*National Imaging Associates, Inc.	
Clinical guidelines **HEART MRI**	**Original Date: March 26, 2008**
CPT Codes: 75557, 75559, 75561, 75563 +75565	**Last Revised Date: April 2023**
Guideline Number: NIA_CG_028	**Implementation Date: January 2024**

GENERAL INFORMATION

- *It is an expectation that all patients receive care/services from a licensed clinician. All appropriate supporting documentation, including recent pertinent office visit notes, laboratory data, and results of any special testing must be provided. If applicable: All prior relevant imaging results and the reason that alternative imaging cannot be performed must be included in the documentation submitted.*
- *Where a specific clinical indication is not directly addressed in this guideline, medical necessity determination will be made based on widely accepted standard of care criteria. These criteria are supported by evidence-based or peer-reviewed sources such as medical literature, societal guidelines and state/national recommendations.*

INDICATIONS FOR CARDIAC MAGNETIC RESONANCE (CMR)

See Legislative Requirements for specific mandates in Washington State

Cardiomyopathy & Heart Failure[1, 2,3]

- To assess systolic and diastolic function in the evaluation of a newly diagnosed cardiomyopathy
- Suspected infiltrative disease such as amyloidosis, sarcoidosis[4], hemochromatosis, or endomyocardial fibrosis if PET has not been performed
- Suspected inherited or acquired cardiomyopathy
- Diagnosis of acute myocarditis, with suspicion based upon new, unexplained findings such as:
    - Rise in troponin not clearly due to acute myocardial infarction
    - Change in ECG suggesting acute myocardial injury or pericarditis, without evident myocardial infarction
- Assessment of hypertrophic cardiomyopathy[5]

    - When TTE is inadequate for diagnosis, management or operative planning, or when tissue characterization (degree of fibrosis) will impact indications for ICD
    - For patients with LVH when there is a suspicion of alternative diagnoses, including infiltrative or storage disease as well as athlete's heart
    - For patients who are not otherwise as high risk for SCD, in whom the decision to proceed with an ICD is uncertain after assessment (which includes personal/family history, echocardiography), and CMR imaging is beneficial to assess for maximum LV wall thickness, ejection fraction (EF), LV apical aneurysm, and extent of myocardial fibrosis with LGE
    - For patients with obstructive HCM in whom the autonomic mechanism of obstruction is inconclusive on echocardiography, CMR is indicated for selection and planning of SRT (septal reduction therapy)
    - For patients with HCM, repeat imaging on a periodic basis (every 3-5 years) for the purpose of SCD risk stratification to evaluate changes in LGE, EF, development of apical aneurysm or LV wall thickness
- Arrhythmogenic right ventricular cardiomyopathy to aid in identification and diagnosis (assessment of myocardial fat, fibrosis, and RV tissue characteristics), based upon reason for suspicion, such as:
    - Nonsustained ventricular tachycardia (VT)
    - Unexplained syncope
    - ECG abnormalities
    - First-degree relatives with positive genotype for ARVD
- Noncompaction cardiomyopathy to aid in the diagnosis (measurement of compacted to noncompacted myocardium) when TTE is suggestive
- Clinical symptoms and signs consistent with a cardiac diagnosis known to cause presyncope/syncope (including, but not limited to, hypertrophic cardiomyopathy)
- Pulmonary hypertension in the absence of severe valvular disease

Valvular Heart Disease

- Evaluation of valvular stenosis, regurgitation, or valvular masses when transthoracic echocardiography (TTE) is inadequate[6]
- Pre-TAVR assessment if the patient has not undergone cardiac CT[7]
- Prior to transcatheter mitral valve intervention, when TTE and TEE result in uncertain assessment of the severity of mitral regurgitation[8, 9]
- Suspected clinically significant bioprosthetic valvular dysfunction and inadequate images from TTE and TEE[6]

Evaluation of Intra- and Extra-Cardiac Structures

- Initial evaluation of cardiac mass, suspected tumor or thrombus, or potential cardiac source of emboli
- Re-evaluation of intracardiac mass when findings would change therapy

- Evaluation of pericardial disease to provide structural and functional assessment and differentiate constrictive vs restrictive physiology
- Assessment of left ventricular pseudoaneurysm, when TTE was inadequate
- Identification and characteristics of coronary aneurysms or anomalous coronary arteries

Pre-procedure Evaluation for Closure of ASD or PFO

- For assessment of atrial septal anatomy and atrial septal aneurysm
- For assessment of suitability for percutaneous device closure

Assessment Following LAA Occlusion

- For surveillance at 45 days or FDA guidance, if TEE or Heart CT was not done, to assess:
    - Device stability
    - Device leaks
    - To exclude device migration

Pre-Ablation Planning

- Evaluation of left atrium and pulmonary veins prior to radiofrequency ablation for atrial fibrillation, if cardiac CT has not been done

Aortic Pathology

- CT, MR, or echocardiogram can be used for screening and follow-up, with CT and MR preferred for imaging beyond the proximal ascending thoracic aorta
- Screening of first-degree relatives with a history of thoracic aortic aneurysm or dissection
- Six-month follow-up after initial diagnosis of thoracic aortic aneurysm to measure rate of change
- Annual follow-up for an enlarged thoracic aortic aneurysm (usually defined as > 4.4.cm)
- Biannual (2x/year) follow-up of enlarged aortic root or showing growth rate ≥ 0.5 cm/year
- Screening of first-degree relative with a bicuspid aortic valve
- Re-evaluation (<1 y) of the size and morphology of the aortic sinuses and ascending aorta in patients with a bicuspid AV and an ascending aortic diameter >4 cm with 1 of the following:
    - Aortic diameter >4.5 cm
    - Rapid rate of change in aortic diameter
    - Family history (first-degree relative) of aortic dissection
- Patients with Turner's syndrome annually if an abnormality exists; if initial study normal, can have imaging every 5 - 10 years[10]

- Evaluation in patients with known or suspected connective tissue disease or genetic condition that predispose to aortic aneurysm or dissection, such as Marfan syndrome, Ehlers-Danlos or Loeys-Dietz syndrome (at the time of diagnosis and 6 months thereafter), followed by annual imaging (can be done more frequently if > 4.5 cm or rate of growth > 0.5 cm/year- up to twice per year)

Congenital Heart Disease (CHD)[11]

- For all indications below, either CT or CMR can be done
- All lesions: evaluation prior to planned repair and evaluation for change in clinical status and/or new concerning signs or symptoms
- Patent Ductus Arteriosus: routine surveillance (1-2 years) in a patient with postprocedural aortic obstruction
- Eisenmenger Syndrome and Pulmonary Hypertension associated with CHD:
    - Evaluation due to change in pulmonary arterial hypertension-targeted therapy
    - Initial evaluation with suspicion of pulmonary hypertension following CHD surgery
- Aortic Stenosis or Regurgitation:
    - Routine surveillance (6-12 months) in a child with aortic sinus and/or ascending aortic dilation with increasing size
    - Routine surveillance (2–3 years) in a child with aortic sinus and/or ascending aortic dilation with stable size (CMR only)
- Aortic Coarctation and Interrupted Aortic Arch:
    - Routine surveillance (3–5 years) in a child or adult with mild aortic coarctation
    - Post procedure (surgical or catheter-based) routine surveillance (3–5 years) in an asymptomatic patient to evaluate for aortic arch aneurysms, in-stent stenosis, stent fracture, or endoleak
- Coronary anomalies
- Tetralogy of Fallot:
    - Postoperative routine surveillance (2–3 years) in a patient with pulmonary regurgitation and preserved ventricular function (CMR only)
    - Routine surveillance (2–3 years) in an asymptomatic patient with no or mild sequelae (CMR only)
    - Routine surveillance (2–3 years) in a patient with valvular or ventricular dysfunction, right ventricular outflow tract obstruction, branch pulmonary artery stenosis, arrhythmias, or presence of an RV-to-PA conduit
- Double Outlet Right Ventricle: Routine surveillance (3–5 years) in an asymptomatic patient with no or mild sequelae (CMR only)
- D-Loop Transposition of the Great Arteries (postoperative):
    - Routine surveillance (3–5 years) in an asymptomatic patient
    - Routine surveillance (1–2 years) in a patient with dilated aortic root with increasing size, or aortic regurgitation

    - Routine surveillance (3–12 months) in a patient with ≥moderate systemic AV valve regurgitation, systemic RV dysfunction, LVOT obstruction, or arrhythmias
- Congenitally Corrected Transposition of the Great Arteries:
    - Unrepaired: routine surveillance (3–5 years) in an asymptomatic patient
    - Postoperative: routine surveillance (3–5 years) in an asymptomatic patient
    - Postoperative anatomic repair: routine surveillance (6–12 months) in a patient with valvular or ventricular dysfunction, right or left ventricular outflow tract obstruction, or presence of an RV-to-PA conduit
    - Postoperative physiological repair with VSD closure and/or LV-to-PA conduit: routine surveillance (3–12 months) in a patient with ≥moderate systemic AV valve regurgitation, systemic RV dysfunction, and/or LV-to-PA conduit dysfunction
- Truncus Arteriosus: routine surveillance (1–2 years) in an asymptomatic child or adult with ≥ moderate truncal stenosis and/or regurgitation
- Single-Ventricle Heart Disease:
    - Postoperative routine surveillance (1–2 years) in an asymptomatic patient
    - Routine surveillance (1–2 years) in an asymptomatic adult postoperative Stage 2 palliation (CMR only)
- Ebstein's anomaly and Tricuspid Valve dysplasia (only CMR indicated):
    - Evaluation prior to planned repair and evaluation for change in clinical status and/or new concerning signs or symptoms
- Pulmonary Stenosis (only CMR indicated)
    - Unrepaired: routine surveillance (3–5 years) in an asymptomatic adult with PS and pulmonary artery dilation
    - Postprocedural (surgical or catheter-based): routine surveillance (1–3 years) in an asymptomatic adult with moderate or severe sequelae
- Pulmonary Atresia (postprocedural complete repair): routine surveillance (1–3 years) in an asymptomatic adult with ≥ moderate sequelae

Coronary Artery Disease Evaluation (CMR as an alternative to pharmacologic MPI)

CMR, which is done pharmacologically, is used for the assessment of coronary artery disease, and can be performed if the patient would otherwise be a candidate for a pharmacologic MPI.

- If the patient can walk and is having an MPI for another reason (LBBB, CABG, etc.), MPI is chosen over CMR
- Assessment of LV wall motion to identify patients with akinetic segments that would benefit from coronary revascularization
- To identify the extent and location of myocardial necrosis in patients with chronic or acute ischemic heart disease
- Follow-up of known CAD
    - Coronary stenosis of unclear significance on previous coronary angiography [3, 12]

- To diagnose microvascular dysfunction in patients with persistent stable anginal chest pain with suspected ischemia and nonobstructive coronary artery disease (INOCA) as documented in provider notes (no MPI diversion required). [13]

LEGISLATIVE REQUIREMENTS

Washington State

- Health Technology Clinical Committee (HTCC) findings Washington State, HCA Issue #34297
    - Cardiac Magnetic Resonance Angiography (CMRA) is a **covered benefit** for adults and children with known or suspected coronary vessel anomalies or congenital heart disease.
    - CMRA is a **covered benefit with conditions** for stable symptomatic adults with known or suspected Coronary Artery Disease (CAD).
    - **Limitations of Coverage:** CMRA should not be a first line diagnostic tool in patients with stable symptoms consistent with CAD. CMRA is covered with conditions for stable symptomatic adults with known or suspected CAD when the following conditions are met:
        - In consultation with a cardiologist, **AND**
        - The patient is unable to tolerate or safely participate in other noninvasive anatomic or functional testing.
- CMRA is **not a covered service** in Coronary Artery Bypass Graft (CABG) patients without CAD symptoms, or in those requiring cardiac lead placement unless cardiac vascular anomalies are suspected.
- Echocardiography continues to be the first tool to rule out medical issues and CMRA is only appropriate if clinical questions are not answered.

Source: Washington State Health Care Authority[14], June 1, 2023

BACKGROUND[15]

- CMR is an imaging modality used to assess cardiac or vascular anatomy, function, perfusion, and tissue characteristics in a single examination. In lesions affecting the right heart, CMR provides excellent visualization and volume determination regardless of RV shape. This is particularly useful in patients with congenital heart disease
- **CMR Safety[16-19]**
  Since many cardiac patients have cardiac implanted electrical devices, the risk of CMR to the patient and the device must be weighed against the benefit to the patient in terms of clinical value in optimal management.

Cardiac magnetic imaging (CMR) is often required when transthoracic echocardiography (TTE) and transesophageal echocardiography (TEE) provide inadequate imaging data.

Stress CMR for assessment of coronary artery disease (CAD) is performed pharmacologically either as:

- Vasodilator perfusion imaging with gadolinium contrast; **OR**
- Dobutamine inotropic wall motion (ventriculography)

With respect to CAD evaluation, since CMR is only pharmacologic (non-exercise stress), and stress echocardiography (SE) or myocardial perfusion imaging (MPI) provide similar information about CAD:

- Requests for stress CMR require **diversion** to exercise SE first, and to exercise MPI second.
- **Exemptions** for the diversion to SE or exercise MPI:
    - If body habitus or marked obesity (e.g., BMI ≥ 40) would interfere significantly with imaging with SE and MPI[20]
    - Evaluation of young (< 55 years old) patients with documented complex CAD, who are likely to need frequent non-invasive coronary ischemia evaluation and/or frequent radiation exposure from other testing[21]

OVERVIEW

CMR in CORONARY ARTERY DISEASE (CAD)[12, 22, 23]

Stable patients without known CAD fall into 2 categories[12, 22, 23]:

- **Asymptomatic**, for whom global risk of CAD events can be determined from coronary risk factors, using calculators available online
- **Symptomatic,** for whom we estimate the pretest probability that their chest-related symptoms are due to clinically significant (≥ 50%) CAD (below):

The 3 Types of Chest Pain or Discomfort

- **Typical Angina (Definite)** is defined as including all **3** characteristics:
    - Substernal chest pain or discomfort with characteristic quality and duration
    - Provoked by exertion or emotional stress
    - Relieved by rest and/or nitroglycerine
- **Atypical Angina (Probable)** has only **2** of the above characteristics
- **Nonanginal Chest Pain/Discomfort** has only **0 - 1** of the above characteristics

The medical record should provide enough detail to establish the type of chest pain. From those details, The Pretest Probability of obstructive CAD is estimated from the **Diamond Forrester Table** below, recognizing that in some cases multiple additional coronary risk factors could increase pretest probability[12]:

Diamond Forrester Table

Age (Years)	Gender	Typical/Definite Angina Pectoris	Atypical/Probable Angina Pectoris	Nonanginal Chest Pain
≤ 39	Men	Intermediate	Intermediate	Low
	Women	Intermediate	Very low	Very low
40 – 49	Men	High	Intermediate	Intermediate
	Women	Intermediate	Low	Very low
50 – 59	Men	High	Intermediate	Intermediate
	Women	Intermediate	Intermediate	Low
≥ 60	Men	High	Intermediate	Intermediate
	Women	High	Intermediate	Intermediate

- **Very low:** < 5% pretest probability of CAD, usually not requiring stress evaluation[22]
- **Low:** 5 - 10% pretest probability of CAD
- **Intermediate:** 10% - 90% pretest probability of CAD
- **High:** > 90% pretest probability of CA

For additional information on stress imaging, please refer to NIA guideline CG 024 Myocardial Perfusion Imaging (aka Nuclear Cardiac Imaging Study).

Abbreviations

ARVD/C	Arrhythmogenic right ventricular dysplasia/cardiomyopathy
ASD	Atrial septal defect
CABG	Coronary artery bypass grafting surgery
CAD	Coronary artery disease
CMR	Cardiac magnetic resonance (imaging)
CT	Computed tomography
ECG	Electrocardiogram
EF	Ejection fraction
HCM	Hypertrophic cardiomyopathy
ICD	Implantable cardioverter-defibrillator
LAA	Left atrial appendage
LBBB	Left bundle-branch block
LGE	Late gadolinium enhancement
LV	Left ventricle
LVH	Left ventricular hypertrophy
LVOT	Left ventricular outflow
MPI	Myocardial perfusion imaging
MR	Mitral regurgitation
MR(I)	Magnetic resonance (imaging)
PA	Pulmonary artery
PET	Positron emission tomography
PFO	Patent foramen ovale
PS	Pulmonary stenosis
RV	Right ventricle
SCD	Sudden cardiac death
SE	Stress echocardiography
SRT	Septal reduction therapy
TAVR	Transcatheter Aortic Valve Replacement
TTE	Transthoracic Echo
TEE	Transesophageal Echo
VT	Ventricular tachycardia

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POLICY HISTORY

Date	Summary
April 2023	• Added statement on clinical indications not addressed in this guideline • Added Washington State Legislative Language
February 2022	• Deleted the statement of deferral toward a stress echo, leaving the equivalency statement toward MPI • Clarified the requirement for description of chest pain by adding sentence "The medical record should provide enough detail to establish the type of chest pain." • Changed postoperative routine surveillance for single-ventricle heart disease to 1 – 2 years in an asymptomatic patient

Reviewed / Approved by NIA Clinical Guideline Committee

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