

## 2011 Imaging Criteria

Magnetic Resonance Imaging (MRI), Cardiac<sup>(1)</sup>

ICD-9-CM: 88.92  
 CPT: 75557, 75561  
 I/O Setting: Outpatient

## INDICATION(S)

- 100 Suspected arrhythmogenic RV dysplasia
- 200 Suspected hypertrophic cardiomyopathy
- 300 Suspected constrictive pericarditis
- 400 Suspected intracardiac mass by TTE
- 500 Assessment of myocardial viability

- 100 Suspected arrhythmogenic RV dysplasia **[All]**<sup>(2, 3)</sup>
  - 110 Low CAD risk<sup>(4)</sup>
  - 120 Presyncope/syncope  $\geq$  2 episodes by Hx<sup>(5, 6, 7)</sup>
  - 130 No murmur by PE
  - 140 ECG nondiagnostic for etiology of syncope
  - 150 Findings **[One]**<sup>(8)</sup>
    - 151 First degree relative with RV dysplasia<sup>(9)</sup>
    - 152 Mild RV enlargement by TTE
    - 153 Regional RV systolic dysfunction by TTE
    - 154 Sustained (> 30 secs) V tach by ambulatory electrocardiography/ECG/ETT/EP testing
- 200 Suspected hypertrophic cardiomyopathy **[All]**<sup>(10)</sup>
  - 210 Presyncope/syncope  $\geq$  2 episodes by Hx<sup>(5, 6, 11)</sup>
  - 220 No murmur by PE
  - 230 ECG nondiagnostic for etiology of syncope
  - 240 Findings **[One]**
    - 241 Cardiac arrest survivor
    - 242 Family Hx **[One]**
      - 1 Sudden cardiac death in a first degree family relative < 40<sup>(9)</sup>
      - 2 Sudden cardiac death in a first degree relative with hypertrophic cardiomyopathy<sup>(9)</sup>
    - 243 Left ventricular/septal thickening by TTE
    - 244 Abnormal BP response to exercise
    - 245 Sustained (> 30 secs) V tach by ambulatory electrocardiography/ECG/ETT/EP testing
- 300 Suspected constrictive pericarditis **[Both]**<sup>(12, 13)</sup>
  - 310 Right heart failure by PE<sup>(14)</sup>

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- 320 TTE nondiagnostic for constrictive pericarditis<sup>(15)</sup>
- 400 Suspected intracardiac mass by TTE<sup>(16, 17)</sup>
- 500 Assessment of myocardial viability **[All]**<sup>(18)</sup>
  - 510 Evidence of ischemia **[One]**
    - 511 Angina/anginal equivalent<sup>(19, 20)</sup>
    - 512 MI/CABG/PCI by Hx
  - 520 EF ≤ 35% by testing<sup>(21)</sup>
  - 530 SPECT scan nondiagnostic for extent of myocardial viability<sup>(22)</sup>
  - 540 Cardiac revascularization/transplant planned<sup>(23, 24)</sup>
  - 550 Send for secondary medical review<sup>(25\*MDR)</sup>

## Notes

**(1)**

The following are examples of relative and absolute contraindications to the use of magnetic resonance imaging:

- Implanted devices that are electrically or magnetically activated (e.g., cardiac pacemakers, automatic cardioverter defibrillators, drug infusion pumps, cochlear implants)
- Ferromagnetic metal objects (e.g., cerebral aneurysm clips, intraocular metallic foreign body, prostheses, screws)
- Pregnancy, first trimester
- Renal insufficiency in cases when magnetic resonance imaging is performed with gadolinium-based contrast

**(2)**

Arrhythmogenic RV dysplasia (ARVD), also known as arrhythmogenic RV cardiomyopathy, is a genetically determined heart muscle disorder that leads to fibro-fatty replacement of the myocardium of the right ventricle. Pathology may extend to the left ventricle as well. Patients typically present with syncope or heart failure. The resulting structural abnormalities can lead to ventricular arrhythmias including ventricular tachycardia and, in some cases, sudden death. Evaluation of this disorder is considered challenging and a number of studies (e.g., ECG, TTE, MRI, biopsy) are usually required to assess for ventricular abnormalities and confirm the diagnosis (Santangeli et al., *Am J Med* 2009; 122(11): 1010-1012; Jain et al., *J Cardiovasc Magn Reson* 2008; 10(1): 32).

**(3)**

Cardiac MRI is used in arrhythmogenic RV dysplasia for RV visualization, quantitative RV function analysis, and due to the limitations of echocardiography as a result of the proximity to the sternum (Pennell, *Circulation* 2010; 121(5): 692-705).

**(4)**

The probability of a patient having CAD can be calculated based on history, clinical findings, abnormal resting ECG, and multiple risk factors for atherosclerosis. One model uses age, gender, and chest pain characteristics, with the latter being the most predictive for CAD. There are a number of algorithms that can be used to calculate a patient's CAD risk. In symptomatic patients, pretest probability can be stratified as high (> 90%), intermediate (10% to 90%), low (< 10%), or very low (< 5%) pretest probability of CAD (Hendel et al., *J Am Coll Cardiol* 2009; 53(23): 2201-2229).

**(5)-DEF:**

Syncope is the transient loss of consciousness and postural tone caused by diminished cerebral blood flow. It is characterized by rapid onset, short duration, and spontaneous complete recovery.

Presyncope is an episode of near-fainting or a sign of impending loss of consciousness. Symptoms include, but are not limited to, dizziness, lightheadedness, blurred vision, and general unsteadiness.

**(6)**

Syncope has been associated with increased risk of sudden cardiac death. The severity of other symptoms such as dyspnea, chest pain, and effort intolerance has not been correlated with increased risk of sudden cardiac death (Maron et al., *Circulation* 2003; 107(23): 2872-2875).

**(7)-POL:**

In patients with a family history of ARVD, it may be appropriate to perform an MRI earlier in the evaluation (i.e., after a single episode of presyncope or syncope). This is a matter of local medical policy.

**(8)**

These criteria define findings, along with recurrent syncope and an equivocal ECG, that suggest possible RV arrhythmogenic dysplasia.

**(9)-DEF:**

A first degree relative is defined as a blood-related sibling, parent, or child.

**(10)-DEF:**

Hypertrophic cardiomyopathy is a disease process characterized by abnormal thickening of the heart muscle.

**(11)-POL:**

In patients with a family history of sudden cardiac death or hypertrophic cardiomyopathy, it may be appropriate to perform an MRI earlier in the evaluation (i.e., after a single episode of presyncope or syncope). This is a matter of local medical policy.

**(12)-DEF:**

Constrictive pericarditis results when a thick, fibrotic, or calcified pericardium restricts diastolic filling. Potential causes of constrictive pericarditis include infectious diseases, trauma, metastases, and connective tissue disorders.

**(13)**

MRI provides comprehensive, multiplanar imaging of pericardial disease without ionizing radiation (Napolitano et al., *Can Assoc Radiol J* 2009; 60(1): 40-46). Therefore, cardiac MRI is a useful tool in making a definitive diagnosis when echocardiographic diagnosis remains unclear (Pennell, *Circulation* 2010; 121(5): 692-705; White and Patel, *Magn Reson Imaging Clin N Am* 2007; 15(4): 541-564).

**(14)**

Findings of right heart failure include weight gain, peripheral edema, hepatomegaly, distended neck veins, and ascites. Therapy for HF may include digoxin, ACE inhibitors, and diuretics. The HF associated with constrictive pericarditis, however, may not respond to digoxin or ACE inhibitors because the primary problem is not associated with myocardial contractility but with constriction. In these cases, diuretics are the mainstay of therapy. Often patients have biventricular (both right and left) heart failure.

**(15)**

TTE is the initial modality used in the evaluation of suspected pericardial disease. It is inexpensive, rapidly performed, and available in virtually all hospital settings.

**(16)**

Intracardiac masses include tumor, thrombus (most common), or vegetation. Echocardiography, CT, and MRI are among the modalities used to evaluate patients with an intracardiac mass; each modality has its own advantages and disadvantages (Grizzard and Ang, *Cardiol Clin* 2007; 25(1): 111-140).

**(17)**

CT and MRI can provide information regarding the morphology of cardiac masses not obtained by echocardiography. MRI is superior to CT in the comprehensive evaluation of cardiac masses due to its ability to differentiate a cardiac mass based on its soft-tissue composition. MRI is useful for further evaluation of a mass suspected but incompletely imaged on echocardiography. In addition to its ability to characterize the tissue, MRI provides detail on the relation of the mass to surrounding tissue and organs (Pennell, *Circulation* 2010; 121(5): 692-705; Grizzard and Ang, *Cardiol Clin* 2007; 25(1): 111-140).

**(18)**

Patients with chronic LV dysfunction may have viable myocardium that is both "hibernating" and "stunned." Following an episode of ischemia, contractile function may remain reduced for a period of time before eventually recovering. Prolonged or repetitive reduction in myocardial flow may lead to chronically reduced contractility in viable myocardial tissue, which is referred to as "hibernating myocardium." PET, SPECT, and MRI are used to evaluate for viability in patients with LV dysfunction. Functional MRI assesses the presence of scar tissue; PET and SPECT provide additional information on the viable tissue that further assists in determining if revascularization is warranted (Bax et al., *Cardiol Clin* 2009; 27(2): 265-276; Lalonde et al., *Cardiol Clin* 2009; 27(2): 237-255).

**(19)-DEF:**

Angina pectoris is defined as discomfort in the chest associated with myocardial ischemia. Symptoms of angina may vary from patient to patient and include sensations of pain (classically involving the chest with radiation to the left arm), choking, pressure, squeezing, tightness, heaviness, or burning. Isolated shoulder, back, neck, and jaw complaints can also be described.

**(20)**

As a significant number of patients with acute MI do not have classic symptoms of chest pain, it is important to consider atypical angina (also known as an anginal equivalent) when evaluating a patient with risk factors or a history of CAD (Anderson et al., *J Am Coll Cardiol* 2007; 50(7): e1-e157). Atypical presentations are seen more frequently in women, the elderly, and diabetic patients and may include jaw or neck pain, nausea with vomiting, dyspnea and unexplained fatigue (Amsterdam et al., *Circulation* 2010; July 26, 2010; Berg et al., *Gend Med* 2009; 6(3): 454-462).

**(21)**

Testing includes imaging by TTE, TEE, left ventriculogram, or by RVG.

**(22)**

In certain patients, SPECT may be anticipated to yield suboptimal results. Myocardial SPECT studies in women tend to have a higher rate of false positives than men due to attenuation artifact from breast tissue. The distorted images generally affect the anterior aspect of the heart (Nurkalem et al., *J Digit Imaging* 2008; 21(4): 446-451). Breast implants made from either silicone or saline can compound the amount of artifacts seen in SPECT studies (Stinis et al., *Int J Cardiovasc Imaging* 2006; 22(3-4): 449-455). Attenuation artifact from excess soft tissue and large upper extremities in obese individuals can interfere with SPECT image

interpretation. The lateral aspect of the heart is most affected when there is excess tissue under the arm (Lalonde et al., *Cardiol Clin* 2009; 27(2): 237-255; Hepner and Thomas, *Am Heart Hosp J* 2007; 5(3): 189-191).

**(23)**

Imaging is performed in potential heart transplant candidates to exclude the presence of viable myocardium.

**(24)**

Patients with severe stenosis by coronary angiography are not candidates for revascularization if the surrounding myocardium is nonviable. Once viability is confirmed, however, evidence shows that revascularization results in improvement in LV function, symptoms, exercise capacity, and survival (Schinkel et al., *J Nucl Med* 2007; 48(7): 1135-1146).

**(25)-MDR:**

**Because SPECT scan provides better information than MRI regarding myocardial viability and has proven clinical outcomes, requests for cardiac MRI to assess myocardial viability requires secondary medical review (Kim et al., *J Am Coll Cardiol* 2009; 55(1): 1-16).**