriateness Criteria®.

### Guideline Committee

Committee on Appropriateness Criteria, Expert Panel on Neurologic Imaging

### Composition of Group That Authored the Guideline

*Panel Members:* Patrick A. Turski, MD (*Principal Author*); Franz J. Wippold II, MD (*Panel Chair*); Rebecca S. Cornelius, MD (*Panel Vice-Chair*); James A. Brunberg, MD; Patricia C. Davis, MD; Robert L. De La Paz, MD; Pr. Didier Dormont;



Linda Gray, MD; John E. Jordan, MD; Surēsh Kumar Mukherji, MD; Brian Nussenbaum, MD; David J. Seidenwurm, MD; Michael A. Sloan, MD, MS; Robert D. Zimmerman, MD

## Financial Disclosures/Conflicts of Interest

Not stated

## Guideline Status

This is the current release of the guideline.

This guideline updates a previous version: Turski PA, Seidenwurm DJ, Davis PC, Brunberg JA, De La Paz RL, Dormont D, Hackney DB, Jordan JE, Karis JP, Mukherji SK, Wippold FJ II, Zimmerman RD, McDermott MW, Sloan MA, Expert Panel on Neurologic Imaging. Vertigo and hearing loss. [online publication]. Reston (VA): American College of Radiology (ACR); 2006. 8 p. [53 references]

The appropriateness criteria are reviewed annually and updated by the panels as needed, depending on introduction of new and highly significant scientific evidence.

## Guideline Availability

Electronic copies: Available in Portable Document Format (PDF) from the [American College of Radiology \(ACR\) Web site](#)



ACR Appropriateness Criteria® *Anytime, Anywhere™* (PDA application). Available from the [ACR Web site](#)



Print copies: Available from the American College of Radiology, 1891 Preston White Drive, Reston, VA 20191. Telephone: (703) 648-8900.

## Availability of Companion Documents

The following are available:

- ACR Appropriateness Criteria® overview. Reston (VA): American College of Radiology; 2 p. Electronic copies:

Available in Portable Document Format (PDF) from the [American College of Radiology \(ACR\) Web site](#)



- ACR Appropriateness Criteria® literature search process. Reston (VA): American College of Radiology; 1 p.

Electronic copies: Available in PDF from the [ACR Web site](#)



- ACR Appropriateness Criteria® evidence table development. Reston (VA): American College of Radiology; 4 p.

Electronic copies: Available in PDF from the [ACR Web site](#)



- ACR Appropriateness Criteria® radiation dose assessment introduction. Reston (VA): American College of

Radiology; 2 p. Electronic copies: Available in PDF from the [ACR Web site](#)



- ACR Appropriateness Criteria® manual on contrast media. Reston (VA): American College of Radiology; 90 p.

Electronic copies: Available in PDF from the [ACR Web site](#)



## Patient Resources

None available

## NGC Status

This summary was completed by ECRI on July 31, 2001. The information was verified by the guideline developer as of August 24, 2001. This summary was updated by ECRI on August 17, 2006. This summary was updated by ECRI Institute on May 17, 2007 following the U.S. Food and Drug Administration (FDA) advisory on Gadolinium-based contrast agents. This summary was updated by ECRI Institute on June 20, 2007 following the U.S. Food and Drug Administration (FDA) advisory on gadolinium-based contrast agents. This NGC summary was updated by ECRI Institute on May 26, 2010. This summary was updated by ECRI Institute on January 13, 2011 following the U.S. Food and Drug Administration (FDA) advisory on gadolinium-based contrast agents.

## Copyright Statement

Instructions for downloading, use, and reproduction of the American College of Radiology (ACR) Appropriateness

Criteria® may be found on the [ACR Web site](#)



## Disclaimer

### NGC Disclaimer

The National Guideline Clearinghouse™ (NGC) does not develop, produce, approve, or endorse the guidelines represented on this site.

All guidelines summarized by NGC and hosted on our site are produced under the auspices of medical specialty societies, relevant professional associations, public or private organizations, other government agencies, health care organizations or plans, and similar entities.

Guidelines represented on the NGC Web site are submitted by guideline developers, and are screened solely to determine that they meet the NGC Inclusion Criteria which may be found at <http://www.guideline.gov/about/inclusion-criteria.aspx>.

NGC, AHRQ, and its contractor ECRI Institute make no warranties concerning the content or clinical efficacy or effectiveness of the clinical practice guidelines and related materials represented on this site. Moreover, the views and opinions of developers or authors of guidelines represented on this site do not necessarily state or reflect those of NGC, AHRQ, or its contractor ECRI Institute, and inclusion or hosting of guidelines in NGC may not be used for advertising or commercial endorsement purposes.

Readers with questions regarding guideline content are directed to contact the guideline developer.