UNITEDHEALTHCARE COMMUNITY PLAN:
RADIOLOGY IMAGING COVERAGE DETERMINATION GUIDELINE

Adult Cardiac Imaging Guidelines (For Ohio Only)

V2.0.2024

Guideline Number: CSRAD003OH.C

Effective Date: November 15, 2024

Application (for Ohio Only)

This Medical Policy only applies to the state of Ohio. Any requests for services that are stated as unproven or services for which there is a coverage or quantity limit will be evaluated for medical necessity using Ohio Administrative Code 5160-1-01.

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Guideline Development (Preface-1)

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Guideline Development (Preface-1.1)

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- The UnitedHealthcare's evidence-based, proprietary clinical guidelines evaluate a range of advanced imaging and procedures, including NM, US, CT, MRI, PET, Radiation Oncology, Sleep Studies, as well as Cardiac, musculoskeletal and Spine interventions.
- UnitedHealthcare reserves the right to change and update the guidelines. The guidelines undergo a formal review annually. UnitedHealthcare's guidelines are based on current evidence supported by major national and international association and society guidelines and criteria, peer-reviewed literature, major treatises as well as, input from health plans, and practicing academic and community-based physicians.
- These guidelines are not intended to supersede or replace sound medical judgment, but instead, should facilitate the identification of the most appropriate imaging or other designated procedure given the individual's clinical condition. These guidelines are written to cover medical conditions as experienced by the majority of individuals. However, these guidelines may not be applicable in certain clinical circumstances, and physician judgment can override the guidelines.
- These guidelines provide evidence-based, clinical benefits with a focus on health care quality and patient safety.
- Clinical decisions, including treatment decisions, are the responsibility of the individual and his/her provider. Clinicians are expected to use independent medical judgment, which takes into account the clinical circumstances to determine individual management decisions.
- UnitedHealthcare supports the Choosing Wisely initiative (**https:// www.choosingwisely.org/**) by the American Board of Internal Medicine (ABIM) Foundation and many national physician organizations, to reduce the overuse of diagnostic tests that are low value, no value, or whose risks are greater than the benefits.

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Investigational and Experimental Studies

- Certain studies, treatments, procedures, or devices may be considered experimental, investigational, or unproven for any condition, illness, disease, injury being treated if one of the following is present:
  - if there is a paucity of supporting evidence;
  - if the evidence has not matured to exhibit improved health parameters;
  - if clinical utility has not been demonstrated in any condition; OR
  - if the study, treatment, procedure, or device lacks a collective opinion of support
- Supporting evidence includes standards that are based on credible scientific evidence published in peer-reviewed medical literature (such as well conducted randomized clinical trials or cohort studies with a sample size of sufficient statistical power) generally recognized by the relevant medical community. Collective opinion of support includes physician specialty society recommendations and the views of physicians practicing in relevant clinical areas when physician specialty society recommendations are not available.

Clinical and Research Trials

- Similar to investigational and experimental studies, clinical trial imaging requests will be considered to determine whether they meet UnitedHealthcare's evidence-based guidelines.
- Imaging studies which are inconsistent with established clinical standards, or are requested for data collection and not used in direct clinical management are not supported.

Legislative Mandate

- State and federal legislations may need to be considered in the review of advanced imaging requests.

References (Preface-2)

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1. Coverage of Clinical Trials under the Patient Protection and Affordable Care Act; 42 U.S.C.A. § 300gg-8.

Clinical Information (Preface-3)

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Clinical Documentation and Age Considerations

- UnitedHealthcare's guidelines use an evidence-based approach to determine the most appropriate procedure for each individual, at the most appropriate time in the diagnostic and treatment cycle. UnitedHealthcare's guidelines are framed by:
  - Clinical presentation of the individual, rather than the studies requested
  - Adequate clinical information that must be submitted to UnitedHealthcare in order to establish medical necessity for advanced imaging or other designated procedures includes, but is not limited to, the following:
    - Pertinent clinical evaluation should include a recent detailed history, physical examination[20] since the onset or change in symptoms, and/or laboratory and prior imaging studies.
      - Condition-specific guideline sections may describe additional clinical information which is required for a pertinent clinical evaluation.
      - The Spine and Musculoskeletal guidelines require x-ray studies from when the current episode of symptoms has started or changed; x-ray imaging does not have to be within the past 60 days.
      - Advanced imaging or other designated procedures should not be ordered prior to clinical evaluation of an individual by the physician treating the individual. This may include referral to a consultant specialist who will make further treatment decisions.
      - Other meaningful technological contact (telehealth visit, telephone or video call, electronic mail or messaging) since the onset or change in symptoms by an established individual can serve as a pertinent clinical evaluation.
        - Some conditions may require a face-to-face evaluation as discussed in the applicable condition-specific guideline sections.
    - A recent clinical evaluation may be unnecessary if the individual is undergoing a guideline-supported, scheduled follow-up imaging or other designated procedural evaluation. Exceptions due to routine surveillance indications are addressed in the applicable condition-specific guideline sections.
  - UnitedHealthcare’s evidence-based approach to determine the most appropriate procedure for each individual requires submission of medical records pertinent to the requested imaging or other designated procedures.
- Many conditions affecting the pediatric population are different diagnoses than those occurring in the adult population. For those diseases which occur in both pediatric and adult populations, minor differences may exist in management due to individual

age, comorbidities, and differences in disease natural history between children and adults.
  - Individuals who are 18 years old or younger[19] should be imaged according to the Pediatric Imaging Guidelines if discussed in the condition-specific guideline sections. Any conditions not specifically discussed in the Pediatric Imaging Guidelines should be imaged according to the General Imaging Guidelines. Individuals who are >18 years old should be imaged according to the General Imaging Guidelines, except where directed otherwise by a specific guideline section.
- The terms “male” and “female” used in these guidelines refer to anatomic-specific diseases and disease predispositions associated with the individual's sex assigned at birth rather than their gender identity. It should be noted that gender identity and anatomic-specific diseases as well as disease predispositions are not always linked. As such, these guidelines should be applied to the individual’s corresponding known or suspected anatomic-specific disease or disease predisposition. At UnitedHealthcare, we believe that it is important to understand how all individuals, including those who are gender-diverse, choose to identify themselves. To ensure that gender-diverse individuals are treated with respect and that decisions impacting their healthcare are made correctly and with sensitivity, UnitedHealthcare recognizes all individuals with the following gender marker options: Male, Female, Transgender Male, Transgender Female, “X”, and “Not Specified.”

General Imaging Information

- “Standard” or “conventional” imaging is most often performed in the initial and subsequent evaluations of malignancy. Standard or conventional imaging includes plain film, CT, MRI, or US.
  - Often, further advanced imaging is needed when initial imaging, such as ultrasound, CT, or MRI does not answer the clinical question. Uncertain, indeterminate, inconclusive, or equivocal may describe these situations.
- Appropriate use of contrast is a very important component of evidence-based advanced imaging use.
  - The appropriate levels of contrast for an examination (i.e., without contrast, with contrast, without and with contrast) is determined by the evidence-based guidance reflected in the condition-specific guideline sections.
  - If, during the performance of a non-contrast imaging study, there is the unexpected need to use contrast in order to evaluate a possible abnormality, then that is appropriate.[1]

Ultrasound

- Diagnostic ultrasound uses high-frequency sound waves to evaluate soft tissue structures and vascular structures utilizing grey scale and Doppler techniques.
- Ultrasound allows for dynamic real-time imaging at the bedside.

  - Ultrasound is limited in areas where there is dense bone or other calcification.
  - Ultrasound also has a relatively limited imaging window so may be of limited value in evaluating very large abnormalities.
  - In general, ultrasound is highly operator-dependent, and proper training and experience are required to perform consistent, high-quality evaluations.
- Indications for ultrasound may include, but are not limited to, the following:
  - Obstetric and gynecologic imaging
  - Soft tissue and visceral imaging of the chest, abdomen, pelvis, and extremities
  - Brain and spine imaging when not obscured by dense bony structures
  - Vascular imaging when not obscured by dense bony structures
  - Procedural guidance when not obscured by dense bony structures
  - Initial evaluation of ill-defined soft tissue masses or fullness and differentiating adenopathy from mass or cyst. Prior to advanced imaging, ultrasound can be very beneficial in selecting the proper modality, body area, image sequences, and contrast level that will provide the most definitive information for the individual.
- More specific guidance for ultrasound usage, including exceptions to this general guidance, can be found throughout the condition-specific guidelines.

Computed Tomography (CT)

- The AMA CPT® manual does not describe nor assign any minimum or maximum number of sequences for any CT study. CT imaging protocols are often influenced by the individual's clinical situation and additional sequences are not uncommon. There are numerous CT protocols that may be performed to evaluate specific clinical questions, and this technology is constantly undergoing development.
- CT utilizes ionizing radiation to create cross-sectional and volumetric images of the body.
  - Advantages over ultrasound include a much larger field of view and faster completion time in general. Disadvantages compared to ultrasound include lack of portability and exposure to ionizing radiation.
  - Advantages over MRI include faster imaging and a more spacious scanner area limiting claustrophobia. Disadvantages compared to MRI include decreased soft tissue definition, especially with non-contrast imaging, and exposure to ionizing radiation.
- CT can be performed without, with, or without and with intravenous (IV) contrast depending on the clinical indication and body area.
  - In general, non-contrast imaging is appropriate for evaluating structures with significant tissue density differences such as lung parenchyma and bony structures, or when there is a contraindication to contrast.
  - In general, CT with contrast is the most common level of contrast and can be used when there is need for improved vascular or soft tissue resolution, including better

characterization of known or suspected malignancy, as well as infectious and inflammatory conditions.
    - CT without and with contrast has a limited role as the risks of doubling the ionizing radiation exposure rarely outweigh the benefits of multiphasic imaging, though there are some exceptions which include, but are not limited to, the following:
        - Characterization of a mass
        - Characterization of arterial and venous anatomy
        - CT with contrast may be used to better characterize findings on a very recent (within two weeks) inconclusive non-contrast CT where the guidelines would support CT without and with contrast.
    - More specific guidance for CT contrast usage, including exceptions to this general guidance, can be found throughout the condition-specific guidelines.
- Shellfish allergy:
    - It is commonly assumed that an allergy to shellfish indicates iodine allergy, and that this implies an allergy to iodinated contrast media used with CT. However, this is NOT true. Shellfish allergy is due to tropomyosins. Iodine plays no role in these allergic reactions. Allergies to shellfish do not increase the risk of reaction to iodinated contrast media any more than that of other allergens.[1]
- Enteric contrast (oral or rectal) is sometimes used in abdominal imaging. There is no specific CPT® code which refers to enteric contrast.
- The appropriate contrast level and anatomic region in CT imaging is specific to the clinical indication, as listed in the condition-specific guideline sections.
- CT should not be used to replace MRI in an attempt to avoid sedation unless it is listed as a recommended study the appropriate condition-specific guideline.
- There are significant potential adverse effects associated with the use of iodinated contrast media. These include hypersensitivity reactions, thyroid dysfunction, and contrast-induced nephropathy (CIN). Individuals with impaired renal function are at increased risk for CIN.[2]
- Both contrast CT and MRI may be considered to have the same risk profile with renal failure (GFR <30 mL/min).
- The use of CT contrast should proceed with caution in pregnant and breastfeeding individuals. There is a theoretical risk of contrast toxicity to the fetal and infant thyroid. The procedure can be performed if the specific need for that contrast-enhanced procedure outweighs risk to the fetus. Breastfeeding individuals may reduce this risk by choosing to pump and discard breast milk for 12-24 hours after the contrast injection.
- CT without contrast may be appropriate if clinical criteria for CT with contrast are met AND the individual has:
    - Elevated blood urea nitrogen (BUN) and/or creatinine
    - Renal insufficiency
    - Allergies to iodinated contrast

  - Thyroid disease which could be treated with I-131
  - Diabetes
  - Very elderly
  - Urgent or emergent settings due to availability
  - Trauma
- CT is superior to other imaging modalities in certain conditions including, but not limited to, the following:
  - Screening following trauma
  - Imaging pulmonary disease
  - Imaging abdominal and pelvic viscera
  - Imaging of complex fractures
  - Evaluation of inconclusive findings on Ultrasound or MRI, or if there is a contraindication to MRI
- More specific guidance for CT usage, including exceptions to this general guidance, can be found throughout the condition-specific guidelines.

Magnetic Resonance Imaging (MRI)

- The AMA CPT® manual does not describe nor assign any minimum or maximum number of sequences for any MRI study. MRI protocols are often influenced by the individual's clinical situation and additional sequences are not uncommon. There are numerous MRI sequences that may be performed to evaluate specific clinical questions, and this technology is constantly undergoing development.
- Magnetic Resonance Imaging (MRI) utilizes the interaction between the intrinsic radiofrequency of certain molecules in the body (hydrogen in most cases) and a strong external magnetic field.
  - MRI is often superior for advanced imaging of soft tissues and can also define physiological processes in some instances (e.g., edema, loss of circulation [AVN], and increased vascularity [tumors]).
  - MRI does not use ionizing radiation and even non-contrast images have much higher soft tissue definition than CT or Ultrasound.
  - MRI typically takes much longer than either CT or Ultrasound, and for some individuals may require sedation. It is also much more sensitive to individual motion that can degrade image quality than either CT or Ultrasound.
- MRI Breast and MRI Chest are not interchangeable, as they focus detailed sequences on different adjacent body parts.
- MRI may be utilized either as the primary advanced imaging modality, or when further definition is needed based on CT or ultrasound imaging.
- Most orthopedic and dental implants are not magnetic. These include hip and knee replacements; plates, screws, and rods used to treat fractures; and cavity fillings. Yet,

all of these metal implants can distort the MRI image if near the part of the body being scanned.
  - Other implants, however, may have contraindications to MRI. These include the following:
    - Pacemakers
    - ICD or heart valves
    - Metal implants in the brain
    - Metal implants in the eyes or ears
    - Infusion catheters and bullets or shrapnel
  - CT can therefore be an alternative study to MRI in these scenarios.
- The contrast level and anatomic region in MRI imaging is specific to the clinical indication, as listed in the specific guideline sections.
- MRI utilizing Xenon Xe 129 for contrast is considered investigational and experimental at this time. MRI with or with and without contrast in these guidelines refers to MRI utilizing gadolinium for contrast.
- MRI is commonly performed without, without and with contrast.
  - Non-contrast imaging offers excellent tissue definition.
  - Imaging without and with contrast is commonly used when needed to better characterize tissue perfusion and vascularization.
    - Most contrast is gadolinium based and causes T2 brightening of the vascular and extracellular spaces.
    - Some specialized gadolinium and non-gadolinium contrast agents are available, and most commonly used for characterizing liver lesions.
  - MRI with contrast only is rarely appropriate and is usually used to better characterize findings on a recent inconclusive non-contrast MRI, commonly called a completion study.
  - MRI contrast is contraindicated in pregnant individuals.
  - More specific guidance for MRI contrast usage, including exceptions to this general guidance, can be found throughout the condition-specific guidelines.
- MRI may be preferred in individuals with renal failure and in individuals allergic to intravenous CT contrast.
  - Both contrast CT and MRI may be considered to have the same risk profile with renal failure (GFR <30 mL/min).[2]
  - Gadolinium can cause Nephrogenic Systemic Fibrosis (NSF). The greater the exposure to gadolinium in individuals with a low GFR (especially if on dialysis), the greater the chance of individuals developing NSF.
  - Multiple studies have demonstrated potential for gadolinium deposition following the use of gadolinium-based contrast agents (GBCAs) for MRI studies.[3,4,5,6,7] The U.S. Food and Drug Administration (FDA) has noted that there is currently no evidence to suggest that gadolinium retention in the brain is harmful and restricting

gadolinium-based contrast agents (GBCAs) use is not warranted at this time. It has been recommended that GBCA use should be limited to circumstances in which additional information provided by the contrast agent is necessary and the necessity of repetitive MRIs with GBCAs should be assessed.[8]

- A CT may be approved in place of an MRI when clinical criteria are met for MRI AND there is a contraindication to having an MRI (pacemaker, ICD, insulin pump, neurostimulator, etc.).
  - When replacing MRI with CT, contrast level matching should occur as follows:
    - MRI without contrast → CT without contrast
    - MRI without and with contrast → CT with contrast or CT without and with contrast
- The following situations may impact the appropriateness for MRI and or MR contrast:
  - Caution should be taken in the use of gadolinium in individuals with renal failure.
  - The use of gadolinium contrast agents is contraindicated during pregnancy unless the specific need for that procedure outweighs risk to the fetus.
  - MRI can be performed for non-ferromagnetic body metals (i.e., titanium), although some imaging facilities will consider it contraindicated if recent surgery, regardless of the metal type.
- MRI should not be used as a replacement for CT for the sole reason of avoidance of ionizing radiation when MRI is not supported in the condition-based guidelines, since it does not solve the problem of overutilization.
- MRI is superior to other imaging modalities in certain conditions including, but not limited to, the following:
  - Imaging the brain and spinal cord
  - Characterizing visceral and musculoskeletal soft tissue masses
  - Evaluating musculoskeletal soft tissues including ligaments and tendons
  - Evaluating inconclusive findings on ultrasound or CT
  - Individuals who are pregnant or have high radiation sensitivity
  - Suspicion, diagnosis, or surveillance of infections
- More specific guidance for MRI usage, including exceptions to this general guidance, can be found throughout the condition-specific guidelines.

Positron Emission Tomography (PET)

- PET is a nuclear medicine study that uses a positron emitting radiotracer to create cross-sectional and volumetric images based on tissue metabolism.
- Conventional imaging (frequently CT, sometimes MRI or bone scan) of the affected area(s) drives much of initial and restaging and surveillance imaging for malignancy and other chronic conditions. PET is not indicated for surveillance imaging unless specifically stated in the condition-specific guideline sections.
- PET/MRI is generally not supported, see **PET-MRI (Preface-5.3)**.

- PET is rarely performed as a single modality, but is typically performed as a combined PET/CT.
  - The unbundling of PET/CT into separate PET and diagnostic CT CPT® codes is not supported, because PET/CT is done as a single study.
- PET/CT lacks the tissue definition of CT or MRI, but is fairly specific for metabolic activity based on the radiotracer used.
- Indications for PET/CT may include the following:
  - Oncologic Imaging for evaluation of tumor metabolic activity
  - Cardiac Imaging for evaluation of myocardial metabolic activity
  - Brain Imaging for evaluation of metabolic activity for procedural planning
- More specific guidance for PET usage, including exceptions to this general guidance, can be found throughout the condition-specific guidelines.

Overutilization of Advanced Imaging

- A number of recent reports describe overutilization in many areas of advanced imaging and other procedures, which may include the following:
  - High-level testing without consideration of less invasive, lower cost options which may adequately address the clinical question at hand
  - Excessive radiation and costs with unnecessary testing
  - Defensive medical practice
  - CT without and with contrast (so called "double contrast studies") requests, which have few current indications
  - MRI requested in place of CT to avoid radiation without considering the primary indication for imaging
  - Adult CT settings and protocols used for smaller people and children
  - Unnecessary imaging procedures when the same or similar studies have already been conducted
- A review of the imaging or other relevant procedural histories of all individuals presenting for studies has been recognized as one of the more important processes that can be significantly improved. By recognizing that a duplicate or questionably indicated examination has been ordered for individuals, it may be possible to avoid exposing them to unnecessary risks.[9,10] To avoid these unnecessary risks, the precautions below should be considered:
  - The results of initial diagnostic tests or radiologic studies to narrow the differential diagnosis should be obtained prior to performing further tests or radiologic studies.
  - The clinical history should include a potential indication such as a known or suspected abnormality involving the body part for which the imaging study is being requested. These potential indications are addressed in greater detail within the applicable guidelines.

  - The results of the requested imaging procedures should be expected to have an impact on individual management or treatment decisions.
  - Repeat imaging studies are not generally necessary unless there is evidence of disease progression, recurrence of disease, and/or the repeat imaging will affect an individual's clinical management.
- Pre-operative imaging/pre-surgical planning imaging/pre-procedure imaging is not indicated if the surgery/procedure is not indicated. Once the procedure has been approved or if the procedure does not require prior authorization, the appropriate pre-procedural imaging may be approved.

References (Preface-3)

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CPT® 76376 and CPT® 76377

- Both codes require concurrent supervision of the image post-processing 3D manipulation of the volumetric data set and image rendering.
  - Concurrent supervision is defined as active physician participation in and monitoring of the reconstruction process including design of the anatomic region that is to be reconstructed; determination of the tissue types and actual structures to be displayed (e.g., bone, organs, and vessels); determination of the images or cine loops that are to be archived; and, monitoring and adjustment of the 3D work product. The American College of Radiology (ACR) recommends that it is best to document the physician's supervision or participation in the 3D reconstruction of images.
- These two codes differ in the need for and use of an independent workstation for post-processing.
  - CPT® 76376 reports procedures not requiring image post-processing on an independent workstation.
  - CPT® 76377 reports procedures that require image post-processing on an independent workstation.
- These 3D rendering codes should not be used for 2D reformatting.
- Two-dimensional reconstruction (e.g., reformatting an axial scan into the coronal plane) is now included in all cross-sectional imaging base codes and is not separately reimbursable.
- The codes used to report 3D rendering for ultrasound and echocardiography are also used to report the 3D post processing work on CT, MRI, and other tomographic modalities.
- Providers may be required to obtain prior authorization on these 3D codes even if prior authorization is not required for the echocardiography and/or ultrasound procedure codes. It may appear that UnitedHealthcare pre-authorizes echocardiography and/or ultrasound when, in fact, it may only be the 3D code that needs the prior authorization.
- CPT® codes for 3D rendering should not be billed in conjunction with computer-aided detection (CAD), MRA, CTA, nuclear medicine SPECT studies, PET, PET/CT, Mammogram, MRI Breast, US Breast, CT Colonography (virtual colonoscopy), Cardiac MRI, Cardiac CT, or Coronary CTA studies.

- CPT® 76377 (3D rendering requiring image post-processing on an independent workstation) or CPT® 76376 (3D rendering not requiring image post-processing on an independent workstation) can be considered in the following clinical scenarios:
  - Bony conditions:
    - Evaluation of congenital skull abnormalities in newborns, infants, and toddlers (usually for pre-operative planning)
    - Complex fractures (comminuted or displaced)/dislocations of any joint (for pre-operative planning when conventional imaging is insufficient)
    - Spine fractures, pelvic/acetabulum fractures, intra-articular fractures (for pre-operative planning when conventional imaging is insufficient)
    - Pre-operative planning for other complex surgical cases
    - Complex facial fractures
  - Pre-operative planning for other complex surgical cases
  - Cerebral angiography
  - Pelvis conditions:
    - Uterine intra-cavitary lesion when initial US is equivocal: See **Abnormal Uterine Bleeding (AUB) (PV-2.1)** and **Leiomyoma/Uterine Fibroids (PV-12.1)** in the Pelvis Imaging Guidelines.
    - Hydrosalpinxes or peritoneal cysts when initial US is indeterminate: See **Complex Adnexal Masses (PV-5.3)** in the Pelvis Imaging Guidelines.
    - Lost IUD (inability to feel or see IUD string) with initial US: See **Intrauterine Device (PV-10.1)** in the Pelvis Imaging Guidelines.
    - Uterine anomalies with initial US: See **Uterine Anomalies (PV-14.1)** in the Pelvis Imaging Guidelines.
    - Infertility: See **Initial Infertility Evaluation, Female (PV-9.1)** in the Pelvis Imaging Guidelines.
  - Abdomen conditions:
    - CT Urogram: See **Hematuria and Hydronephrosis (AB-39)** in the Abdomen Imaging Guidelines.
    - MRCP: See **MR Cholangiopancreatography (MRCP) (AB-27)** in the Abdomen Imaging Guidelines.

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CT-, MR-, or Ultrasound-Guided Procedures (Preface-4.2)

PRF.CD.0004.2.A

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- CT-, MR-, and Ultrasound-guidance procedure codes contain all of the imaging necessary to guide a needle or catheter. It is inappropriate to routinely bill a diagnostic procedure code in conjunction with a guidance procedure code.
- Imaging studies performed as part of a CT-, MR-, or Ultrasound-guided procedure should be reported using the CPT® codes in the following table:

TABLE: Imaging Guidance Procedure Codes

CPT®	Description
19085	Biopsy, breast, with placement of breast localization device(s), when performed, and imaging of the biopsy specimen, when performed, percutaneous; first lesion, including MR guidance
19086	Biopsy, breast, with placement of breast localization device(s), when performed, and imaging of the biopsy specimen, when performed, percutaneous; each additional lesion, including MR guidance
75989	Imaging guidance for percutaneous drainage with placement of catheter (all modalities)
76942	Ultrasonic guidance for needle placement
77011	CT guidance for stereotactic localization
77012	CT guidance for needle placement
77013	CT guidance for, and monitoring of parenchymal tissue ablation
77021	MR guidance for needle placement
77022	MR guidance for, and monitoring of parenchymal tissue ablation

CPT® 19085 and CPT® 19086

- The proper way to bill an MRI-guided breast biopsy is CPT® 19085 (Biopsy, breast, with placement of breast localization device(s), when performed, and imaging of the biopsy specimen, when performed, percutaneous; first lesion, including MR guidance). Additional lesions should be billed using CPT® 19086.
  - **CPT® 77021** (MR guidance for needle placement) is not an appropriate code for a breast biopsy.

CPT® 75989

- This code is used to report imaging guidance for a percutaneous drainage procedure in which a catheter is left in place.
- This code can be used to report whether the drainage catheter is placed under fluoroscopy, Ultrasound-, CT-, or MR-guidance modality.

CPT® 77011

- A stereotactic CT localization scan is frequently obtained prior to sinus surgery. The dataset is then loaded into the navigational workstation in the operating room for use during the surgical procedure. The information provides exact positioning of surgical instruments with regard to the individual's 3D CT images.[3]
- In most cases, the pre-operative CT is a technical-only service that does not require interpretation by a radiologist.
  - The imaging facility should report CPT® 77011 when performing a scan not requiring interpretation by a radiologist.
  - If a diagnostic scan is performed and interpreted by a radiologist, the appropriate diagnostic CT code (e.g., CPT® 70486) should be used.
  - It is not appropriate to report both CPT® 70486 and CPT® 77011 for the same CT stereotactic localization imaging session.
  - 3D Rendering (CPT® 76376 or CPT® 76377) should not be reported in conjunction with CPT® 77011 (or CPT® 70486 if used). The procedure inherently generates a 3D dataset.

CPT® 77012 (CT) and CPT® 77021 (MR)

- These codes are used to report imaging guidance for needle placement during biopsy, aspiration, and other percutaneous procedures.
- They represent the radiological supervision and interpretation of the procedure and are often billed in conjunction with surgical procedure codes.
  - For example, CPT® 77012 is reported when CT guidance is used to place the needle for a conventional arthrogram.
  - Only codes representing percutaneous surgical procedures should be billed with CPT® 77012 and CPT® 77021. It is inappropriate to use with surgical codes for open, excisional, or incisional procedures.

- **CPT® 77021** (MR guidance for needle placement) is not an appropriate code for breast biopsy.
  - CPT® 19085 would be appropriate for the first breast biopsy site and CPT® 19086 would be appropriate for additional concurrent biopsies.

CPT® 77013 (CT) and CPT® 77022 (MR)

- These codes include the initial guidance to direct a needle electrode to the tumor(s), monitoring for needle electrode repositioning within the lesion, and as necessary for multiple ablations to coagulate the lesion and confirmation of satisfactory coagulative necrosis of the lesion(s) and comparison to pre-ablation images.
  - **NOTE:** CPT® 77013 should only be used for non-bone ablation procedures.
    - CPT® 20982 includes CT guidance for bone tumor ablations.
  - Only codes representing percutaneous surgical procedures should be billed with CPT® 77013 and CPT® 77022. It is inappropriate to use with surgical codes for open, excisional, or incisional procedures.
- CPT® 77012 and CPT® 77021 (as well as guidance codes CPT® 76942 [US], and CPT® 77002 - CPT® 77003 [fluoroscopy]) describe radiologic guidance by different modalities.
  - Only one unit of any of these codes should be reported per individual encounter (date of service). The unit of service is considered to be the individual encounter, not the number of lesions, aspirations, biopsies, injections, or localizations.

Unlisted Procedures/Therapy Treatment Planning (Preface-4.3)

PRF.CD.0004.3.UOH
v2.0.2024

CPT®	Description
76497	Unlisted CT procedure (e.g., diagnostic or interventional)
76498	Unlisted MR procedure (e.g., diagnostic or interventional)
78999	Unlisted procedure, diagnostic nuclear medicine

- These unlisted codes should be reported whenever a diagnostic or interventional CT or MR study is performed in which an appropriate anatomic site-specific code is not available.
  - A Category III code that describes the procedure performed must be reported rather than an unlisted code if one is available.
- CPT® 76497 or CPT® 76498 (Unlisted CT or MRI procedure) can be considered in the following clinical scenarios:
  - Studies done for navigation and planning for neurosurgical procedures (i.e., Stealth or Brain Lab Imaging)[1,2]
  - Custom joint arthroplasty planning (not as an alternative recommendation): See **Osteoarthritis (MS-12.1)** in the Musculoskeletal Imaging Guidelines.
  - Any procedure/surgical planning if thinner cuts or different positional acquisition (than those on the completed diagnostic study) are needed. These could include navigational bronchoscopy: See **Navigational Bronchoscopy (CH-1.7)** in the Chest Imaging Guidelines.

Therapy Treatment Planning

- Radiation Therapy Treatment Planning: See **Unlisted Procedure Codes in Oncology (ONC-1.5)** in the Oncology Imaging Guidelines.

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CPT® 76380 Limited or Follow-up CT (Preface-4.5)

PRF.CD.0004.5.UOH

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- CPT® 76380 describes a limited or follow-up CT scan. The code is used to report any CT scan, for any given area of the body, in which the work of a full diagnostic code is not performed.
- Common examples include, but are not limited to, the following:
  - Limited sinus CT imaging protocol
  - Limited or follow-up slices through a known pulmonary nodule
  - Limited slices to assess a non-healing fracture (such as the clavicle)
- Limited CT (CPT® 76380) is not indicated for treatment planning purposes. See **Unlisted Procedure Codes in Oncology (ONC-1.5)** in the Oncology Imaging Guidelines.
- It is inappropriate to report CPT® 76380, in conjunction with other diagnostic CT codes, to cover 'extra slices' in certain imaging protocols.
  - There is no specific number of sequences or slices defined in any CT CPT® code definition.
  - The AMA, in *CPT® 2019*, does not describe nor assign any minimum or maximum number of sequences or slices for any CT study.
    - A few additional slices or sequences are not uncommon.
    - CT imaging protocols are often influenced by the individual's clinical situation. Sometimes the protocols require more time and sometimes less.

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SPECT/CT Imaging (Preface-4.6)

PRF.CD.0004.6.A

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- SPECT/CT involves SPECT (Single Photon Emission Computed Tomography) nuclear medicine imaging and CT for optimizing location, accuracy, and attenuation correction and combines functional and anatomic information.
  - Common studies using this modality include ^{123}I- or ^{131}I-Metaiodobenzylguanidine (MIBG) and octreotide scintigraphy for neuroendocrine tumors.
- Hybrid Nuclear/CT scan can be reported as CPT® 78830 (single area and single day), CPT® 78831 (2 or more days), or CPT® 78832 (2 areas with one day and 2-day study).
- CPT® 78072 became effective January 1, 2013 for SPECT/CT parathyroid nuclear imaging.

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CPT® 76140 Interpretation of an Outside Study (Preface-4.7)

PRF.CD.0004.7.UOH

v2.0.2024

- It is inappropriate to use diagnostic imaging codes for interpretation of a previously performed exam that was completed at another facility.
  - If the outside exam is being used for comparison with a current exam, the diagnostic code for the current examination includes comparison to the prior study.[4]
  - CPT® 76140 is the appropriate code to use for an exam which was completed elsewhere and a secondary interpretation of the images is requested.[5]

Quantitative MR Analysis (Preface-4.8)

PRF.CD.0004.8.A

v2.0.2024

- Category III CPT® codes for quantitative analysis of multiparametric-MR (mp-MRI) data with and without an associated diagnostic MRI have been established. Quantitative mp-MRI uses software to analyze tissue physiology of visceral organs and other anatomic structures non-invasively. At present, these procedures are primarily being used in clinical trials and there is no widely recommended indications in clinical practice. As such, these procedures are considered to be investigational and experimental for coverage purposes.
  - CPT® 0648T (without diagnostic MRI) and CPT® 0649T (with diagnostic MRI) refer to data analysis with and without associate imaging of a single organ, with its most common use being LiverMultiScan (LMS).
    - See **Fatty Liver (AB-29.2)** in the Abdomen Imaging Guidelines.
  - CPT® 0697T (without diagnostic MRI) and CPT® 0698T (with diagnostic MRI) refer to data analysis with and without associate imaging of a multiple organs, with its most common use being CoverScan.
  - Volumetric and quantitative MRI analysis of the brain (CPT® 0865T or CPT® 0866T) lack sufficient specificity and sensitivity to be clinically useful. Its use is limited to research studies and is otherwise considered to be not medically necessary in routine clinical practice.

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HCPCS Codes (Preface-4.9)

PRF.CD.0004.9.UOH

v2.0.2024

- Healthcare Common Procedure Coding System (HCPCS) codes are utilized by some hospitals in favor of the typical Level-III CPT® codes. These codes are typically 4 digits preceded by a C or S.[6]
  - Many of these codes have similar code descriptions to Level-III CPT® codes (i.e., C8931 – MRA with dye, Spinal Canal; and, CPT® 72159 – MRA Spinal Canal).
  - If cases are submitted with HCPCS codes with similar code descriptions to the typical Level-III CPT® codes, those procedures should be managed in the same manner as the typical CPT® codes.
  - HCPCS code management is discussed further in the applicable guideline sections.
- Requests for many Healthcare Common Procedure Coding System (HCPCS) codes, including non-specific codes such as S8042 (Magnetic resonance imaging [MRI], low-field), should be redirected to a more appropriate and specific CPT® code. Exceptions are noted in the applicable guideline sections.

Whole-Body Imaging (Preface-5)

Guideline

Whole-Body CT Imaging (Preface-5.1)

PRF.WB.0005.1.UOH

v2.0.2024

- Whole-body CT or LifeScan (CT Brain, Chest, Abdomen, and Pelvis) for screening of asymptomatic individuals is not indicated. The performance of whole-body screening CT examinations in healthy individuals does not meet any of the current validity criteria for screening studies and there is no clear documentation of benefit versus radiation risk.
- Whole-body low-dose CT is supported for oncologic staging in Multiple Myeloma. See **Multiple Myeloma and Plasmacytomas (ONC-25)** in the Oncology Imaging Guidelines.

Whole-Body MR Imaging (Preface-5.2)

PRF.WB.0005.2.A

v2.0.2024

- Whole-body MRI (WBMRI) is, with the exception of select cancer predisposition syndromes and autoimmune conditions discussed below, generally not supported at this time due to lack of standardization in imaging technique and lack of evidence that WBMRI improves outcome for any individual disease state.
  - While WBMRI has the benefit of whole-body imaging and lack of radiation exposure, substantial variation still exists in the number of images, type of sequences (STIR vs. diffusion weighting, for example), and contrast agent(s) used.
- Coding considerations:
  - There are no established CPT® or HCPCS codes for reporting WBMRI.
  - WBMRI is at present only reportable using CPT® 76498. All other methods of reporting whole-body MRI are inappropriate including the following:
    - Separate diagnostic MRI codes for multiple individual body parts
    - MRI Bone Marrow Supply (CPT® 77084)
- Disease-specific considerations:
  - Cancer screening:
    - Interval WBMRI is recommended for cancer screening in individuals with select cancer predisposition syndromes. Otherwise, WBMRI has not been shown to improve outcomes for cancer screening.
      - For additional information, see **Li-Fraumeni Syndrome (LFS) (PEDONC-2.2)**, **Hereditary Paraganglioma-Pheochromocytoma (HPP) Syndromes (PEDONC-2.13)**, or **Constitutional Mismatch Repair Deficiency (CMMRD or Turcot Syndrome) (PEDONC-2.15)** in the Pediatric Oncology Imaging Guidelines.
  - Cancer staging and restaging:
    - While the feasibility of WBMRI has been established, data remain conflicting on whether WBMRI is of equivalent diagnostic accuracy compared with standard imaging modalities such as CT, scintigraphy, and PET imaging.
    - Evidence has not been published establishing WBMRI as a standard evaluation for any type of cancer.
  - Autoimmune disease:
    - WBMRI can be approved in some situations for individuals with chronic recurrent multifocal osteomyelitis.
      - For additional information, see **Chronic Recurrent Multifocal Osteomyelitis (PEDMS-10.2)** in the Pediatric Musculoskeletal Imaging Guidelines.

PET-MRI (Preface-5.3)

PRF.WB.0005.3.A

v2.0.2024

- PET-MRI is generally not supported for a vast majority of oncologic and neurologic conditions due to lack of standardization in imaging technique and interpretation. However, it may be appropriate in select circumstances when the following criteria are met:
  - The individual meets condition-specific guidelines for PET-MRI OR
  - The individual meets ALL of the following:
    - The individual is a pediatric patient or being treated under a pediatric guideline and treatment plan AND
    - The individual meets guideline criteria for PET-CT, AND
    - PET-CT is not available at the treating institution, AND
    - The provider requests PET-MRI in lieu of PET-CT
- When the above criteria are met, PET-MRI may be reported using the code combination of PET Whole-Body (CPT® 78813) and MRI Unlisted (CPT® 76498). All other methods of reporting PET-MRI are inappropriate.
  - When clinically appropriate, diagnostic MRI codes may be indicated at the same time as the PET-MRI code combination.
- For more information, see **PET Imaging in Pediatric Oncology (PEDONC-1.4)** in the Pediatric Oncology Imaging Guidelines, and **PET Brain Imaging (PEDHD-2.3)** and **Special Imaging Studies in Evaluation for Epilepsy Surgery (PEDHD-6.3)** in the Pediatric Head Imaging Guidelines.

References (Preface-5)

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References (Preface-6)

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References (Preface-6.1)

References (Preface-6.1)

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- Complete reference citations for the journal articles are embedded within the body of the guidelines and/or may be found on the Reference pages at the end of some guideline sections.
- The website addresses for certain references are included in the body of the guidelines but are not hyperlinked to the actual website.
- The website address for the American College of Radiology (ACR) Appropriateness Criteria® is http://www.acr.org.

Copyright Information (Preface-7)

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Copyright Information (Preface-7.1)

Copyright Information (Preface-7.1)

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Trademarks (Preface-8)

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Trademarks (Preface-8.1)

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Trademarks (Preface-8.1)

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General Information

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General Information

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Abbreviations for the Cardiac Imaging Guidelines

Abbreviation	Description
ACC	American College of Cardiology
ACS	acute coronary syndrome
AHA	American Heart Association
ASCOT	Anglo-Scandinavian Cardiac Outcomes Trial
ASD	atrial septal defect
BMI	body mass index
CABG	coronary artery bypass grafting
CAD	coronary artery disease
CAD-RADS	The Coronary Artery Disease Reporting and Data System
CHF	congestive heart failure
COPD	chronic obstructive pulmonary disease
CT	computed tomography
CCTA	coronary computed tomography angiography
CTA	computed tomography angiography
EBCT	electron beam computed tomography
ECP	external counterpulsation (also known as EECP)
ECG	electrocardiogram

Abbreviation	Description
ECP	external counterpulsation
ETT	exercise treadmill stress test
FDG	Fluorodeoxyglucose, a radiopharmaceutical used to measure myocardial metabolism
HCM	hypertrophic cardiomyopathy
IV	intravenous
LAD	left anterior descending coronary artery
LDL-C	low density lipoprotein cholesterol
LHC	left heart catheterization
LV	left ventricle
LVEF	left ventricular ejection fraction
MI	myocardial infarction
MPI	myocardial perfusion imaging (SPECT study, nuclear cardiac study)
MRA	magnetic resonance angiography
MRI	magnetic resonance imaging
mSv	millisievert (a unit of radiation exposure) equal to an effective dose of a joule of energy per kilogram of recipient mass
MUGA	multi gated acquisition scan of the cardiac blood pool
PCI	percutaneous coronary intervention (includes percutaneous coronary angioplasty (PTCA) and coronary artery stenting)
PET	positron emission tomography

Abbreviation	Description
PTCA	percutaneous coronary angioplasty
RHC	right heart catheterization
SPECT	single photon emission computed tomography
TEE	transesophageal echocardiogram
TIA	Transient Ischemic Attack
VSD	ventricular septal defect

Glossary

Agatston Score: a nationally recognized calcium score for the coronary arteries based on Hounsfield units and size (area) of the coronary calcium
Angina: principally chest discomfort, exertional (or with emotional stress) and relieved by rest or nitroglycerin
Anginal variants or equivalents: a manifestation of myocardial ischemia which is perceived by individuals to be (otherwise unexplained) dyspnea, unusual fatigue, more often seen in females and may be unassociated with chest pain
ARVD/ARVC – Arrhythmogenic Right Ventricular Dysplasia/Cardiomyopathy: a potentially lethal inherited disease with syncope and rhythm disturbances, including sudden death, as presenting manifestations
BNP: B-type natriuretic peptide, blood test used to diagnose and track heart failure (n-T-pro-BNP is a variant of this test)
Brugada Syndrome: an electrocardiographic pattern that is unique and might be a marker for significant life-threatening dysrhythmias
Double Product (Rate Pressure Product): an index of cardiac oxygen consumption, is the systolic blood pressure times heart rate, generally calculated at peak exercise; over 25000 means an adequate stress load was performed

Fabry's Disease: an infiltrative cardiomyopathy, can cause heart failure and arrhythmias
Fatigue: a subjective feeling of weakness, tiredness or exhaustion. Exertional fatigue is acute in nature, with rapid onset, short duration, and short recovery period.
Hibernating myocardium: viable but poorly functioning or non-functioning myocardium which likely could benefit from intervention to improve myocardial blood supply
Optimized Medical Therapy: should include (where tolerated) antiplatelet agents, calcium channel antagonists, partial fatty acid oxidase inhibitors (e.g. ranolazine), statins, short-acting nitrates as needed, long-acting nitrates up to 6 months after an acute coronary syndrome episode, beta blocker drugs (optional), angiotensin-converting enzyme (ACE) inhibitors/angiotensin receptor blocking (ARB) agents (optional)
Platypnea: shortness of breath when upright or seated (the opposite of orthopnea) and can indicate cardiac malformations, shunt or tumor
Silent ischemia: absence of ischemic symptoms or signs prior to objective demonstration of ischemia by stress testing and/or demonstration of obstructive CAD
Syncope: loss of consciousness; near-syncope is not syncope
Takotsubo cardiomyopathy: apical dyskinesis oftentimes associated with extreme stress and usually thought to be reversible
Troponin: a marker for ischemic injury, primarily cardiac

Practice Estimate of Effective Radiation Dose chart for Selected Imaging Studies

Imaging Study	Estimate of Effective Radiation Dose
Sestamibi myocardial perfusion study (MPI) PET myocardial perfusion study: Rubidium-82 NH3	 9-12 mSv 3 mSv 2 mSv

Imaging Study	Estimate of Effective Radiation Dose
Thallium myocardial perfusion study (MPI)	22-31 mSv
Diagnostic conventional coronary angiogram (cath)	5-10 mSv
Computed tomography coronary angiography (CTCA) (with prospective gating)	5-15 mSv Less than 5 mSv
CT Abdomen and Pelvis	8-14 mSv
Chest x-ray	<0.1 mSv

General Guidelines (CD-1.0)

CD.GG.0001.0.A

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- A current clinical evaluation (within 60 days) is required prior to considering advanced imaging, which includes:
  - Relevant history and physical examination and appropriate laboratory studies and non-advanced imaging modalities, such as recent ECG (within 60 days), chest x-ray or ECHO/ultrasound, after symptoms started or worsened.
    - Effort should be made to obtain copies of reported “abnormal” ECG studies in order to determine whether the ECG is uninterpretable for ischemia on ETT
    - Most recent previous stress testing and its findings should be obtained
    - Other meaningful contact (telephone call, electronic mail or messaging) by an established individual can substitute for a face-to-face clinical evaluation.
  - A recent clinical evaluation documenting any subjective findings (complaints, changes in behavior) or objective findings (clinical exam findings).
    - Other meaningful contact (telephone call, electronic mail or messaging) by an established individual can substitute for a face-to-face clinical evaluation such as requests based on new increased or worsening symptoms (within the last 60 days).
    - Some conditions may require a face to face evaluation as discussed in the applicable condition -specific guideline sections (such as requests based on new physical exam findings).
    - A recent clinical evaluation may be unnecessary if the individual is undergoing a guideline -supported, scheduled follow -up imaging or other designated procedural evaluation.
    - Exceptions due to routine surveillance indications are addressed in the applicable condition -specific guideline sections
  - Vital signs, height and weight, or BMI, or description of general habitus is needed.
  - Clinical question to be answered by advanced imaging that will affect management of the individual’s clinical condition.
- Cardiac imaging is not indicated if the results will not affect clinical management decisions. If a decision to perform cardiac catheterization or other angiography has already been made, there is often no need for imaging stress testing
- Assessment of ischemic symptoms (if present) based on the descriptions below following this section.

Ischemic evaluation

- For the purposes of guideline sections addressing ischemic evaluation, symptoms can be defined as the following:

- **Cardiac chest pain/pressure/tightness (likely anginal symptoms):**[1] Chest/ epigastric/shoulder/ arm/jaw pain, chest pressure/discomfort occurring with exertion or emotional stress and relieved by rest, nitroglycerin, or both.
- **Less-likely anginal symptoms:** Symptoms including dyspnea or fatigue when not exertional and not relieved by rest/nitroglycerin; also includes generalized fatigue or chest discomfort occurring in a time course not suggestive of angina (eg, resolves spontaneously within seconds or lasts for an extended period and is unrelated to exertion)
- **Noncardiac explanation:** An alternative diagnosis, such as gastroesophageal reflux, chest trauma, anemia, chronic obstructive pulmonary disease, or pleurisy, is present and is the most likely explanation for the patient's symptoms
- **Anginal equivalents** (individuals with previously documented CAD only):
  - Symptoms consistent with individual's known angina pattern in an individual with a history of CABG or PCI
  - Dyspnea on exertion
  - Fatigue (overwhelming sense of exhaustion causing a decreased capacity for physical activity or mental work)

- Other signs and symptoms suggestive of potential cardiac etiology:
  - Dyspnea
  - Orthopnea
  - Paroxysmal nocturnal dyspnea
  - Heartburn unrelated to meals/nausea and vomiting
  - Palpitations
  - Syncope
  - Heart failure
- Chest pain remains the predominant symptom reported by females among those diagnosed with an acute coronary syndrome.
- For the purpose of this guideline, evidence documenting the presence of CAD includes any of the following:
  - Prior heart catheterization or CCTA revealing any of the following:
    - ≥40% stenosis of the left main coronary artery
    - ≥50% stenosis for other coronary arteries
    - Significant stenosis defined by an FFR of ≤0.80
    - History of a prior PCI or CABG
- For the purpose of this guideline, evidence documenting the presence of non-obstructive CAD includes prior heart catheterization or CCTA revealing any of the following:

[1] Multimodality Writing Group for Chronic Coronary Disease, Winchester DE, Maron DJ, et al. ACC/AHA/ASE/ ASNC/ASPC/HFSA/HRS/SCAI/SCCT/SCMR/STS 2023 Multimodality Appropriate Use Criteria for the Detection and Risk Assessment of Chronic Coronary Disease. J Am Coll Cardiol. 2023;81(25):2445-2467. doi:10.1016/ j.jacc.2023.03.411.

- <40% stenosis of the left main coronary artery
- <50% stenosis for other coronary arteries
- FFR >0.8

- The Coronary Artery Disease Reporting and Data System (CAD-RADS) classification of percentage luminal diameter coronary artery stenosis on coronary CT angiography (CCTA)[2] is as follows:
  - CAD-RADS 0: 0%
  - CAD-RADS 1: 1 to 24%
  - CAD-RADS 2: 25 to 49%
  - CAD-RADS 3: 50 to 69%
  - CAD-RADS 4: 70 to 99% or ≥50% left main coronary artery stenosis
  - CAD-RADS 5: 100% (total occlusion)
- For the purposes of this guideline, evidence documenting a prior MI includes any of the following:
  - Presence of diagnostic Q waves on an ECG
  - A fixed perfusion defect on MPI
  - Akinetic or dyskinetic wall motion on echocardiogram
  - Area of Late Gadolinium Enhancement (LGE) on cardiac MRI suggesting scar
- Findings that may alter the ECG changes during exercise or are uninterpretable for ischemia on a stress test:
  - Complete Left Bundle Branch Block (bifasicular block involving right bundle branch and left anterior hemiblock does not render ECG uninterpretable for ischemia)
  - Ventricular paced rhythm
  - Pre-excitation pattern such as Wolff-Parkinson-White
  - ≥1.0 mm ST segment depression (NOT nonspecific ST/T wave changes)
  - LVH with repolarization abnormalities, also called LVH with strain (NOT without repolarization abnormalities or by voltage criteria)
  - T wave inversion in at least two contiguous inferior and/or lateral leads. This includes leads II, AVF, V5 or V6. (T wave inversion isolated in lead III or T wave inversion in lead V1 and V2 are not included).
  - Individual on digitalis preparation

[2] Fletcher GF, Ades PA, Kligfield P, et al. Exercise standards for testing and training: a scientific statement from the American Heart Association. Circulation. 2013;128(8):873-934. doi:10.1161/CIR.0b013e31829b5b44.

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Stress Testing

Guideline

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Stress Testing without Imaging – Procedures (CD-1.2)

CD.ST.0001.2.A
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The Exercise Treadmill Test (ETT) is without imaging.

- Necessary components of an ETT include:
  - ECG that can be interpreted for ischemia.
  - Individual capable of exercise to achieve target heart rate on a treadmill or similar device (5 METs or greater; see functional capacity below). Target heart rate is calculated as 85% of the maximum age predicted heart rate (MPHR). MPHR is estimated as 220 minus the individual's age.
- An abnormal ETT (exercise treadmill test) includes at least one of the following:
  - ST segment depression (horizontal or downsloping, ≥1.0 mm below baseline)
  - Development of chest pain
  - Drop in systolic blood pressure >10 mmHg during exercise
  - Non-sustained ventricular tachycardia ≥3 consecutive ventricular beats at a rate of >100 beats per minute
  - Sustained ventricular tachycardia (ventricular rhythm at rate >100 beats/minute lasting >30 seconds or requiring termination due to hemodynamic compromise in <30 seconds)
- Functional capacity ≥5 METs equates to the following:
  - Can walk four blocks without stopping
  - Can walk up a hill
  - Can climb one flight of stairs without stopping
  - Can perform heavy work around the house
  - Can walk 4 mph at a brisk pace

Background and supporting information

An observational study found that, compared with the Duke Activity Status Index, subjective assessment by clinicians generally underestimated exercise capacity

Upsloping ST segment depression is not considered to be an abnormal ETT finding because of its low specificity.

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Stress Testing with Imaging – Procedures (CD-1.3)

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- Imaging Stress Tests include any one of the following:
  - Stress Echocardiography see **Stress Echocardiography (Stress Echo) – Coding (CD-2.7)**
  - SPECT MPI see **Myocardial Perfusion Imaging (MPI) – Coding (CD-3.1)**
  - Stress perfusion MRI see **Cardiac MRI – Indications for Stress MRI (CD-5.3)**
  - PET Perfusion see **Cardiac PET-Perfusion-Indications (CD-6.2)**
- Stress testing with imaging can be performed with maximal exercise or chemical stress (adenosine, dipyridamole, dobutamine, or regadenoson) and does not alter the CPT® codes used to report these studies.

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Stress Testing with Imaging - Indications (CD-1.4)

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Stress echo, SPECT MPI or stress MRI

Codes Addressed	CPT®
Cardiac MRI for morphology and function without contrast, with stress imaging	75559
Cardiac MRI for morphology and function without and with contrast, with stress imaging	75563
MPI, tomographic (SPECT) including attenuation correction, qualitative or quantitative wall motion, ejection fraction by first pass or gated technique, additional quantification, when performed); single study, at rest or stress (exercise or pharmacologic)	78451
MPI, tomographic (SPECT) (including attenuation correction, qualitative or quantitative wall motion, ejection fraction by first pass or gated technique, additional quantification, when performed); multiple studies, at rest and/or stress (exercise or pharmacologic) and/or redistribution and/or rest reinjection	78452
Echocardiography (TTE), (2D), with or without m-mode, during rest and cardiovascular stress, with interpretation and report	93350
Echocardiography (TTE), (2D), m-mode, during rest and cardiovascular stress test using treadmill, bicycle exercise and/or pharmacologically induced stress, with interpretation	93351

Stress test with imaging (Stress echo, SPECT MPI, or stress MRI) is indicated for **any** of the following:

Likely anginal symptoms

New, recurrent or worsening likely anginal symptoms as defined in **General Guidelines (CD-1.0)**

Symptomatic with known CAD

Prior history of PCI (percutaneous coronary intervention) or CABG (coronary artery bypass graft surgery) or a history of obstructive CAD as defined in **General Guidelines (CD-1.0)** and **either** of the following:

- Likely anginal symptoms as defined in **General Guidelines (CD-1.0)**
- Symptoms similar to prior ischemic episode

Symptomatic with uninterpretable ECG

New, recurrent, or worsening symptoms of chest pain, or exertional dyspnea, or exertional fatigue and resting ECG is uninterpretable for ischemia due to **any** of the following:

- Complete Left Bundle Branch Block (bifasicular block involving right bundle branch and left anterior hemiblock does not render ECG uninterpretable for ischemia)
- Ventricular paced rhythm
- Pre-excitation pattern such as Wolff-Parkinson-White
- Greater or equal to 1.0 mm ST segment depression (NOT nonspecific ST/T wave changes)
- LVH with repolarization abnormalities, also called LVH with strain (NOT without repolarization abnormalities or by voltage criteria)
- T wave inversion in at least two contiguous inferior and/or lateral leads. This includes leads II, AVF, V5 or V6. (T wave inversion isolated in lead III or T wave inversion in lead V1 and V2 are not included)
- Individual on digitalis preparation

Symptomatic with inconclusive or abnormal ETT or elevated CAC

New, recurrent or worsening symptoms of chest pain, or exertional dyspnea, or exertional fatigue and any of the following:

- Inconclusive ETT (exercise treadmill test) due to any of the following:
  - <85% maximum predicted heart rate achieved
  - Exercise ECG is uninterpretable for ischemia (for example due to development of rate-related left bundle branch block during exercise)
- Abnormal ETT as defined in **Stress Testing without Imaging - Procedures (CD-1.2)**
- Coronary artery calcium (CAC) score ≥100

Heart failure or left ventricular systolic dysfunction

Stress test with imaging is indicated to evaluate heart failure or left ventricular systolic dysfunction when there is documentation of **any** of the following:

- New or worsening heart failure
- New left ventricular systolic dysfunction (left ventricular ejection fraction <50%)
- Worsening left ventricular systolic dysfunction (decline in left ventricular ejection fraction ≥10%)

- Significant ischemic ventricular dysfunction (suspected hibernating myocardium) to assess myocardial viability when there are persistent symptoms or heart failure and revascularization is being considered.

Note:

MRI, cardiac PET, SPECT MPI, or Dobutamine stress echo can be used to assess myocardial viability depending on physician preference. See also **Cardiac PET – Metabolic – Indications (CD-6.4)**

Syncope or arrhythmia

Stress test with imaging is indicated for **any** of the following:

- Syncope of suspected ischemic etiology not otherwise explained
- Sustained ventricular tachycardia (ventricular rhythm at rate >100 beats/minute lasting >30 seconds or requiring termination due to hemodynamic compromise in <30 seconds).
- Non-sustained ventricular tachycardia ≥3 consecutive ventricular beats at rate >100 beats/minute
- Frequent PVCs (premature ventricular contractions) > 30 PVCs per hour
- Prior to starting a Class IC antiarrhythmic agent (flecainide or propafenone) to assess for CAD and annually while taking the medication

With or without symptoms for moderate coronary artery stenosis

Stress test with imaging is indicated to evaluate the functional significance of moderate stenosis when there is documentation of **either** of the following:

- CCTA (coronary computed tomography angiography) with moderate stenosis (50 to 69% - CAD-RADS 3 as defined in **General Guidelines CD-1.0**)
- Invasive coronary angiography with intermediate severity stenosis and invasive physiological testing has not been done

Without symptoms

Stress test with imaging is indicated for any of the following:

- Prior to starting Interleukin-2
- An uninterpretable ECG as described in **General Guidelines (CD 1.0)** that has not been previously evaluated
- Every 2 years if there is a history of silent ischemia (absence of ischemic symptoms or signs prior to objective demonstration of ischemia by stress testing and/or demonstration of obstructive CAD as defined in **General Guidelines (CD-1.0)**
- Prior to starting a Class IC antiarrhythmic agent (flecainide or propafenone) to assess for CAD and annually while taking the medication

- Asymptomatic individual who has an ischemic EKG response on ETT (horizontal or downsloping ST depression ≥1.0 mm below baseline).

Cardiac perfusion PET

Codes addressed	CPT®
Myocardial imaging, positron emission tomography (PET), perfusion study (including ventricular wall motion[s] and/or ejection fraction[s], when performed); single study, at rest or stress (exercise or pharmacologic), with concurrently acquired computed tomography transmission scan	78430
Myocardial imaging, positron emission tomography (PET), perfusion study (including ventricular wall motion[s] and/or ejection fraction[s], when performed); multiple studies at rest and stress (exercise or pharmacologic), with concurrently acquired computed tomography transmission scan	78431
Myocardial imaging, positron emission tomography (PET), perfusion study (including ventricular wall motion[s] and/or ejection fraction[s], when performed); single study at rest or stress (exercise or pharmacologic)	78491
Myocardial imaging, positron emission tomography (PET), perfusion study (including ventricular wall motion[s] and/or ejection fraction[s], when performed); multiple studies at rest and stress (exercise or pharmacologic)	78492

Stress test with imaging using cardiac perfusion PET (CPT® 78430, 78431, 78491, 78492) is indicated in place of stress echo, SPECT MPI, or stress MRI when **any** of the above indications for stress testing with imaging (symptomatic or regardless of symptoms) have been met **and** there is documentation of **one** of the following:

- Individual is severely obese
- Individual has large breasts or implants
- Individual incapable of exercise due to physical (musculoskeletal or neurological) inability to achieve target heart rate.

Note: Target heart rate is calculated as 85% of the maximum age predicted heart rate (MPHR). MPHR is estimated as 220 minus the individual's age. See **Cardiac PET – Perfusion – Indications (CD-6.2)** for additional indications for cardiac PET perfusion

Stress Testing with Imaging – Preoperative (CD-1.5)

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- There are **2** steps that determine the need for imaging stress testing in (stable) pre-operative individuals:
  - Step1: Would the individual qualify for imaging stress testing independent of planned surgery?
    - If yes, proceed to stress testing guidelines **Stress Testing with Imaging – Indications (CD-1.4)**
    - If no, go to step 2
  - Step 2: Is the surgery considered high, moderate or low-risk? (see **Table-2**) If high or moderate-risk, proceed below. If low-risk, there is no evidence to determine a need for preoperative cardiac testing.
    - **High-Risk Surgery:** All individuals in this category should receive an imaging stress test if there has not been an imaging stress test within 1 year unless the individual has developed new cardiac symptoms or a new change in the EKG since the last stress test.
    - **Intermediate-Risk Surgery:** One or more clinical risk factors and unable to perform an ETT per guidelines if there has not been an imaging stress test within 1 year unless the individual has developed new cardiac symptoms or a new change in the EKG since the last stress test.
    - **Low-Risk:** Preoperative imaging stress testing is not supported.
  - Clinical Risk Factors (for cardiac death and non-fatal MI at time of non-cardiac surgery)
    - History of ischemic heart disease (previous MI, previous positive stress test, use of nitroglycerin, typical angina, ECG Q waves, previous PCI or CABG)
    - History of compensated previous congestive heart failure (history of heart failure, previous pulmonary edema, third heart sound, bilateral rales, chest x-ray showing heart failure)
    - History of previous TIA or stroke
    - Diabetes Mellitus
    - Creatinine level > 2 mg/dL

Table-2

Cardiac Risk Stratification List		
High-Risk (> 5%)	**Intermediate-Risk (1-5%)**	**Low-Risk (<1%)**
• Open aortic and other major open vascular surgery • Open peripheral vascular surgery • Esophagectomy • Pneumonectomy • Open intraperitoneal and/or intrathoracic surgery with organ resection	• Open intraperitoneal and/ or intrathoracic surgery without major organ resection • Open carotid endarterectomy • Head and neck surgery • Open orthopedic surgery • Open prostate surgery	• Endoscopic procedures • Superficial procedures • Cataract surgery • Breast surgery • Ambulatory surgery • Laparoscopic and endovascular procedures that are unlikely to require further extensive surgical intervention

Transplant (CD-1.6)

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v2.0.2024

- Stress Testing in individuals for Non-Cardiac Transplant
  - Individuals who are candidates for any type of organ, bone marrow, or stem cell transplant can undergo imaging stress testing every year (stress echo, SPECT MPI, stress MRI, or stress cardiac PET perfusion per the transplant center's protocol) prior to transplant. See **Kidney Transplant, Pre-Transplant Imaging Studies (AB-42.5)**.
  - Individuals who have undergone organ transplant are at increased risk for ischemic heart disease secondary to their medication. Risk of vasculopathy is 7% at one-year, 32% at five years and 53% at ten years. An imaging stress test can be repeated annually after transplant for at least two years or within one year of a prior cardiac imaging study if there is evidence of progressive vasculopathy.
  - After two consecutive normal imaging stress tests, repeated testing is not supported more often than every other year without evidence for progressive vasculopathy or new symptoms.
  - Stress testing after five years may proceed according to normal patterns of consideration.
- Post-Cardiac transplant assessment of transplant CAD:
  - One of the following imaging studies may be performed annually:
    - SPECT MPI
    - Stress ECHO
    - Stress MRI
    - Cardiac PET perfusion

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Echocardiography (ECHO)

Guideline

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Transthoracic Echocardiogram (TTE) - Coding (CD-2.1)

CD.EC.0002.1.A
v2.0.2024

Transthoracic Echocardiography (TTE) - Coding

Transthoracic Echocardiography

Description	CPT®
TTE for congenital cardiac anomalies, complete	93303
TTE for congenital cardiac anomalies, follow-up or limited	93304
TTE with 2-D, M-mode, Doppler and color flow, complete	93306
TTE with 2-D, M-mode, without Doppler or color flow	93307
TTE with 2-D, M-mode, follow-up or limited	93308

3D Echocardiography

Description	CPT®
3D echocardiographic imaging and postprocessing during transesophageal echocardiography, or during transthoracic echocardiography for congenital cardiac anomalies, for the assessment of cardiac structure(s) (eg, cardiac chambers and valves, left atrial appendage, interatrial septum, interventricular septum) and function, when performed (List separately in addition to code for echocardiographic imaging) Code with (93303-93304, 93312, 93314, 93315, 93317, 93350-93351)	+93319

Doppler Echocardiography

Description	CPT®
Doppler echo, pulsed wave and/or spectral display	+93320
Doppler echo, pulsed wave and/or spectral display, follow-up or limited study	+93321

Description	CPT®
Doppler echo, color flow velocity mapping	+93325
CPT® 93320 and CPT® 93321 should not be requested or billed together	

C Codes

C codes are unique temporary codes established by CMS. C codes were established for contrast echocardiography. Each echocardiography C code corresponds to a standard echo code (Class I CPT® code) The C code and the matching CPT code should not both be approved.

C Code	Transthoracic Echocardiography	CPT®
C8921	TTE for congenital cardiac anomalies, complete	93303
C8922	TTE for congenital cardiac anomalies, follow-up or limited	93304
C8929	TTE with 2-D, M-mode, Doppler and color flow, complete	93306
C8923	TTE with 2-D, M-mode, without Doppler or color flow	93307
C8924	TTE with 2-D, M-mode, follow-up or limited	93308

Myocardial strain imaging

Description	CPT®
Myocardial strain imaging using speckle tracking-derived assessment of myocardial mechanics (List separately in addition to codes for echocardiography imaging)	+93356

Investigational codes

Description	CPT®
Myocardial contrast perfusion echocardiography, at rest or with stress, for assessment of myocardial ischemia or viability	0439T

Transthoracic Echocardiography (TTE) – Coding - General Information (CD-2.1.1)

- Complete transthoracic echocardiogram with spectral and color flow Doppler (CPT® 93306).
  - 93306 includes the Doppler exams, so CPT® codes 93320-93325 should not be assigned together with CPT® 93306.
  - Doppler codes (CPT®93320, CPT® 93321, and CPT® 93325) are 'add-on codes' (as denoted by the + sign) and are assigned in addition to code for the primary procedure.
- For a 2D transthoracic echocardiogram without Doppler, report CPT® 93307.
- Limited transthoracic echocardiogram (CPT® 93308) should be billed if the report does not "evaluate or document the attempt to evaluate" all of the required structures.
  - A limited transthoracic echocardiogram is reported with CPT® 93308.
  - CPT® 93321 (not CPT® 93308 if Doppler is included in the study. CPT® 93325 can be reported with CPT® 93308 if color flow Doppler is included in the study.
  - A limited congenital transthoracic echocardiogram is reported with CPT® 93304.
- Doppler echo may be used for evaluation of the following:
  - Shortness of breath
  - Known or suspected valvular disease
  - Known or suspected hypertrophic obstructive cardiomyopathy
  - Shunt detection

Background and Supporting Information

- Providers performing echo on a pediatric individual, may not know what procedure codes they will be reporting until the initial study is completed.
- If a congenital issue is found on the initial echo, a complete echo is reported with codes CPT® 93303, CPT® 93320, and CPT® 93325 because CPT® 93303 does NOT include Doppler and color flow mapping.
- If no congenital issue is discovered, then CPT® 93306 is reported alone and includes 2-D, Doppler, and color flow mapping.
- Since providers may not know the appropriate code/s that will be reported at the time of the pre-authorization request, they may request all 4 codes (CPT® 93303, CPT® 93320, CPT® 93325, and CPT® 93306).
- CPT® 76376 and CPT® 76377 are not unique to 3D Echo. These codes also apply to 3D rendering of MRI and CT studies, see **3D Echocardiography – Coding (CD-2.9)**
- CPT® 93325 may also be used with fetal echocardiography
- CPT® 93319 3D echo imaging post-processing of TEE or TTE to evaluate congenital cardiac abnormalities. see **3D Echocardiography – Coding (CD-2.9)**

Myocardial contrast perfusion echocardiography (CPT® 0439T) (CD-2.11)

- Investigational see **Transthoracic Echocardiography (TTE) – Coding (CD-2.1)**

Transthoracic Echocardiography (TTE) Indications/initial evaluation (CD-2.2)

CD.EC.0002.2.A
v2.0.2024

Transthoracic Echocardiography (TTE) is indicated for initial evaluation for any of the following:

Symptoms or signs suggesting cardiovascular disease

- Chest pain/discomfort
- Dyspnea/shortness of breath, or hypoxemia
- Palpitations
- Presyncope/Syncope
- Headache with transcranial Doppler evidence of a shunt or high-degree of suspicion for embolic process
- Dependent lower extremity edema
- Abnormal precordial or peripheral pulse
- New or changing heart murmur or click
- Suspected hypertensive heart disease (initial evaluation)
- Initial evaluation of known/suspected heart failure based on symptoms and/or signs
- Suspected endocarditis with any:
  - Fever
  - Peripheral stigmata of endocarditis
  - New murmur
- History of rheumatic heart disease
- Suspected pericardial diseases
- Suspected cardiac injury due to blunt chest trauma

Diagnostic tests suggesting cardiovascular disease

- Newly diagnosed RBBB or LBBB
- Frequent VPCs defined as occurring more frequently than 30 times per hour or occurring in a pattern of bigeminy, trigeminy, or runs of ventricular tachycardia
- Non sustained or sustained ventricular tachycardia (VT)
- Ventricular fibrillation (VF)
- Newly diagnosed atrial fibrillation/flutter
- Cardiomegaly on a Chest X ray or other imaging

- Elevated level of cardiac biomarkers (Creatinine Kinase isoforms, Troponin I or T, Brain Natriuretic Peptide (BNP), N Terminal pro b-type natriuretic peptide (NT-proBNP) above the normal reference range as defined by the local laboratory assays)
- Initial evaluation of known/suspected heart failure based on diagnostic tests
- Suspected inherited or acquired cardiomyopathy (e.g., restrictive, infiltrative, dilated, hypertrophic)
- Suspected pulmonary hypertension. See **Pulmonary Hypertension CD-8.1**
  - ECG changes of right ventricular hypertrophy
  - Right ventricular hypertrophy or pulmonary artery dilation on other imaging
  - Pulmonary embolism with persistent or new symptoms
- Dilated aortic root and/or ascending aorta seen on other imaging
- Suspected endocarditis with positive blood cultures indicating bacteremia
- Suspected pericardial diseases
- Cardiac mass suspected on other imaging
- To rule out intra-cardiac thrombus in individuals with left ventricular systolic dysfunction prior to undergoing catheter ablation of ventricular arrhythmia.
- ≥6 weeks post myocardial infarction

Extra-cardiac conditions and therapies associated with cardiovascular disease or risk

- CONDITIONS
  - Initial cardiac evaluation of a known systemic, congenital, or acquired disease that could be associated with structural heart disease
  - At risk for developing iron-overload cardiomyopathy (hereditary hemochromatosis or hereditary or acquired hematologic conditions requiring multiple transfusions)
  - Known or suspected connective tissue disease or a genetic condition that predisposes to an aortic aneurysm or dissection (may repeat every two years if negative) See **Screening for Vascular related genetic connective tissue Disorders PVD-2.2**
  - At risk for pulmonary hypertension. See **Pulmonary Hypertension CD-8.1**
    - Scleroderma
    - Lupus
    - Mixed connective tissue disease
    - Hereditary Hemorrhagic Telangiectasia
    - Individuals with pulmonary hypertension mutations (e.g., BMPR2)
  - Suspected pulmonary hypertension in the presence of:
    - Liver disease
    - Lung disease

        - HIV
    - Newly diagnosed or strongly suspected cerebral ischemia or peripheral embolic event
- THERAPIES
    - Use of anorectic drugs, ergot derivatives, or other agents associated with valvular heart disease
    - Pre-procedure evaluation for TIPS (transjugular intrahepatic portosystemic shunt) See **Hepatic Arteries and Veins AB-43.1**
    - Prior to solid organ transplant or hematopoietic stem cell transplant
    - Prior to exposure to cardiotoxic medications or radiation therapy. See **Cardiotoxic agent/Cancer Therapeutics-Related Cardiac Dysfunction CD-12.1**

Inherited cardiovascular conditions

- Member has first degree relative diagnosed with thoracic aortic aneurysm or dissection (may repeat every two years if negative). See **Screening for Vascular related genetic connective tissue Disorders PVD-2.2**, **Thoracic Aortic Aneurysm PVD-6.2**
- Member has first degree relative diagnosed with Bicuspid aortic valve. See **Screening for TAA in individuals with bicuspid aortic valves PVD-2.3**
- Member has diagnosed first degree relative or member is genotype positive for an inherited cardiomyopathy including any of the following:
    - Hypertrophic cardiomyopathy
    - Non compaction cardiomyopathy
    - Familial Dilated Cardiomyopathy
    - Arrhythmogenic Cardiomyopathy (e.g., ARVC)

Additional indications

- One repeat echo can be approved if requested for contrast study (for evaluation of shunts or for left ventricular cavity opacification) when the results of the initial study indicate the need for contrast but contrast was not administered at the initial study.
- Evaluation of congenital heart disease: see **Adult Congenital Heart Disease CD-11** and **Congenital Heart Disease PEDCD-2** in the Pediatric Cardiology imaging guidelines

Frequency of Echocardiography Testing (CD-2.3)

CD.EC.0002.3.A
v2.0.2024

Repeat testing by interval

Repeat Transthoracic Echocardiography (TTE) is indicated for any of the following:

Every 3 years

Valvular heart disease (See also below indications for Valve surgery or intervention)

- Bicuspid aortic valve
- Mild aortic stenosis or aortic valve sclerosis without stenosis
- Mild aortic or mitral regurgitation
- Any mitral stenosis that is not severe, mitral valve area >1.5 cm^2
- Rheumatic valve changes with commissural fusion
- Surgical valve repair or replacement (including bioprosthetic valve <10 years since implant)

Cardiomyopathy

- First degree relative with a diagnosis of inherited cardiomyopathy including:
  - Hypertrophic Cardiomyopathy
  - Familial Dilated Cardiomyopathy
  - Idiopathic Dilated Cardiomyopathy
- Individuals genotype-positive for:
  - Familial Dilated Cardiomyopathy
  - Arrhythmogenic Cardiomyopathy (e.g., ARVC)

Every 2 years

Vascular disease

- First degree relative with known thoracic aortic aneurysm or dissection a repeat echo is allowed every two years when both:
  - Prior aortic imaging (echo, CT, MR) is negative
  - Last aortic imaging was ≥2 years. See **Screening for Vascular related genetic connective tissue Disorders (PVD-2.2)**

Every year

Valvular heart disease

(See also below indications for Valve surgery or intervention)

- Moderate or severe regurgitation
- Moderate or severe stenosis
- Significant valve deformity (regardless of extent of regurgitation or stenosis) when there is documentation of either:
  - Thickened myxomatous valve
  - Bileaflet prolapse
- Surgical bioprosthetic valve replacement ≥10 years since implant

Cardiomyopathy/heart failure

- Left ventricular systolic dysfunction to evaluate the effectiveness of ongoing therapy
- Hypertrophic cardiomyopathy See below indications for hypertrophic cardiomyopathy. See **Hypertrophic Cardiomyopathy CD-14**
- Frequent right ventricular pacing >40%
- Chronic LBBB
- Left ventricular non-compaction cardiomyopathy
- At risk for developing iron-overload cardiomyopathy (hereditary hemochromatosis or hereditary or acquired hematologic conditions requiring multiple transfusions)
- Inherited neuromuscular, metabolic, hematologic or cutaneous syndromes that are known to be associated with the development of cardiomyopathy

Pericardial disease

- Chronic pericardial effusions when findings would potentially alter therapy

Vascular disease

- Aortic root dilatation that has not yet been repaired See **Thoracic aortic aneurysm PVD 6.2** and
- For post-repair see **Post-Aortic Endovascular/Open Surgery Surveillance Studies PVD-6.8**

At risk for pulmonary Hypertension

See **Pulmonary Hypertension CD-8.1**

- Systemic Sclerosis or Scleroderma
- Individuals with pulmonary hypertension mutations (e.g., BMPR2)
- First-degree relatives of individuals with pulmonary hypertension
- Connective tissue disorder with symptoms consistent with pulmonary hypertension
- Individuals with TR velocity ≥2.8 m/s, with no other findings on additional testing

- Individuals being treated with medications associated with pulmonary hypertension
- Individuals who have a concern documented for pulmonary hypertension and had a negative echocardiogram but still show signs or symptoms of pulmonary hypertension

Every 6 months or twice a year

Valvular heart disease

- Asymptomatic, severe mitral regurgitation if valve surgery is being considered

Pulmonary Hypertension

- See below indications for Pulmonary Hypertension (See **Pulmonary Hypertension CD-8.1**)
- Surveillance of stable individuals with moderate or severe pulmonary hypertension (pulmonary artery systolic pressure ≥50 mmHg)

Anytime

Repeat transthoracic echocardiogram is indicated **anytime** (without regard for the number or timing of previous ECHO studies) if there is a change in clinical status, or new signs and symptoms with documentation of **any** of the following:

- Cardiac murmurs
- Myocardial infarction or acute coronary syndrome
- Congestive heart failure (new or worsening):
  - New symptoms of dyspnea
  - Orthopnea
  - Paroxysmal nocturnal dyspnea
  - Elevated BNP
- Known pericardial disease with clinical concern for cardiac tamponade or pericardial constriction
- Infective endocarditis for any of the following:
  - Repeat imaging within 5–7 days for initially negative or inconclusive imaging when clinical suspicion of endocarditis remains high
  - New or worsening symptoms or signs of endocarditis
  - As needed to guide changes in antibiotic therapy
  - At completion of antibiotic therapy
- Stroke/transient ischemic attack
- Decompression illness
- Prosthetic valve dysfunction or thrombosis
- Cardiac transplant
- Individuals with Left Ventricular Assist Device (LVAD)

- See also section on **Repeat testing per condition** below and **Left ventricular assist devices (LVAD) (CD-9.4)**

Repeat testing per condition

Repeat Transthoracic Echocardiography (TTE) is indicated for any of the following:

Valve surgery or intervention

Repeat Transthoracic Echocardiography (TTE) is indicated for any of the following:

- **Surgical valve repair or replacement** (including bioprosthetic valve <10 years since implant)
  - 6 weeks post-surgery to establish baseline
  - Surveillance every 3 years after surgery
- **Surgical bioprosthetic valve replacement ≥10 years since implant**
  - Annually
- **TAVR**
  - One week after procedure to establish baseline
  - 1 month post-procedure
  - 1 year post-procedure
  - Thereafter annually
- **Mitra-Clip**
  - 1 month post-procedure
  - 6 months post-procedure
  - 1 year post-procedure
  - Thereafter annually to 5 years

See also **Transcatheter Aortic Valve Replacement (TAVR) (CD-4.8)**

See also **Percutaneous Mitral Valve Repair (mitral valve clip) (CD-13.5)**

PFO closure, TIPS, Cardiac device therapy, LVAD

Repeat Transthoracic Echocardiography (TTE) is indicated for any of the following:

- **PFO Closure**
  - Pre-operative evaluation for closure of PFO
  - Post-procedural evaluation of PFO repair
  - 6 month follow-up after PFO repair
  - Annually if there is a residual shunt on post-operative imaging

  For ASD closure see**ASD-Atrial septal defects (CD 11.2.1)**

- **TIPS (transjugular intrahepatic portosystemic shunt)** See **Hepatic Arteries and Veins (AB 43.1)**
  - One time post-procedure for routine follow-up
  - **Any time** post-procedure (either):
    - For new signs or symptoms
    - For concern for new or worsening pulmonary hypertension or heart failure
- **Cardiac device therapy**
  - Re-evaluation is indicated 3 months after revascularization or maximally tolerated optimal medical therapy to determine either:
    - Candidacy for device therapy
    - Optimal choice of device
  - One time follow up within 12 months of implantation of a CRT-D device
- **Left ventricular assist device (LVAD)** see **Left ventricular assist devices (LVAD) (CD-9.4)**
  - Prior to implant
  - Routine Post-implant at the following intervals:
    - 2 weeks
    - One month
    - Three months
    - Six months
    - Twelve months
    - Every 6 months thereafter

Pulmonary hypertension

Repeat Transthoracic Echocardiography (TTE) is indicated for individuals with known pulmonary hypertension for any of the following:

- **Routine follow up**
  - Every 6 months for surveillance of stable individuals with moderate or severe pulmonary hypertension (pulmonary artery systolic pressure ≥50 mm Hg)
- **Pregnancy**
  - Prior to planned pregnancy
  - During pregnancy as often as requested by the provider
- **Pre-procedure**
  - Prior to planned intubation (e.g., for elective surgery)
- **Clinical/therapy change:**
  - Anytime, without regard for the number or timing of previous ECHO studies to evaluate either:
    - Change in therapy
    - Change in clinical findings or symptoms

- Therapy changes:
  - At baseline
  - Then every 3 months

See also **Pulmonary Hypertension CD-8.1**

Hypertrophic Cardiomyopathy (HCM)

Repeat Transthoracic Echocardiography (TTE) is indicated for individuals with hypertrophic cardiomyopathy for any of the following:

- **Routine Surveillance Imaging**
  - Every year
- **Mavacamten: Initiation of treatment**
  - Baseline at the beginning of treatment
  - 4 weeks after treatment initiation
  - 8 weeks after treatment initiation
  - 12 weeks after treatment initiation
  - Then every 12 weeks while on mavacamten
- **Mavacamten: Changes in treatment**
  - 4 weeks after any interruption of treatment (any missed dose)
  - After any dosage change (including restart of treatment):
    - 4 weeks after dosage change
    - 12 weeks after dosage change
  - After initiating a weak CYP2C19 inhibitor (e.g., omeprazole) or moderate CYP3A4 inhibitor (e.g., ciprofloxacin):
    - 4 weeks after start of medication
    - 12 weeks after start of medication
  - At any time regardless of timing of prior echo when there are new cardiac signs or symptoms, or worsening of clinical status
- **Post- Septal Reduction Therapy (SRT)**
  - Within 3 to 6 months after surgical myectomy or alcohol septal ablation

See also **Hypertrophic Cardiomyopathy CD-14**

Cardiac Transplant

Anytime (without regard for the number or timing of previous ECHO studies) when there is a history of cardiac transplant, per transplant center protocol

Cardiotoxic Agents

For re-evaluation in an individual previously or currently undergoing therapy with cardiotoxic agents or radiation therapy follow **Cardiotoxic agent/Cancer Therapeutics-Related Cardiac Dysfunction (CD-12.1)**

Background and supporting information

Decisions regarding routine echocardiographic follow-up should not be based on the degree of regurgitation alone, but should take into account associated structural valvular and cardiac abnormalities. For example: a structurally normal mitral valve with moderate mitral regurgitation by color flow Doppler and normal left atrial size, does not generally require routine echocardiographic follow-up. However, a thickened, myxomatous appearing mitral valve with bi-leaflet prolapse and only trivial or mild mitral regurgitation, should be followed echocardiographically at routine intervals.

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CD.EC.0002.3.A

v2.0.2024

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Transesophageal Echocardiography (TEE) (CD-2.4) (CD-2.5)

CD.EC.0002.5.A
v2.0.2024

Transesophageal echocardiography (TEE) – coding (CD-2.4)

TEE coding

Transesophageal Echocardiography	CPT®
TEE with 2-D, M-mode, probe placement, image acquisition, interpretation and report	93312
TEE probe placement only	93313
TEE image acquisition, interpretation, and report only	93314
TEE for congenital anomalies with 2-D, M-mode, probe placement, image acquisition, interpretation and report	93315
TEE for congenital anomalies, probe placement only	93316
TEE for congenital anomalies, image acquisition, interpretation and report only	93317
TEE for monitoring purposes, ongoing assessment of cardiac pumping function on an immediate time basis	93318

Doppler Echocardiography

Description	CPT®
Doppler echo, pulsed wave and/or spectral display	+93320
Doppler echo, pulsed wave and/or spectral display, follow-up or limited study	+93321
Doppler echo, color flow velocity mapping	+93325
Doppler echo, if performed, may be reported separately in addition to the primary TEE codes: CPT® 93312, CPT® 93314, CPT® 93315, and CPT® 93317	

C codes

HCPCS	Description	CPT®
C8925	TEE with 2-D, M-mode, probe placement, image acquisition, interpretation and report	93312
C8926	TEE for congenital anomalies with 2-D, M-mode, probe placement, image acquisition, interpretation and report	93315
C8927	TEE for monitoring purposes, ongoing assessment of cardiac pumping function on an immediate time basis	93318

- The complete transesophageal echocardiogram service, including both (1) probe (transducer) placement and (2) image acquisition/interpretation, is reported with CPT® 93312.
  - Probe placement only is reported with CPT® 93313.
  - The image acquisition/interpretation only is reported with CPT® 93314.
- Physicians assign codes CPT® 93312, CPT® 93313, and/or CPT® 93314 to report professional services if the test is performed in a hospital or other facility where the physician cannot bill globally.
  - Modifier -26 (professional component) is appended to the appropriate code
  - CPT® 93313 and CPT® 93314 should never be used together. If both services are provided, CPT® 93312 is reported.
- Hospitals should report TEE procedures using CPT® 93312 (the complete service).CPT® 93313 and CPT® 93314 are not used for hospital billing.
- Monitoring of patients undergoing cardiac surgery is CPT® 93318.

Transesophageal echocardiography (TEE) – indications (CD-2.5)

- Limited transthoracic echo window when further information is needed to guide management (e.g. suspected or confirmed endocarditis, suspected intracardiac mass, etc.)
- Assessing valvular dysfunction, especially mitral regurgitation, when TTE is inadequate and intervention is being considered to repair/replace valve.
- Evaluation of cardiac mass, suspected tumor or thrombus

- Pre-procedural assessment of PFO/ASD
- Pre-operative evaluation prior to planned LVAD implant
- Embolic source or intracardiac shunting when TTE is inconclusive
  - Examples: atrial septal defect, ventricular septal defect, patent foramen ovale, aortic cholesterol plaques, thrombus in cardiac chambers, valve vegetation, tumor
- Embolic events when there is an abnormal TTE or a history of atrial fibrillation
  - Clarify atria/atrial appendage, aorta, mitral/aortic valve beyond the information that other imaging studies have provided
- Cardiac valve dysfunction
  - Differentiation of tricuspid from bicuspid aortic valve in setting of aortic enlargement or significant stenosis or significant regurgitation
  - Congenital abnormalities
- Assessing for left atrial thrombus prior to cardioversion of atrial fibrillation or atrial flutter.
- Assessing for left atrial thrombus prior to planned atrial fibrillation ablation/pulmonary vein isolation procedure.
- For initial imaging of ascending and descending thoracic aortic aneurysms.
- For repeat imaging or established thoracic aneurysms, TEE is indicated **only** when imaging with CT or MR is contraindicated.
- Left atrial appendage (LAA) Closure device (e.g., WATCHMAN®)
  - Pre-procedural evaluation with or without 3D imaging
  - Repeat TEE 45 days post procedure
    - If the TEE at 45 days showed a peri-device gap ≥ 5 mm or Device Related Thrombus, another follow up TEE, usually 3- 6 months can be performed before the one year surveillance
  - 1 year post-procedure
  - See also **Percutaneous Mitral Valve Repair (mitral valve clip) (CD-13.5)**

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Stress echocardiography (stress echo) (CD-2.6) (CD-2.7)

CD.EC.0002.7.A
v2.0.2024

Stress echo – coding (CD-2.6)

Associated codes

Stress Echocardiography	CPT®
Echo, transthoracic, with (2D), includes M-mode, during rest and exercise stress test and/or pharmacologically induced stress, with report;[3]	93350
Echo, transthoracic, with (2D), includes M-mode, during rest and exercise stress test and/or pharmacologically induced stress, with report: including performance of continuous electrocardiographic monitoring, with physician supervision[3]	93351
Doppler Echocardiography	
Doppler echo, pulsed wave and/or spectral display[4]	+93320
Doppler echo, pulsed wave and/or spectral display, follow-up/limited study	+93321
Doppler echo, color flow velocity mapping[4]	+93325

Associated HCPCS codes

CPT®	Stress Echocardiography	HCPCS
93350	Echo, transthoracic, with (2D), includes M-mode, during rest and exercise stress test and/or pharmacologically induced stress, with report;[5]	C8928

[3] CPT® 93350 and CPT® 93351 do not include Doppler studies

[4] Doppler echo (CPT® +93320 and CPT® +93325), if performed, may be reported separately in addition to the primary SE codes: CPT® 93350 or CPT® 93351.

[5] CPT® 93350 and CPT® 93351 do not include Doppler studies

CPT®	Stress Echocardiography	HCPCS
93351	Echo, transthoracic, with (2D), includes M-mode, during rest and exercise stress test and/or pharmacologically induced stress, with report: including performance of continuous electrocardiographic monitoring, with physician supervision[5]	C8930

Stress echo-indications other than ruling out CAD (CD-2.7)

CPT® 93350 or 93351

- See: **Stress Testing with Imaging – Indications (CD-1.4)**
- In addition to the evaluation of CAD, stress echo can be used to evaluate the following conditions:
  - Dyspnea on exertion (specifically to evaluate pulmonary hypertension)
  - Right heart dysfunction
  - Valvular heart disease when the outcome would affect a therapeutic or interventional decision
  - Pulmonary hypertension when the outcome will measure response to therapy and/or prognostic information
  - Hypertrophic cardiomyopathy (as defined in **Obstructive Hypertrophic Cardiomyopathy (HCM) (CD-12.3)** for **either** of the following:
    - Exercise stress echo (CPT® 93351 or 93350) is indicated for the detection and quantification of dynamic left ventricular outflow tract obstruction in symptomatic individuals with HCM who do **not** have a resting or provocable outflow tract gradient ≥50 mm Hg on TTE.
    - Stress echo can be repeated when there is documentation of **any** of the following:
      - In 1 to 2 years if the resting or provocable outflow tract gradient is < 30 mm Hg on prior stress echo
      - Worsening symptoms
      - There has been a therapeutic change (i.e., change in medication, surgical procedure performed).
- In general spectral Doppler (CPT® 93320 or 93321) and color-flow Doppler (CPT® 93325) are necessary in the evaluation of the above conditions and can be added to the stress echo code.

3D Echocardiography (CD-2.8)(CD-2.9)

CD.EC.0002.9.A
v2.0.2024

3D echocardiography – coding (CD-2.8)

- CPT® 93319 with one of the following (CPT® 93303, 93304, 93312, 93314, 93315, or 93317) for congenital cardiac abnormalities

3D echocardiography – indications (CD-2.9)

Echocardiography with 3-dimensional (3D) rendering (CPT® 93319) is becoming universally available, yet its utility remains limited based on the current literature.

- 3D Echo may be indicated when a primary echocardiogram is approved and **one** of the following is needed:
  - Left ventricular volume and ejection fraction assessment when measurements are needed for treatment decision (e.g., implantation of ICD, alteration in cardiotoxic chemotherapy)
  - Mitral valve anatomy specifically related to mitral valve stenosis
  - Pre-procedural evaluation of left atrial appendage occlusion (e.g., WATCHMAN®)
  - Pre-operative evaluation for LVAD implant
  - Guidance of transcatheter procedures such as:
    - Mitral valve clipping
    - TAVR
    - Left atrial appendage closure device (e.g., WATCHMAN®)

Myocardial strain imaging (CPT® 93356) (CD-2.12)

CD.EC.0002.12.A

v2.0.2024

- Myocardial strain imaging (CPT® 93356, speckle tracking longitudinal strain) is indicated for the initial evaluation of LVH, in addition to the primary echocardiogram, when there is documentation of **both**:
  - Unclear etiology
  - Concern for infiltrative cardiomyopathy
- See myocardial strain imaging in **Cardiotoxic Agent-Related Cardiac Dysfunction (CD-12)**
- Myocardial strain imaging (CPT® 93356) in addition to the primary echocardiogram in individuals receiving therapy with cardiotoxic agents for ANY of the following:
  - Initial evaluation-prior to treatment with EITHER:
    - Medications that could result in cardiotoxicity/heart failure
    - Radiation that could result in cardiotoxicity/heart failure
  - Re-evaluation of an individual previously or currently undergoing therapy as per echocardiogram parameters. See **Cardiotoxic agent/Cancer Therapeutics-Related Cardiac Dysfunction (CD-12.1)**
  - Re-evaluation of an individual undergoing therapy with worsening symptoms

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CD.EC.0002.A
v2.0.2024

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Nuclear Cardiac Imaging

Guideline

Myocardial Perfusion Imaging (MPI) (CD-3.1)(CD-3.2)

CD.NC.0003.1.A
v2.0.2024

Myocardial Perfusion Imaging (MPI) – Coding (CD-3.1)

Nuclear Cardiac Imaging Procedure Codes	
Myocardial Perfusion Imaging (MPI)	**CPT ®**
MPI, tomographic (SPECT) (including attenuation correction, qualitative or quantitative wall motion, ejection fraction by first pass or gated technique, additional quantification, when performed); single study, at rest or stress (exercise or pharmacologic)	**78451**
MPI, tomographic (SPECT) (including attenuation correction, qualitative or quantitative wall motion, ejection fraction by first pass or gated technique, additional quantification, when performed); multiple studies, at rest and/or stress (exercise or pharmacologic) and/or redistribution and/or rest reinjection	**78452**
Absolute quantitation of myocardial blood flow (AQMBF), single-photon emission computed tomography (SPECT), with exercise or pharmacologic stress, and at rest, when performed (List separately in addition to code for primary procedure)	**+0742T**

- The most commonly performed myocardial perfusion imaging are single (at rest or stress, CPT® 78451) and multiple (at rest and stress, CPT® 78452) SPECT studies.
  - Evaluation of the individual's left ventricular wall motion and ejection fraction are routinely performed during MPI and are included in the code's definition.
  - First pass studies, (CPT® 78481 and CPT® 78483), MUGA, (CPT® 78472 and CPT® 78473) and SPECT MUGA (CPT® 78494) should not be reported in conjunction with MPI codes.
  - Attenuation correction, when performed, is included in the MPI service by code definition. No additional code should be assigned for the billing of attenuation correction.
- **Multi-day Studies:** In the absence of written payer guidelines to the contrary, it is not appropriate to bill separately for the rest and stress segments of MPI even if

performed on separate calendar dates. A single code is assigned to define the entire procedure on the date all portions of the study are completed.

Note:

3D rendering should not be billed in conjunction with MPI.

MPI – Indications (CD-3.2)

See: **Stress Testing with Imaging – Indications (CD-1.4)**

Absolute quantitation of myocardial blood flow (AQMBF)(SPECT)

- AQMBF obtained by CZT-SPECT is considered experimental, investigational, or unproven at this time.

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CD.NC.0003.1.A
v2.0.2024

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MUGA – Coding (CD-3.3)

CD.NC.0003.3.A
v2.0.2024

Cardiac blood pool imaging, or radionuclide ventriculography, can be used to evaluate ventricular function. Cardiac blood pool imaging includes first pass studies (CPT® 78481 and 78483) as well as gated equilibrium studies (CPT® 78472, 78473, 78494, and +78496).

Gated equilibrium studies can also be referred to as multi-gated acquisition (MUGA) scan or equilibrium radionuclide angiography (ERNA). Imaging for gated equilibrium studies can be planar or three-dimensional (single photon emission computed tomography, SPECT).

Of note, all cardiac blood pool imaging is synchronized with electrocardiographic RR interval (EKG-gated); thus, regular rhythm is required for accurate LV assessment.

Gated Equilibrium Studies – Planar	CPT®
Cardiac blood pool imaging, gated equilibrium; planar, single study at rest or stress, wall motion study plus ejection fraction, with or without quantitative processing	**78472**
Cardiac blood pool imaging, gated equilibrium; planar, multiple studies, wall motion study plus ejection fraction, at rest and stress, with or without additional quantification	**78473**
Gated Equilibrium Studies - SPECT	**CPT®**
Cardiac blood pool imaging, gated equilibrium, SPECT, at rest, wall motion study plus ejection fraction, with or without quantitative processing	**78494**
First Pass studies	**CPT®**
Cardiac blood pool imaging (planar), first pass technique; single study, at rest or with stress (exercise and/or pharmacologic), wall motion study plus ejection fraction, with or without quantification	**78481**

Gated Equilibrium Studies – Planar	CPT®
Cardiac blood pool imaging (planar), first pass technique; multiple studies, at rest and with stress (exercise and/or pharmacologic), wall motion study plus ejection fraction, with or without quantification	**78483**
Cardiac blood pool imaging, gated equilibrium, single study, at rest, with right ventricular ejection fraction by first pass technique (List separately in addition to code for primary procedure) This CPT code is an add-on code to 78472.	**+78496**

- The technique employed for a MUGA service guides the code assignment.
  - CPT® 78472 is used for a planar MUGA scan at rest or stress
  - CPT® 78473 for planar MUGA scans, multiple studies at rest and stress.
- Planar MUGA studies (CPT® 78472 and CPT® 78473) should not be reported in conjunction with:
  - SPECT MPI (CPT® 78451 - CPT® 78454)
  - First pass studies (CPT® 78481- CPT® 78483)
  - SPECT MUGA (CPT® 78494).
- CPT® +78496 is assigned only in conjunction with CPT® 78472.

MUGA Study – Cardiac Indications (CD-3.4)

CD.NC.0003.4.A
v2.0.2024

MUGA (Multi Gated Acquisition) – Blood Pool Imaging Indications

- Echocardiography is the preferred method of following left ventricular systolic function.
- MUGA may be indicated when a recent ECHO, as indicated in **Transthoracic Echocardiography (TTE) – Indications (CD-2.2)** and/or **Frequency of Echocardiography Testing (CD 2.3)**, was technically limited and prevented accurate assessment of left ventricular function.
- MUGA is indicated when there is a significant discrepancy between LVEF assessment by ECHO and another modality (i.e., one study reports normal LVEF and the other, a reduced LVEF) AND there is clear documentation as to how quantitative measurement of LVEF will affect individual management (e.g., implantation of an ICD, alteration in cardiotoxic chemotherapy, etc.).
- MUGA may be performed in place of an ECHO in the following circumstances:
  - To determine candidacy for ICD/CRT and/or to determine optimal choice of device in individuals who meet criteria for ICD based on ejection fraction and other criteria.
  - When previously or currently undergoing therapy with potentially cardiotoxic agents, including chemotherapy and radiation, AND a history of previous low LV ejection fraction (LVEF <50%). See **Cardiotoxic agent/Cancer Therapeutics-Related Cardiac Dysfunction (CD-12.1)**
- MUGA is **not** indicated when requested simply to compare LVEF by the same modality, a prior MUGA is not a reason to approve another MUGA.

Right ventricular first pass study

- (CPT® 78472 and 78496) may be performed when ECHO is technically limited and prevents accurate assessment of RV function AND when further information about RV function is needed to guide management (e.g. established/diagnosed pulmonary hypertension, suspected or confirmed pulmonary embolus).

First pass studies

- First pass studies (CPT® 78481 and CPT® 78483) may be approved in place of MUGA when indications are met for MUGA and/or there is need for information that cannot be obtained by MUGA.

- First pass studies, (CPT® 78481 and CPT® 78483), MUGA (CPT® 78472 and CPT® 78473) and SPECT MUGA (CPT® 78494) should not be reported in conjunction with MPI codes.

Myocardial Sympathetic Innervation Imaging in Heart Failure (CD-3.6)

CD.NC.0003.6.A

v2.0.2024

- Nuclear imaging using I-123-meta-iodobenzylguanidine (I-123-mIBG) in an attempt to image increased myocardial sympathetic activity is considered to be experimental and investigational.
- The AMA has established the following set of Category III codes to report these studies:
  - **CPT® 0331T** - Myocardial sympathetic innervation imaging, planar qualitative and quantitative assessment
  - **CPT® 0332T** - Myocardial sympathetic innervation imaging, planar qualitative and quantitative assessment; with tomographic SPECT.

Background and supporting information

In heart failure, the sympathetic nervous system is activated in order to compensate for the decreased myocardial function. Initially, this is beneficial, however, long-term this compensatory mechanism is detrimental and causes further damage.

Markers have been developed, using radioactive iodine, in an attempt to image this increased myocardial sympathetic activity. Currently, AdreView™ (Iodine-123 meta-iodobenzylguanidine), is the only FDA-approved imaging agent available for this purpose.

Myocardial Tc-99m Pyrophosphate Imaging (CD-3.7)

CD.NC.0003.7.A
v2.0.2024

Myocardial Tc-99m Pyrophosphate Imaging	
MUGA (Multi Gated Acquisition) – Blood Pool Imaging	**CPT®**
Myocardial Imaging, infarct avid, planar, qualitative or quantitative	**78466**
Myocardial Imaging, infarct avid, planar, qualitative or quantitative with ejection fraction by first pass technique	**78468**
Myocardial Imaging, infarct avid, planar, qualitative or quantitative tomographic SPECT with or without quantification	**78469**
Radiopharmaceutical Localization Imaging Limited area	**78800**
Radiopharmaceutical Localization Imaging SPECT Note: When reporting CPT® 78803, planar imaging of a limited area or multiple areas should be included with the SPECT	**78803**
Radiopharmaceutical localization of tumor, inflammatory process or distribution of radiopharmaceutical agent(s) (includes vascular flow and blood pool imaging, when performed); tomographic (SPECT) with concurrently acquired computed tomography (CT) transmission scan for anatomical review, localization and determination/detection of pathology, single area (e.g., head, neck, chest, pelvis), single-day imaging	**78830**

- Historically this method of imaging the myocardium was used to identify recent infarction, hence, the term "infarct-avid scan." Although still available, the sensitivity and specificity for identifying infarcted myocardial tissue are variable and the current use for this indication is limited. See **Cardiac MRI (CD-5)**.

Cardiac Amyloidosis (CD-3.8)

CD.NC.0003.8.A
v2.0.2024

- Tc-99m pyrophosphate imaging (CPT® 78803 or 78830) may be used to identify cardiac amyloidosis. Chest SPECT and planar imaging may be used, as well as whole-body imaging for identification of systemic ATTR (transthyretin) amyloidosis. See **Myocardial Tc-99m Pyrophosphate Imaging (CD-3.7)** for coding information
- For a single planar imaging session alone (without a SPECT study), report CPT® 78800 Radiopharmaceutical Localization Imaging Limited area
- Tc-99m pyrophosphate imaging can be pursued for diagnosis of ATTR amyloidosis in the presence of known systemic amyloidosis if Cardiac MRI (CMR) is either contraindicated or indeterminate in individuals undergoing evaluation for kidney transplant. See **Kidney Transplant, Pre-Transplant Imaging Studies (AB-42.5)**.
- Tc-99m pyrophosphate imaging can be pursued for diagnosis of ATTR amyloidosis after screening for presence of a monoclonal light chain to exclude AL amyloidosis:
  - Serum kappa/lambda free light chain ratio (not SPEP)
    - Abnormal if ratio is <0.26 or >1.65
  - Serum and urine immunofixation electrophoresis (IFE)
    - Abnormal if monoclonal protein detected
- Tc-99m pyrophosphate imaging may also be used for the following:
  - Diagnosis of cardiac ATTR in individuals with cardiac MRI or echocardiography findings consistent with or suggestive of cardiac amyloidosis.
  - Individuals with suspected cardiac ATTR amyloidosis and contraindications to CMR such as renal insufficiency or an implantable cardiac device.
  - Individuals with systemic amyloidosis who are being evaluated for kidney transplant if CMR is either contraindicated or indeterminate. See **Kidney Transplant, Pre-Transplant Imaging Studies (AB-42.5)**.
- Cardiac follow-up should be based on Echocardiogram, Tn, NT-proBNP, clinical exam and symptoms

Background and supporting information

- The following conditions would raise high index of suspicion:
  - Left ventricular hypertrophy but low voltage on ECG
  - Heart failure with preserved ejection fraction and an increase in left ventricular wall thickness.
  - Unexplained heart failure with preserved ejection fraction and concomitant right heart failure in an individual over the age of 60
  - Individuals, especially elderly males, with signs/symptoms of heart failure and any of the following:

        - Lumbar spinal stenosis
        - Spontaneous biceps tendon rupture
        - Bilateral carpal tunnel syndrome
        - Atrial arrhythmia in the absence of usual risk factors
    - Known or suspected familial amyloidosis.
    - Low flow, low gradient aortic stenosis

Non-imaging Heart Function and Cardiac Shunt Imaging (CD-1.7)

CD.NC.0001.7.A

v2.0.2024

- Procedures reported with CPT® 78414 and CPT® 78428 are essentially obsolete and should not be performed in lieu of other preferred modalities.
- Echocardiogram is the preferred method for cardiac shunt detection, rather than the cardiac shunt imaging study described by CPT® 78428.
- Ejection fraction can be obtained by echocardiogram, SPECT MPI, MUGA study, cardiac MRI, cardiac CT, or cardiac PET depending on the clinical situation, rather than by the non-imaging heart function study described by CPT® 78414.

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Cardiac CT

Guideline

Cardiac CT and CTA - General information and coding (CD-4.1)

CD.CT.0004.1.A
v2.0.2024

Associated Codes

Cardiac Imaging Procedure Codes

Cardiac CT and CCTA	CPT®
CT, heart, without contrast, with quantitative evaluation of coronary calcium • The code set for Cardiac CT and CCTA (CPT® 75572-CPT® 75574), include quantitative and functional assessment (for example, calcium scoring) if performed • CPT® 75571 describes a non-contrast CT of the heart with calcium scoring and should be reported only when calcium scoring is performed as a stand-alone procedure. ◦ Can be used to report a preliminary non-contrast scan which indicates an excessive amount of calcium such that the original scheduled study must be discontinued. ◦ CPT® 75571 should not be reported in conjunction with any of the contrast CT/CTA codes (CPT® 75572- CPT® 75574).	75571
CT, heart, with contrast, for evaluation of cardiac structure and morphology (including 3D image post-processing, assessment of cardiac function, and evaluation of venous structures, if performed).	75572
Computed tomography, heart, with contrast material, for evaluation of cardiac structure and morphology in the setting of congenital heart disease (including 3D image post-processing, assessment of left ventricular [LV] cardiac function, right ventricular [RV] structure and function and evaluation of vascular structures, if performed).	75573
CTA, heart, coronary arteries and bypass grafts (when present), with contrast, including 3D image post-processing (including 3D image post-processing, assessment of cardiac function, and evaluation of venous structures, if performed).	75574

Cardiac CT and CCTA	CPT®
Noninvasive estimate of coronary fractional flow reserve (FFR) derived from augmentative software analysis of the data set from a coronary computed tomography angiography, with interpretation and report by a physician or other qualified health care professional	75580

Cardiac Imaging Procedure Codes

Description	CPT®
Automated quantification and characterization of coronary atherosclerotic plaque to assess severity of coronary disease, using data from coronary computed tomographic angiography; data preparation and transmission, computerized analysis of data, with review of computerized analysis output to reconcile discordant data, interpretation and report	0623T
Automated quantification and characterization of coronary atherosclerotic plaque to assess severity of coronary disease, using data from coronary computed tomographic angiography; data preparation and transmission	0624T
Automated quantification and characterization of coronary atherosclerotic plaque to assess severity of coronary disease, using data from coronary computed tomographic angiography; computerized analysis of data from coronary computed tomographic angiography	0625T
Automated quantification and characterization of coronary atherosclerotic plaque to assess severity of coronary disease, using data from coronary computed tomographic angiography; review of computerized analysis output to reconcile discordant data, interpretation and report	0626T

Cardiac CT and CTA - General information (CD-4.1)

- Only one code from the set: CPT® 75572 - CPT® 75574 can be reported per encounter.
- CPT® 75574 includes evaluation of cardiac structure and morphology when performed; therefore, additional code/s should not be assigned.
- Automated quantification and characterization of coronary atherosclerotic plaque (CPT® 0623T, 0624T, 0625T, 0626T) is a service in which coronary computed tomographic angiography (CCTA) data are analyzed using computerized algorithms

to assess the extent and severity of coronary artery disease. The use of automated quantification and characterization of coronary atherosclerotic plaque is considered investigational and experimental at this time.

Background and Supporting Information

The high negative predictive value (98%-99%) of CCTA in ruling out significant coronary artery disease has been confirmed in multiple studies.

3D rendering should not be billed in conjunction with Cardiac CT and CCTA.

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CT for Coronary Calcium Scoring (CD-4.2)

CD.CT.0004.2.A
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CPT® 75571

Coronary artery calcium score (CPT ® 75571) is **not** supported for evaluation of CAD in symptomatic individuals.

CT Calcium Scoring-Asymptomatic and for CAD Screening

- Coronary artery calcium score (CPT® 75571) is indicated when there is documentation of **all** of the following:
  - Results will impact risk-based decisions for preventive interventions
  - An LDL-C level ≥70 mg/dL (1.8 mmol/L) AND <190 mg/dL (4.9 mmol/L)
  - Individual is an adult age 40-75
  - 10-year ASCVD risk including pooled cohort equation is between 5.0% to 19.9%
  - There is no documented CAD
  - Individual is not currently on a statin
  - Individual is not a smoker
  - There is no history of diabetes
  - There is no family history of premature CAD
  - There has been no calcium score performed in the previous 5 years
  - There has been no prior calcium score >0
- Coronary calcium scoring is **not** indicated in someone with known CAD.

CT Calcium Scoring For Low Gradient Aortic Stenosis

- Coronary artery calcium score (CPT® 75571) is indicated in low gradient aortic stenosis when symptomatic, severe aortic stenosis is suspected. Low gradient aortic stenosis is defined as an AVA <1 and a mean gradient <40 mmHg.

CCTA – Indications for CCTA (CD-4.3)

CD.CT.0004.3.A
v2.0.2024

CCTA (CPT® 75574) is indicated for any of the following:

- New, recurrent or worsening likely anginal symptoms as defined in **General Guidelines (CD-1.0)**
- New, recurrent or worsening symptoms of chest pain, or exertional dyspnea, or exertional fatigue and any of the following:
  - Persistent symptoms after a normal stress test
  - Equivocal, borderline, abnormal or discordant prior noninvasive evaluation where obstructive coronary artery disease remains a concern (<90 days)
  - Abnormal rest ECG findings, such as a new LBBB, or T-wave inversions, when ischemia is a concern
  - A prior CABG when **only** graft patency is a concern
- Evaluation of an individual under the age of 40 for suspected anomalous coronary artery(ies) or for treatment planning when there is a history of one or more of the following:
  - Syncopal episodes during strenuous activities
  - Persistent chest pain brought on by exertion or emotional stress, and normal stress test
  - Full sibling(s) with history of sudden death syndrome before age 40 or with documented anomalous coronary artery
  - Resuscitated sudden death and contraindications for conventional coronary angiography
  - Prior nondiagnostic coronary angiography in determining the course of the anomalous coronary artery in relation to the great vessels, origin of a coronary artery or bypass graft location (any):
    - Anomalies of origin:
      - LCA or the RCA arising from the pulmonary artery;
      - Interarterial course between the pulmonary artery and the aorta of either the RCA arising from the left sinus of Valsalva or the LCA arising from the right sinus of Valsalva
    - Anomalies of course:
      - Myocardial bridging
    - Anomalies of termination:
      - Coronary artery fistula
- Initial imaging study in individuals with hypertrophic cardiomyopathy and stable anginal symptoms.

  - Chest discomfort is common in individuals with hypertrophic cardiomyopathy. The incidence of false positive myocardial perfusion imaging abnormalities is higher in these individuals, whereas the incidence of severe coronary artery stenosis is low.
- Individuals who have recovered from unexplained sudden cardiac arrest in lieu of invasive coronary angiography **(both)**:
  - Confirm the presence or absence of ischemic heart disease
  - Exclude the presence of an anomalous coronary artery.

CCTA – Regardless of symptoms (CD-4.4)

CD.CT.0004.4.A
v2.0.2024

(CPT® 75574)

- Evaluation of newly diagnosed congestive heart failure or cardiomyopathy (all):
  - No prior history of coronary artery disease, the ejection fraction is ‹50 percent
  - No contraindications to cardiac CT angiography.
  - No cardiac catheterization, SPECT, cardiac PET, or stress echocardiogram has been performed since the diagnosis of congestive heart failure or cardiomyopathy.
- Unclear coronary artery anatomy despite conventional cardiac catheterization
- Re-do CABG **(either)**
  - Assess bypass graft patency
  - Evaluate the location of the left internal mammary artery (LIMA) and or right internal mammary artery (RIMA) prior to repeat bypass surgery
- Follow-up Left main stent one time at 6-12 months
- Evaluate coronary artery anomalies and other complex congenital heart disease of cardiac chambers or great vessels:
  - Report CPT® 75574 for evaluating coronary artery anomalies.
  - Report CPT® 75573 for congenital heart disease.
  - To evaluate the great vessels, CTA Chest (CPT® 71275) can be performed instead of CCTA or in addition to CCTA.
  - For anomalous pulmonary venous return, can add CT Abdomen and Pelvis with contrast (CPT® 74177).
- When CCTA will replace conventional invasive coronary angiography for any of the following:
  - Ventricular tachycardia (6-beat runs or greater)
  - Delayed presentation or retrospective evaluation of suspected Takotsubo syndrome (stress cardiomyopathy)
  - Preoperative assessment of the coronary arteries in planned surgery for any of the following:
    - Aortic dissection
    - Aortic aneurysm
    - Valvular surgery
    - Liver transplant (for initial pre-transplant evaluation and may be repeated once in 3 years)

  - To assess for coronary involvement in individuals with systemic vasculitis (e.g. Giant Cell Arteritis, Takayasu's, Kawasaki's disease) when there are clinical features suggestive of underlying vasculitis including:
    - Unexplained elevated cardiac markers (erythrocyte sedimentation rate, C-reactive protein)
    - Constitutional symptoms (fever, chills, night sweats, weight loss)
    - Multiple visceral infarcts in the absence of embolic etiology
- **Cardiac Trauma**: CTA Chest (CPT® 71275) and CCTA (CPT® 75574) are useful in detecting aortic and coronary injury and can help in the evaluation of myocardial and pericardial injury see **Cardiac Trauma – Imaging (CD-10.1)**
- Preoperative assessment for planned liver or kidney transplant

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Fractional Flow Reserve by Computed Tomography (CD-4.5)

CD.CT.0004.5.A
v2.0.2024

Fractional flow reserve (FFR) (CPT® 75580) is typically measured using invasive techniques. FFR can be obtained noninvasively from coronary computed tomography angiography data (FFR-CT).

- Indications for FFR-CT:
  - To further assess CAD seen on a recent CCTA that is of uncertain physiologic significance

CT Heart – Indications (CPT® 75572) (CD-4.6)

CD.CT.0004.6.A
v2.0.2024

CT heart – indications

- Cardiac vein identification for lead placement in individuals needing left ventricular pacing.
- Pulmonary vein isolation procedure (ablation) for atrial fibrillation:
  - MRI Cardiac (CPT® 75557 or CPT® 75561), MRV Chest (CPT® 71555), CTV Chest (CPT® 71275), or CT Cardiac (CPT® 75572) can be performed to evaluate the anatomy of the pulmonary veins prior to an ablation procedure performed for atrial fibrillation.
  - Study may be repeated post-procedure between 3-6 months after ablation because of a 1%-2% incidence of asymptomatic pulmonary vein stenosis
  - See **Pulmonary Vein Imaging – Indications (CD-8.2)**
- If echocardiogram is inconclusive for:
  - Cardiac or pericardial tumor or mass
  - Cardiac thrombus
  - Pericarditis/constrictive pericarditis
  - Complications of cardiac surgery
- In place of MRI when there is clinical suspicion of arrhythmogenic right ventricular dysplasia or arrhythmogenic cardiomyopathy (ARVD/ARVC) if the clinical suspicion is supported by established criteria for ARVD-see **Cardiac MRI – Indications (excluding Stress MRI) (CD-5.2)**
- Recurrent laryngeal nerve palsy due to cardiac chamber enlargement.
- CT Cardiac (CPT® 75572) can be performed instead of TEE for assessment of left atrial appendage (LAA) occlusion device or to assess for thrombus, see: **Transesophageal Echocardiography (TEE) – Indications (CD-2.5)**
- Coronary imaging is not included in the code definition for CPT® 71275.
  - The AMA definition for CPT® 71275 reads: "CTA Chest (non-coronary), with contrast material(s), including non-contrast images, if performed, and image post-processing."

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CT Heart for Congenital Heart Disease (CD-4.7)

CD.CT.0004.7.A
v2.0.2024

CT Heart for Congenital Heart Disease (CPT® 75573) (CD-4.7)

- Coronary artery anomaly evaluation
  - A cardiac catheterization was performed, and not all coronary arteries were identified.
- Thoracic arteriovenous anomaly evaluation
  - A MRI Cardiac or CT angiogram Chest was performed and suggested congenital heart disease.
- Complex adult congenital heart disease evaluation
  - No CT Cardiac or MRI Cardiac has been performed, and there is a contraindication to MRI Cardiac.
  - A CT Cardiac or MRI Cardiac was performed one year ago or more.
- See also section **Adult Congenital Heart Disease (CD-11)**

Transcatheter aortic valve replacement (TAVR) (CD-4.8)

CD.CT.0004.8.A
v2.0.2024

Pre-surgical aortic valve replacement

- Once the decision has been made for aortic valve replacement, the following may be used to determine if an individual is a candidate for TAVR:
  - CTA Chest (CPT® 71275), Abdomen and Pelvis (combination code CPT® 74174) are indicated, and
  - CT Cardiac (CPT® 75572) is indicated to measure the aortic annulus or
  - Coronary CTA (CCTA CPT® 75574) is indicated to both measure the aortic annulus and assess the coronary arteries in lieu of heart catheterization
- A repeat diagnostic left heart catheterization is **not** medically necessary when the individual is undergoing a transcatheter aortic valve replacement (TAVR).

Transfemoral access not feasible

Alternative imaging can be obtained to evaluate vascular access for TAVR in individuals for whom it is documented either via the office note or prior imaging that transfemoral access would not be feasible due to **any** of the following exclusion criteria:

- Small vessels
- Highly calcified vessels
- Stenosed or occluded vessels
- Prior aortoiliac vascular intervention

Imaging is indicated based on the documented intended access site (transaxillary or transcarotid) and should be of the involved body areas. The following studies are indicated based on the documented planned access site:

- CTA of the Head (CPT® 70496) and/or Neck (CPT® 70498) for transcarotid access
- CTA of the Chest (CPT® 71275) and/or Upper extremity (CPT® 73206) for transaxillary access

Post-TAVR

CT Cardiac (CPT® 75572) is indicated:

- If any of the post-TAVR TTEs are indeterminate or raises a concern about any of the following:
  - Valve thrombosis

  - Infective endocarditis
  - Structural degeneration
- When a Valve in Valve implantation or surgical re-do AVR is being contemplated
- Routine CT surveillance or follow up for incidental Hypoattenuated Leaflet Thickening (HALT) with or without restricted leaflet motion, also referred to as Hypoattenuation Affecting Motion (HAM) is NOT recommended

3D Predictive model generation for pre-planning of cardiac procedure (CD 4.9)

CD.CT.0004.9.A
v2.0.2024

Coding

Description	HCPCS
3D predictive model generation for pre-planning of a cardiac procedure, using data from cardiac computed tomographic angiography with report	C9793

Criteria

3D predictive model generation for pre-planning of a cardiac procedure, using data from cardiac computed tomographic angiography is considered to be experimental, investigational or unproven.

Background and supporting information

Cardiac Computed Tomography Angiography is a 3D imaging acquisition, viewing and reporting system. Standard Cardiac Computed Tomography Angiography includes the viewing of 3D images. Currently, there is not enough data to support the use of 3D predictive model generation for pre-planning of cardiac procedures (CPT® C9793). It has not been shown to improve outcomes when compared with standard Cardiac Computed Tomography Angiography.

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Cardiac MRI

Guideline

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Cardiac MRI – Coding (CD-5.1)

CD.MRI.0005.1.A
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Cardiac Imaging Procedure Codes	
Cardiac MRI	**CPT®/HCPCS**
Cardiac magnetic resonance imaging for morphology and function without contrast	**75557**
Cardiac magnetic resonance imaging for morphology and function without contrast; with stress imaging	**75559**
Cardiac magnetic resonance imaging for morphology and function without and with contrast and further sequences	**75561**
Cardiac magnetic resonance imaging for morphology and function without and with contrast and further sequences; with stress imaging	**75563**
Cardiac magnetic resonance imaging for velocity flow mapping (List separately in addition to code for primary procedure)	**+75565**
Cardiac magnetic resonance imaging for morphology and function, quantification of segmental dysfunction; with strain imaging	**C9762**
Cardiac magnetic resonance imaging for morphology and function, quantification of segmental dysfunction; with stress imaging	**C9763**

- Only one procedure code from the set (CPT® 75557- CPT® 75563) should be reported per session.
- Only one flow velocity measurement (CPT® +75565) should be reported per session when indicated.
- C9762-Cardiac magnetic resonance imaging for morphology and function, quantification of segmental dysfunction; with strain imaging. The use of CMR strain imaging for the quantification of segmental dysfunction is considered investigational and experimental at this time.
- C9763-Cardiac magnetic resonance imaging for morphology and function, quantification of segmental dysfunction; with stress imaging. The use of stress CMR

for the quantification of segmental dysfunction is considered investigational and experimental at this time.

Cardiac MRI and MRA Chest – Indications (excluding Stress MRI) (CD-5.2)

CD.MRI.0005.2.A

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- Assess myocardial viability (to differentiate hibernating myocardium from scar) when necessary to determine if revascularization should be performed (CPT® 75561)
- Assessment of global ventricular function, myocardial composition and mass if a specific clinical question is left unanswered by a recent echocardiogram and results will affect individual management (CPT® 75557 or CPT® 75561). Particularly useful in evaluating:
  - Cardiomyopathy (ischemic, diabetic, hypertrophic, or muscular dystrophy)
  - Non-compaction
  - Infiltrative heart disease such as amyloid, iron overload cardiomyopathy (hemosiderosis, hemochromatosis)
  - Post cardiac transplant
  - Hypertrophic cardiomyopathy
  - Suspected acute myocarditis, cardiac aneurysm, trauma, and contusions
  - Monitoring cancer chemotherapy effect on the heart (especially if an accurate assessment of right ventricular function is documented as necessary).
- Pre and post-operative congenital heart disease assessment see **Adult Congenital Heart Disease (CD-11)** for defect specific indications (CPT® 75557 or CPT® 75561).
  - MRA Chest (CPT® 71555) may be added if the aorta or pulmonary artery need to be visualized beyond the root.
  - May add CPT® +75565 in conjunction with CPT® 75557 or CPT® 75561, only if there is a need to clarify findings on a recent echocardiogram and cardiac Doppler study when there is documentation of **either** of the following:
    - Significant valvular disease that may require intervention
    - Intracardiac flow disturbances (e.g., ASD, VSD)
- MRA Chest (CPT® 71555) may be indicated for the following:
  - Thoracic aortic dissection see **Aortic Dissection and Other Aortic Conditions (PVD-6.7)** in the Peripheral Vascular Disease Imaging Guidelines
  - Coarctation of the aorta see:
    - **Coarctation of the Aorta (CD-11.3.2)** for adults
    - **Aortic Coarctation and IAA (interrupted aortic arch) (PEDCD-2.4.11)** for infants and children in the Pediatric Cardiac Imaging Guideline

  - Thoracic aortic aneurysm see **Thoracic Aortic Aneurysm (TAA) (PVD-6.2)** in the Peripheral Vascular Disease Imaging Guidelines.
- Coarctation of the aorta
  - Follow-up (surveillance) imaging after repair of coarctation:
    - Adults: see **Coarctation of the Aorta (CD-11.3.2)**
    - Infants and children: see **Aortic Coarctation and IAA (interrupted aortic arch) (PEDCD-2.4.11)** in the Pediatric Cardiac Imaging Guideline
- Arrhythmogenic right ventricular dysplasia or arrhythmogenic right ventricular cardiomyopathy (ARVD/ARVC) suspicion (CPT® 75557 or CPT® 75561) must have one of the following:
  - Non-sustained or sustained VT of LBBB morphology OR >500 PVC's over 24 hours on event recorder or Holter monitor.
  - ARVD/ARVC confirmed in a first-degree relative either by criteria, autopsy, pathogenic genetic mutation or sudden death <35 years of age with suspected ARVD/ARVC.
  - Inverted T waves in right precordial leads (V1, V2 and V3) or beyond in individuals >14 years of age in the absence of complete RBBB
  - Right ventricular akinesis, dyskinesis or aneurysm noted on echo or RV angiography.
- Differentiate constrictive pericarditis from restrictive cardiomyopathy (CPT® 75561).
- Evaluate cardiac tumor or mass when echocardiogram is inconclusive.
- Evaluate valvular heart disease when echocardiogram is inconclusive:
  - CPT® 75557 **or** CPT® 75561
  - May add CPT® 75565 when there is documentation of either of the following:
    - Significant valvular disease that may require intervention
    - Intracardiac flow disturbances (e.g., ASD, VSD)
- MRI Cardiac (CPT® 75557 or CPT® 75561) **or** chest MRV (CPT® 71555), but not both, for pulmonary vein anatomy for planned ablation procedures in individuals with atrial fibrillation. See **Pulmonary Vein Imaging – Indications (CD-8.2)** for guidelines on follow-up imaging after ablation procedure.
- Suspected cardiac thrombus when echocardiogram is inconclusive (CPT® 75557).
- Right ventricular function evaluation (CPT® 75557 in conjunction with CPT® +75565) if there has been a recent ECHO and there is documented need to perform Cardiac MRI in order to resolve an unanswered question about flow dynamics.
- Cardiac MRI (CPT® 75557 or CPT® 75561) and CMR velocity flow mapping (CPT® 75565) for preoperative evaluation prior to planned LVAD implant
- Shunting through a VSD (CPT® 75557 in conjunction with CPT® +75565) if a recent ECHO has been done, including a bubble study, and there is documented need to perform Cardiac MRI in order to resolve an unanswered question about flow dynamics.

- Conditions that would **not** require an echo prior to an MRI:
  - Anomalous coronary arteries: Cardiac MRI (CPT® 75561) or CCTA (CPT® 75574) is much better at detecting this than conventional angiography.
  - Assess coronary arteries in Kawasaki disease.
  - Fabry disease
    - Late enhancement MRI may predict the effect of enzyme replacement therapy on myocardial changes that occur with this disease (CPT® 75561).
  - Initial evaluation for cardiac sarcoidosis.

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Cardiac MRI – Indications for Stress MRI (CD-5.3)

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- For indications for Stress MRI see **Stress Testing with Imaging – Indications (CD-1.4)**.
- If a nuclear perfusion (MPI) stress test was performed and was equivocal, a stress MRI is indicated.

Cardiac MRI – Aortic Root and Proximal Ascending Aorta (CD-5.4)

CD.MRI.0005.4.A

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- See **Thoracic Aortic Aneurysm (TAA) (PVD-6.2)** in the Peripheral Vascular Disease imaging guidelines

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Cardiac MRI – Evaluation of Pericardial Effusion or Diagnosis of Pericardial Tamponade (CD-5.5)

CD.MRI.0005.5.A

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- Contrast-enhanced cardiac MRI (CPT® 75561) is useful for evaluating pericarditis, neoplastic and other effusion, tamponade or myocardial infiltration if a specific clinical question is left unanswered by echocardiogram or another recent imaging study.

Cardiac MRI – Myocarditis (CD-5.6)

CD.MRI.0005.6.A
v2.0.2024

Clinical evaluation of suspected myocarditis

Initial testing for suspected myocarditis should consist of an electrocardiogram, measurement of cardiac troponin, and an echocardiogram.

Cardiac MRI is indicated for suspected myocarditis in the presence of **all** of the following:

- New onset or persisting symptoms suggestive of myocarditis documented by **any** of the following:
  - Dyspnea
  - Chest pain
  - Palpitations
  - Syncope
  - Effort intolerance
- Evidence for recent or ongoing myocardial injury documented by **any** of the following results on initial screening:
  - Ventricular dysfunction noted on any cardiac imaging study, or
  - New or persisting ECG abnormalities suspicious for myocarditis
    - ST changes, T wave changes, Q waves, or
    - conduction abnormalities, such as LBBB or AV block, or
    - VT or VF
  - Elevated troponin
- Strong suspicion for viral etiology of myocardial injury with documentation of **both**:
  - Recent systemic viral disease, recent mRNA COVID-19 vaccination, or prior myocarditis
  - No evidence of coronary ischemia as documented by **any** of the following:
    - Lack of risk factors for CAD
    - Age under 35 years
    - Negative cardiac imaging study, such as MPI, CCTA, cath

Return to Play Screening for athletes at risk for myocarditis

Cardiac MRI is indicated for **Return to Play Screening** for athletes when there is documentation of **both** of the following:

- Individual has a history of a clinical condition associated with myocarditis (i.e., COVID-19 infection or recent mRNA COVID-19 vaccination)
- Initial screening has been performed with documentation of **either** of the following:
  - Initial screening (ECG, troponin, and TTE) showed evidence for recent or ongoing myocardial injury (as defined above in Clinical Evaluation of Suspected Myocarditis) with ongoing symptoms concerning for myocarditis (dyspnea, chest pain, palpitations, syncope, or effort intolerance).
  - Normal results of initial screening with persistent or new onset symptoms concerning for myocarditis.

Background and Supporting Information

As noted in the "2022 ACC expert consensus decision pathway on cardiovascular sequelae of COVID-19 in adults" and the 2017 "Sports cardiology: core curriculum for providing cardiovascular care to competitive athletes and highly active people", an athlete is defined as an individual who places a high premium on exercise training, competition, and sports achievement.

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Cardiac MRI – Duchenne Muscular Dystrophy (DMD) (CD-5.7)

CD.MRI.0005.7.A
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Cardiac MRI (CPT® 75557 or 75561-does not include CPT® 75565 or 71555 unless otherwise indicated)

- Asymptomatic individual with documented DMD can have annual surveillance cardiac MRI starting at 6 years old (yearly echo is recommended prior to age 6)
- Asymptomatic, documented carrier of DMD can have cardiac MRI every 3 years starting at 18

References (CD-5)

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Cardiac PET

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Cardiac PET – Coding (CD-6.1)

CD.PET.0006.1.A
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Cardiac Imaging Procedure Codes	
Cardiac PET	**CPT®**
Myocardial imaging, positron emission tomography (PET), metabolic evaluation study (including ventricular wall motion[s] and/or ejection fraction[s], when performed), single study	**78459**
Myocardial imaging, positron emission tomography (PET), perfusion study (including ventricular wall motion[s] and/or ejection fraction[s], when performed); single study at rest or stress (exercise or pharmacologic)	**78491**
Myocardial imaging, positron emission tomography (PET), perfusion study (including ventricular wall motion[s] and/or ejection fraction[s], when performed); multiple studies at rest and stress (exercise or pharmacologic)	**78492**
Myocardial imaging, positron emission tomography (PET), metabolic evaluation study (including ventricular wall motion[s] and/or ejection fraction[s], when performed), single study; with concurrently acquired computed tomography transmission scan	**78429**
Myocardial imaging, positron emission tomography (PET), perfusion study (including ventricular wall motion[s] and/or ejection fraction[s], when performed); single study, at rest or stress (exercise or pharmacologic), with concurrently acquired computed tomography transmission scan	**78430**
Myocardial imaging, positron emission tomography (PET), perfusion study (including ventricular wall motion[s] and/or ejection fraction[s], when performed); multiple studies at rest and stress (exercise or pharmacologic), with concurrently acquired computed tomography transmission scan	**78431**

Cardiac Imaging Procedure Codes	
Cardiac PET	**CPT®**
Myocardial imaging, positron emission tomography (PET), combined perfusion with metabolic evaluation study (including ventricular wall motion[s] and/or ejection fraction[s], when performed), dual radiotracer (e.g., myocardial viability);	**78432**
Myocardial imaging, positron emission tomography (PET), combined perfusion with metabolic evaluation study (including ventricular wall motion[s] and/or ejection fraction[s], when performed), dual radiotracer (e.g., myocardial viability); with concurrently acquired computed tomography transmission scan	**78433**
Absolute quantitation of myocardial blood flow (AQMBF), positron emission tomography (PET), rest and pharmacologic stress (List separately in addition to code for primary procedure)	**+78434**
Positron emission tomography (PET) with concurrently acquired computed tomography (CT) for attenuation correction and anatomical localization imaging; skull base to mid-thigh	**78815**

- 3D rendering should not be billed in conjunction with PET.
- Separate codes for such related services as treadmill testing (CPT® 93015-CPT® 93018) and radiopharmaceuticals should be assigned in addition to perfusion PET. These services are paid according to each individual payer.

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Cardiac PET – Perfusion – Indications (CD-6.2)

CD.PET.0006.2.A
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CPT® 78430, CPT® 78431, CPT® 78491 and CPT® 78492

- Meets all of the criteria for an imaging stress test in **Stress Testing with Imaging – Indications (CD-1.4)** and additionally any one of the following:
  - Individual is severely obese (for example BMI >40 kg/m^2) or
  - Individual has large breasts or implants
  - Individual incapable of exercise due to physical (musculoskeletal or neurological) inability to achieve target heart rate. Target heart rate is calculated as 85% of the maximum age predicted heart rate (MPHR). MPHR is estimated as 220 minus the individual's age
- Equivocal nuclear perfusion (SPECT MPI) stress test
- Routine use in post heart transplant assessment of transplant CAD

Cardiac PET – Absolute Quantitation of Myocardial Blood Flow (AQMBF) (CD-6.3)

CD.PET.0006.3.A
v2.0.2024

Absolute Quantitation of Myocardial Blood Flow (CPT® 78434)

Quantitation of myocardial blood flow at rest and with stress in ml/g/min and the calculation of myocardial perfusion reserve (the ratio of stress to rest flow) can be used for diagnosis and prognosis of coronary artery disease and cardiac endothelial dysfunction that can be seen in diabetes, left ventricular hypertrophy, heart transplantation vasculopathy among other conditions.

- AQMBF with PET (CPT® 78434) is an add-on procedure that is indicated when one of the following apply:
  - Primary study Myocardial PET rest/stress perfusion (CPT® 78492 or 78431 only) has been approved
  - Primary study Myocardial PET rest/stress perfusion (CPT® 78492 or 78431 only) has been ordered and is being approved at the same time (see- **Cardiac PET - Perfusion - Indications (CD-6.2)** or **Stress Testing with Imaging - Indications (CD-1.4)**).

Background and supporting information

Despite its utility, AQMBF is a technically challenging measurement. Variables include:

- Different tracers (N-13 ammonia vs Rb-82 Cl) give different values
- Different mathematical models used (static vs dynamic)
- Different stressors are used that give different hyperemic flow results(adenosine vs dipyridamole vs regadenoson)
- Data can be collected in 2D vs 3D modes. Saturation of crystals is more problematic in 3D.
- Cardiac, respiratory and patient motion can degrade measurement accuracy .
- Different vendor software is used by different reading labs.
- Resting blood flow can be elevated due to pain, anxiety, lack of vagal tone, hypertension, etc. and can be normalized by using the rate pressure product (RPP) for calculation of myocardial perfusion reserve (MBF) the ratio of myocardial hyperemic flow/rest flow.

eviCore along with the American Society of Nuclear Medicine, the American College of Cardiology, and the Society of Nuclear Medicine and Metabolic Imaging agree that to minimize the above listed variables, AQMBF should only be approved when performed by (**all):**

- Laboratories that are Intersocietal Accreditation Commission (IAC), American College of Radiology (ACR), or Joint Commission cardiac PET accredited.
- Interpreting physician(s) must be Board certified in Nuclear Cardiology (CBNC), Nuclear Medicine (ABNM), or Radiology (ABR) and have additional training in measuring AQMBF.
- Individual laboratories should have a standard protocol (same tracer, camera, software, stressor, model etc.) for use for all patients.
- Reports should contain rest myocardial blood flow (MBF) and stress MBF in ml/g/min, and myocardial blood flow reserve (MBFR) reported as the ratio of stress to rest MBF (with normal limits).
- Laboratories should have the ability to perform rate-pressure-product (RPP) correction of resting MBF when resting MBF is elevated due to elevated resting RPP and include mention of the true measured resting MBF and MBFR as well as the RPP-corrected resting MBF and RPP-corrected MBFR in the conclusions of the report.
- Health plans will be responsible for verifying requirements.

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References

CD.PET.0006.3.A

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Cardiac PET – Metabolic – Indications (CD-6.4)

CD.PET.0006.4.A

v2.0.2024

- Cardiac PET Metabolic and cardiac SPECT or PET perfusion (CPT® 78429 or CPT® 78459 and CPT® 78451, or CPT® 78432, or CPT® 78433)
  - To determine myocardial viability when a previous study has shown significant left ventricular dysfunction when under consideration for revascularization
- To diagnose strongly suspected cardiac sarcoid or monitor response to therapy for established cardiac sarcoid see **Cardiac Sarcoidosis (CD-3.9)**

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FDG PET/CT for infections (CD-6.5)

CD.PET.0006.5.A

v2.0.2024

- FDG PET/CT (CPT® 78815 or CPT® 78429) is indicated in the assessment of suspected prosthetic heart valve endocarditis when there is documentation of **both** of the following:
  - TTE and/or TEE are equivocal or non-diagnostic
  - Suspicion for prosthetic heart valve endocarditis remains high (all):
    - C-reactive protein ≥40 mg/L
    - No evidence of prolonged antibiotic therapy
    - The implantation was ≥3 months ago and there is no evidence of surgical adhesives used during the valve implantation
- FDG PET/CT for LVAD driveline infection (CPT® 78815 or 78429)
  - Early infection detection for LVAD drivelines is desirable, since once the infection extends to the cannula and pump pocket, eradication becomes difficult. CT findings are nonspecific and metal device artifacts of the driveline itself affects sensitivity.
  - FDG PET/CT is indicated for suspected LVAD infection if other studies and examination remain inconclusive.

References (CD-6)

v2.0.2024

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2. Youssef G, Mylonas I, Leung E, et al. The Use of 18F-FDG PET in the Diagnosis of Cardiac Sarcoidosis: A Systematic Review and Metaanalysis Including the Ontario Experience. Journal of Nuclear Medicine. http://jnm.snmjournals.org/content/53/2/241.long. Published February 1, 2012.
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10. Gulati M, Levy PD, Mukherjee D, et al. 2021 AHA/ACC/ASE/CHEST/SAEM/SCCT/SCMR Guideline for the Evaluation and Diagnosis of Chest Pain: A Report of the American College of Cardiology/American Heart Association Joint Committee on Clinical Practice Guidelines [published correction appears in Circulation. 2021 Nov 30;144(22):e455]. *Circulation*. 2021;144(22):e368-e454. doi:10.1161/CIR.0000000000001029

Diagnostic Heart Catheterization

Guideline

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Diagnostic Heart Catheterization – Coding (CD-7.1) (CD-7.2)

CD.DHC.0007.1.A
v2.0.2024

Diagnostic Heart Catheterization – Code Sets (CD-7.1)

Cardiac Catheterization Procedure Codes

Cardiac Cath Procedure	CPT ®
Congenital Heart Disease Code "Set"	93593-93597
Right heart catheterization for congenital heart defect(s) including imaging guidance by the proceduralist to advance the catheter to the target zone; normal native connections	93593
Right heart catheterization for congenital heart defect(s) including imaging guidance by the proceduralist to advance the catheter to the target zone; abnormal native connections	93594
Left heart catheterization for congenital heart defect(s) including imaging guidance by the proceduralist to advance the catheter to the target zone, normal or abnormal native connections	93595
Right and left heart catheterization for congenital heart defect(s) including imaging guidance by the proceduralist to advance the catheter to the target zone(s); normal native connections	93596
Right and left heart catheterization for congenital heart defect(s) including imaging guidance by the proceduralist to advance the catheter to the target zone(s); abnormal native connections	93597
Anomalous coronary arteries, patent foramen ovale, mitral valve prolapse, and bicuspid aortic valve	93451-93464, 93566-93568

Cardiac Cath Procedure	CPT ®
RHC without LHC or coronaries	93451
LHC without RHC or coronaries	93452
RHC and retrograde LHC without coronaries	93453
Native coronary artery catheterization;	93454
with bypass grafts	93455
with RHC	93456
with RHC and bypass grafts	93457
with LHC	93458
with LHC and bypass grafts	93459
with RHC and LHC	93460
with RHC and LHC and bypass grafts	93461
LHC by trans-septal or apical puncture	+93462
Angiography of non-coronary arteries and veins performed as a distinct service	Select appropriate codes from the Radiology and Vascular Injection Procedures sections.

- CPT® 93593 to 93597 are indicated for invasive evaluation of congenital heart disease. See specific conditions in **Adult Congenital Heart Disease (CD-11)**

Diagnostic Heart Catheterization – Coding Notes (CD-7.2)

- Cardiac catheterization (CPT® 93451-CPT® 93461) includes all "road mapping" angiography necessary to place the catheters, including any injections and imaging supervision, interpretation and report.

- Cardiac catheterization (CPT® 93452-CPT® 93461) (for all conditions other than congenital heart disease) includes contrast injections, imaging supervision, interpretation and report for imaging typically performed.
- Catheter placements in native coronaries or bypass grafts (CPT® 93454-CPT® 93461) include intraprocedural injections for bypass graft angiography, imaging supervision and interpretation.
- Injection codes CPT® 93563-CPT® 93565 should not be used in conjunction with CPT® 93452-CPT® 93461.
- Codes CPT® 93451-CPT® 93461 do not include contrast injections and imaging supervision, interpretation and report for imaging that is separately identified by the following specific procedure codes: CPT® 93566, CPT® 93567 and CPT® 93568.
- Separate diagnostic cardiac catheterization codes should only be assigned in conjunction with interventional procedures in the following circumstances:
  - No prior or recent diagnostic catheterization is available to guide therapy
  - Individual's condition has significantly changed since the last diagnostic cath
  - The treatment plan may be affected
  - Other vessels may be identified for treatment
  - Further establishment of a diagnosis from a non-invasive study is necessary

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LHC – Unstable/Active Coronary Artery Syndromes (CD-7.3.1)

CD.DHC.0008.A
v2.0.2024

Diagnostic Left Heart Catheterization (LHC) is indicated for individuals in acute settings or with **active** unstable angina and should be handled as medical emergencies.

- LHC may be indicated for new onset, accelerating, or worsening ischemic symptoms suggestive of acute coronary syndrome (ACS) occurring at rest, or with minimal exertion resolving with rest, including:
  - Cardiac chest pain (typical angina) with or without new onset, evolving ischemic EKG changes
  - Symptoms consistent with the known angina pattern in an individual with a history of CABG or PCI
- Left and right heart cath may be indicated in place of a left heart cath if the above criteria has been met and there is documentation of any of the following:
  - The major component of the individual's symptoms is dyspnea
  - Newly diagnosed or worsening cardiomyopathy
  - For surgical planning prior to any of the following:
    - Heart valve surgery
    - Congenital heart defect repair
    - Lung transplant
    - Liver transplant

Diagnostic Left Heart Catheterization (LHC) (CD-7.3)

CD.DHC.0007.3.A
v2.0.2024

Stable Established CAD Post Revascularization with CABG or PCI (CD-7.3.2)

Note: These guidelines apply to individuals with stable conditions and who are not in the acute setting (acute coronary syndrome or unstable angina).

- Diagnostic Left Heart Catheterization (LHC) is indicated in individuals with established Coronary Artery Disease (CAD) post revascularization by percutaneous coronary intervention (PCI) or coronary artery bypass graft surgery (CABG) when there is documentation of **one** of the following:
  - New, recurrent, or worsening ischemic symptoms similar to prior ischemic episode.
  - New, recurrent, or worsening likely anginal symptoms as defined in **General Guidelines (CD-1.0)**
  - New, recurrent, or worsening symptoms of chest pain, or exertional dyspnea, or exertional fatigue AND intermediate or high-risk findings on non-invasive stress testing as documented by one of the following:
    - Cardiac chest pain induced by exercise treadmill testing or dobutamine stress testing
    - Exercise treadmill testing inducing any of the following:
      - At least 1 mm downsloping ST-depression
      - 2 mm horizontal ST-depression
      - At least 1 mm ST-elevation in two leads
      - Ventricular tachycardia of at least 3 consecutive beats
    - Myocardial perfusion imaging (SPECT or PET) with ≥5% reversible ischemic burden
    - Stress echo with at least 2 segments of inducible ischemia
    - Severe stress induced left ventricular dysfunction (drop in left ventricular ejection fraction with stress ≥10%)
  - New left ventricular systolic dysfunction (left ventricular ejection fraction <50%)
  - Worsening left ventricular systolic dysfunction (decline in left ventricular ejection fraction ≥10%)
  - New or worsened congestive heart failure

- Ventricular fibrillation
- Sustained ventricular tachycardia

- Left and right heart cath may be indicated in place of a left heart cath if the above criteria has been met and there is documentation of **any** of the following:
  - The major component of the individual's symptoms is dyspnea
  - Newly diagnosed or worsening cardiomyopathy
  - For surgical planning prior to any of the following:
    - Heart valve surgery
    - Congenital heart defect repair
    - Lung transplant
    - Liver transplant

Stable Symptomatic Suspected or Established Coronary Artery Disease (CD-7.3.3)

For the purpose of this guideline, likely anginal symptoms is defined in **General Guidelines (CD-1.0)**

- Diagnostic left heart catheterization to screen for coronary artery disease (CAD) in asymptomatic individuals who are not anticipating other cardiac procedures is **not** indicated
- LHC with coronary arteriography (CPT® 93454, 93455, 93458, 93459) is indicated when there is documentation of one of the following:
  - New onset, persistent, or worsening of likely anginal symptoms and either:
    - Symptomatic failure of a 12 week trial of OMT including as tolerated all of the following:
      - Anti-platelet therapy
      - Statin and/or other lipid-lowering therapy
      - Anti-anginal therapy implemented to pursue a goal heart rate of 60 beats per minute or less
      - Anti-hypertensive therapy as may be indicated to pursue a goal systolic blood pressure (sbp) of less than 140 mmHg and a goal diastolic blood pressure (DBP) of less than 90 mmHg
    - Worsening of likely anginal symptoms during 12 week trial of OMT
  - New onset, persistent, or worsening of likely anginal symptoms and documentation of **both** of the following:
    - Established CAD per **General Guidelines (CD- 1.0)** or age ≥50 years and/or ≥2 CAD risk factors (diabetes mellitus, smoking, family history of premature CAD, hypertension, dyslipidemia), and

    - Likely anginal symptoms at a low level of exercise or at rest despite optimal medical therapy
- LHC may be indicated irrespective of OMT for symptomatic individuals who also have high-risk findings on Coronary CT Angiography See **CCTA - Indications for CCTA (CD-4.3)**, to include any of the following:
    - Left main coronary artery stenosis ≥40%
    - Proximal or mid left anterior descending coronary artery stenosis ≥70%
    - Proximal or mid double-vessel coronary artery stenosis ≥60%
    - Proximal or mid triple-vessel coronary artery stenosis ≥50%
    - CT-FFR measured to be ≤0.8 in the proximal or mid segment of any coronary artery irrespective of degree of stenosis
- LHC may be indicated irrespective of OMT for symptomatic individuals who have BOTH likely anginal symptoms and high-risk findings on non-invasive stress testing including any of the following:
    - Cardiac chest pain induced by exercise treadmill testing or dobutamine stress testing
    - Myocardial perfusion imaging with ≥10% reversible ischemic burden
    - Stress echo with at least 3 segments of inducible ischemia
    - Exercise treadmill testing inducing at least 2.5 mm downsloping ST-depression or 3 mm horizontal ST-depression in two leads
    - Ventricular tachycardia of at least 3 consecutive beats induced by an exercise treadmill test
- LHC may be indicated for any of the following if coronary artery disease is suspected:
    - New or worsened congestive heart failure
    - New left ventricular systolic dysfunction (left ventricular ejection fraction <50%)
    - Worsening left ventricular systolic dysfunction (decline in left ventricular ejection fraction ≥10%)
    - Ventricular fibrillation or sustained ventricular tachycardia
- Left and right heart cath may be indicated in place of a left heart cath if the above criteria has been met and there is documentation of any of the following:
    - The major component of the individual's symptoms is dyspnea
    - Newly diagnosed or worsening cardiomyopathy
    - For surgical planning prior to any of the following:
        - Heart valve surgery
        - Congenital heart defect repair
        - Lung transplant
        - Liver transplant

Background and supporting information

In addition to OMT, physician-guided behavioral modification therapy (BMT) is recommended including all of the following:

- Mediterranean diet
- Moderate intensity physical activity for at least thirty minutes per day at least five times per week as possible
- Attempts at smoking cessation to include at least one of the following:
  - Cognitive behavioral therapy
  - Nicotine withdrawal replacement therapy

Exclusion of Significant Coronary Artery Disease Involvement in other Cardiac Pathology (CD-7.3.4)

- LHC is indicated when the etiology is unclear for **any** of the following if coronary artery disease is suspected:
  - New or worsened congestive heart failure
  - New left ventricular systolic dysfunction (left ventricular ejection fraction <50%)
  - Worsening left ventricular systolic dysfunction (decline in left ventricular ejection fraction ≥10%)
  - Ventricular fibrillation or sustained ventricular tachycardia
  - Unheralded syncope (not near syncope)
  - Suspected myocarditis
- Left and right heart cath may be indicated in place of a left heart cath if the above criteria has been met and there is documentation of any of the following:
  - The major component of the individual's symptoms is dyspnea
  - Newly diagnosed or worsening cardiomyopathy
  - For surgical planning prior to any of the following:
    - Heart valve surgery
    - Congenital heart defect repair
    - Lung transplant
    - Liver transplant

Evaluation of structural heart disease (CD-7.3.5)

Left heart catheterization with coronary arteriography (CPT® 93458 or CPT® 93454) is indicated for any of the following

- Evaluation prior to planned invasive procedure or surgery

  - Ruling out coronary artery disease prior to planned non-coronary cardiac or great vessel surgery (i.e., cardiac valve surgery, aortic dissection, aortic aneurysm, congenital disease repair such as atrial septal defect, etc.).
  - Pre-organ transplant (non-cardiac) - in place of stress imaging for initial pre-transplant evaluation (per the transplant center's protocol) **or** if stress imaging is positive for ischemia. Repeat periodic screening while on a transplant waiting list (in the absence of other clinical indications) is not supported. See **Kidney Transplant, Pre-Transplant Imaging Studies (AB-42.5)**.
  - Prior to catheter ablation of ventricular arrhythmia at one of the following sites:
    - Sinus of Valsalva
    - Coronary venous system
    - Epicardium
- Valvular heart disease when either:
  - There is a discrepancy between the clinical findings (history, physical exam, and non-invasive test results)
  - Valvular surgery is being considered.
- Suspected pericardial disease.
- Previous cardiac transplant:
  - Per transplant center protocol
  - To assess for accelerated coronary artery disease associated with cardiac transplantation.
- Left and right heart cath may be indicated in place of a left heart cath if the above criteria has been met and there is documentation of any of the following:
  - The major component of the individual's symptoms is dyspnea
  - Newly diagnosed or worsening cardiomyopathy
  - For surgical planning prior to any of the following:
    - Heart valve surgery
    - Congenital heart defect repair
    - Lung transplant
    - Liver transplant

Angiography-Derived Fractional Flow Reserve (CD-7.3.6)

Coding

Description	HCPCS
Catheter placement in coronary artery(s) for coronary angiography, including intraprocedural injection(s) for coronary angiography, imaging supervision and interpretation with left heart catheterization including intraprocedural injection(s) for left ventriculography, when performed and intraprocedural coronary fractional flow reserve (FFR) with 3d functional mapping of color-coded FFR values for the coronary tree, derived from coronary angiogram data, for real-time review and interpretation of possible atherosclerotic stenosis(es) intervention	C7557

Criteria

Angiography-Derived Fractional Flow Reserve based on three-dimensional reconstruction of angiographic images is considered to be experimental, investigational, or unproven.

Background and supporting information

Fractional flow reserve (FFR) is an index of the physiological significance of a coronary artery stenosis. It is derived by using a coronary artery pressure guidewire to measure the distal coronary artery pressure. Angiography-Derived Fractional Flow Reserve is an alternative approach to derive FFR without the use of a coronary artery pressure guidewire, based on three-dimensional reconstruction of angiographic images. Mathematical modeling based on hemodynamic laws is then applied to the three-dimensional reconstruction to derive the pressure dynamics along the coronary artery, with results displayed in a color-coded map. Further research is needed to evaluate the accuracy and applicability of Angiography-Derived Fractional Flow Reserve.

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3. Arefinia F et al. Non-invasive fractional flow reserve estimation using deep learning on intermediate left anterior descending coronary artery lesion angiography images. *Sci Rep*. 2024 Jan 20;14(1):1818. doi: 10.1038/s41598-024-52360-5.
4. Advancing Cath Lab Results With FFRangio Coronary Physiology Assessment (ALL-RISE) ClinicalTrials.gov Identifier: NCT05893498. Study Start: 2023-06-21. Primary Completion (Estimated): 2024-12. Clinical Trials.gov.

Right Heart Catheterization and Right and Left Heart Catheterization without Coronary Angiography (CD-7.4)

CD.DHC.0007.4.A

v2.0.2024

- Diagnostic right heart catheterization (CPT® 93451) OR Diagnostic right and left heart catheterization without coronary angiography (CPT® 93453) is indicated when results will impact the diagnosis and management of **any** of the following:
  - Atrial septal defect (ASD) including shunt detection and quantification
  - Ventricular septal defect (VSD) including shunt detection and quantification
  - Patent foramen ovale (PFO)
  - Anomalous pulmonary venous return
  - Congenital defects including persistent left vena cava
  - Pulmonary hypertension
  - Pericardial diseases (constrictive or restrictive pericarditis)
  - Valvular disease
  - Right heart failure
  - Left heart failure
  - Newly diagnosed or worsening cardiomyopathy
  - Preoperative evaluation for valve surgery
  - During a left heart cath where the etiology of the symptoms remains unclear
  - Pre-lung transplant to assess pulmonary pressures
  - Uncertain intravascular volume status with an unclear etiology
  - Prior to LVAD implant and post LVAD implant as needed for hemodynamic assessment to guide changes to therapy
  - Assessment post-cardiac transplant
    - For routine endomyocardial biopsy
    - Assess for rejection
    - Assess pulmonary artery pressure
    - Can be done per the institution protocol or anytime organ rejection is suspected and biopsy is needed for assessment
  - Evaluation of right ventricular morphology.
  - Suspected arrhythmogenic right ventricular dysplasia.

Background and supporting information

General information RHC (CPT® 93451)

- It is performed most commonly from the femoral vein, less often through the subclavian, brachial, or internal jugular vein and inter-atrial septal puncture approach.
- It includes a full oximetry for detection and quantification of shunts.
- Cardiac outputs are calculated by several techniques including the Fick thermodilution

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Combined Right and Left Heart Catheterization Indications (CD-7.5)

CD.DHC.0007.5.A
v2.0.2024

Combined Right and Left Heart Catheterization (CPT® 93460 or CPT® 93461) is indicated for the following:

- Preoperative evaluation for valve surgery
- The indications for **Diagnostic Left Heart Catheterization (LHC) (CD-7.3)** are met and **any** of the following are present:
  - The major component of the individual's symptoms is dyspnea
  - The indications are met according to **Right Heart Catheterization (RHC) (CD-7.4)**
  - Newly diagnosed or worsening cardiomyopathy
- See **Right Heart Catheterization and Right and Left Heart Catheterization without Coronary Angiography (CD- 7.4)** for CPT® 93453

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Planned (Staged) Coronary Interventions (CD-7.6)

CD.DHC.0007.6.A

v2.0.2024

- Planned (Staged) Coronary Interventions applies to individuals with clinically stable symptoms if there is documentation of a recent diagnostic catheterization finding of a significant lesion that was not intervened as part of the initial procedure and the documentation explicitly states that a subsequent procedure will be performed for planned/staged PCI of that lesion.
- The CPT® codes for percutaneous coronary interventions (PCI) include the following imaging services necessary for the procedure(s):
  - Contrast injection, angiography, 'road-mapping', and fluoroscopic guidance
  - Vessel measurement
  - Angiography following coronary angioplasty, stent placement, and atherectomy
- Separate codes for these services should not be assigned in addition to the PCI code/s because the services are already included.
- A repeat diagnostic left heart catheterization is not medically necessary when the individual is undergoing a planned staged percutaneous coronary intervention.

Evaluation of Conditions other than Coronary Artery Disease (CD-7.7)

CD.DHC.0077.A
v2.0.2024

- Right and left heart catheterization (CPT® 93453) is indicated for any of the following:
  - Preoperative assessment prior to planned valvular surgery
  - Evaluation of pulmonary hypertension out of proportion to or unexplained by the severity of valvular disease documented by other non-invasive imaging modalities (i.e., echo, CMR)
  - Left ventricular dysfunction out of proportion to the severity of valvular disease documented by other non-invasive imaging modalities
  - Suspected pericardial tamponade as documented by clinical findings or other non-invasive imaging modalities
  - Suspected, or clinical uncertainty, between constrictive pericarditis vs. restrictive cardiomyopathy physiology when there are questions left unanswered by other cardiac non-invasive imaging modalities
  - Known or suspected cardiomyopathy with or without heart failure documented by prior advanced imaging
  - Re-evaluation of known cardiomyopathy for any of the following:
    - Change in clinical status
    - Change in cardiac exam
    - When required to guide therapy
  - Hypertrophic Cardiomyopathy
  - Subvalvular aortic stenosis
- Right and left heart catheterization (CPT® 93453) is indicated when there is uncertainty between clinical impression and other non-invasive imaging modalities to evaluate the following valvular diseases:
  - Mitral stenosis
  - Mitral regurgitation
  - Aortic stenosis
  - Aortic regurgitation
- Left heart catheterization (CPT® 93452) for hemodynamic evaluation of the left ventricle and aorta is indicated to evaluate aortic stenosis when there is uncertainty between the clinical impression and non-invasive imaging modality findings.

References (CD-7)

v2.0.2024

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Adult Congenital Heart Disease

Guideline

References (CD-11)

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Congenital heart disease – General Information (CD-11.1)

CD.CHD.0011.1.A

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- This section covers adult congenital heart disease (CHD), for other associated disorders please see the condition specific sections
  - Marfan Syndrome
  - Hypertrophic cardiomyopathy (HCM)
  - Bicuspid aortic valve (BAV)

Definitions (CD-11.1.1)

- Physiological stages (A, B, C, D)
  - Each congenital heart lesion is divided into 4 physiological stages (A, B, C, D)

Characteristics	Physiological stage			
	A	B	C	D
NYHA functional class	**I**	**II**	**III**	**IV**
Hemodynamic or anatomic sequelae	None	Mild ventricular enlargement of dysfunction, small shunt	Moderate or greater, ventricular dysfunction. Any venous or arterial stenosis	Moderate or greater, ventricular dysfunction. Any venous or arterial stenosis
Valvular	None	Mild	Moderate or greater	Moderate or greater
Aortic enlargement	None	Mild	Moderate	Severe
Exercise capacity limitation	Normal	Abnormal objective cardiac limitation	Moderate	Severe

Characteristics	Physiological stage			
	A	B	C	D
Renal hepatic pulmonary dysfunction	None		Mild but responsive to medication	Refractory to treatment
Cyanosis/ hypoxemia	None		Mild	Severe
Arrhythmias	None	Arrhythmia not requiring treatment	Needs rx	Refractory to rx
Pulmonary hypertension	None		Mild to moderate	Severe or Eisenmenger

- CHD Anatomic classification
  - Class I-Simple
    - Native disease
      - Isolated small ASD
      - Isolated small VSD
      - Mild isolated pulmonic stenosis
    - Repaired conditions
      - Previously ligated or occluded ductus arteriosus
      - Repaired secundum ASD or sinus venosus defect without significant residual shunt or chamber enlargement
      - Repaired VSD without significant residual shunt or chamber enlargement
  - Class II-Moderate Complexity
    - Repaired or unrepaired conditions
      - Aorto-left ventricular fistula
      - Anomalous pulmonary venous connection, partial or total
      - Anomalous coronary artery arising from the pulmonary artery
      - Anomalous aortic origin of a coronary artery from the opposite sinus
      - AVSD (partial or complete, including primum ASD)
      - Congenital aortic valve disease
      - Congenital mitral valve disease
      - Coarctation of the aorta

- Ebstein anomaly (disease spectrum includes mild, moderate, and severe variations)
- Infundibular right ventricular outflow obstruction
- Ostium primum ASD
- Moderate and large unrepaired secundum ASD
- Moderate and large persistently patent ductus arteriosus
- Pulmonary valve regurgitation (moderate or greater)
- Pulmonary valve stenosis (moderate or greater)
- Peripheral pulmonary stenosis
- Sinus of Valsalva fistula/aneurysm
- Sinus venosus defect
- Subvalvular aortic stenosis (excluding HCM; HCM not addressed in these guidelines)
- Supravalvular aortic stenosis
- Straddling atrioventricular valve
- Repaired tetralogy of Fallot
- VSD with associated abnormality and/or moderate or greater shunt

◦ Class III- Great Complexity (or Complex)
- Cyanotic congenital heart defect (unrepaired or palliated, all forms)
- Double-outlet ventricle
- Fontan procedure
- Interrupted aortic arch
- Mitral atresia
- Single ventricle (including double inlet left ventricle, tricuspid atresia, hypoplastic left heart, any other anatomic abnormality with a functionally single ventricle)
- Pulmonary atresia (all forms)
- TGA (classic or d-TGA; CCTGA or l-TGA)
- Truncus arteriosus
- Other abnormalities of atrioventricular and ventriculoarterial connection (i.e., crisscross heart, isomerism, heterotaxy syndromes, ventricular inversion)

Modalities (CD-11.1.2)

- Echocardiogram- transthoracic (TTE) or transesophageal (TEE)
  - Transthoracic echocardiography (TTE) is an indispensable tool in the initial and serial follow-up evaluation to identify abnormalities and changes that commonly influence management decisions.
- Cardiac MRI (CMR)

  - CMR plays a valuable role in assessment of RV size and function, because it provides data that are reproducible and more reliable than data obtained with alternative imaging techniques
  - For intracardiac congenital heart disease, CMR will typically include flow velocity mapping for shunts and flow assessment.
  - Imaging that only requires aortic arch imaging, does not require intracardiac CMR, only MRA Chest.
- Cardiac Computed Tomography (CCT) and Cardiac Computed Tomography Angiography (CCTA)
  - The most important disadvantage of CCT (including CT angiography) as an imaging technique is the associated exposure to ionizing radiation.
- Cardiac catheterization
  - (hemodynamic and/or angiographic) in individuals with adult CHD AP classification II and III, or interventional cardiac catheterization in individuals with adult CHD AP classification I to III should be performed by, or in collaboration with, cardiologists with expertise in adult CHD
- Exercise Testing
  - Exercise test does not imply stress imaging
- Stress Imaging
  - Includes-MPI, stress echo, stress MRI
  - PET stress may be included as per **Cardiac PET (CD-6)**
- Circumstances where CMR, CCT, TEE, and/or Cardiac Catheterization may be Superior to TTE
  - Assessment of RV size and function in repaired Tetralogy of Fallot (TOF), systemic right ventricles, and other conditions associated with right ventricular (RV) volume and pressure overload
  - Identification of anomalous pulmonary venous connections
  - Serial assessment of thoracic aortic aneurysms, especially when the dilation might extend beyond the echocardiographic windows
  - Accurate assessment of pulmonary artery (PA) pressure and pulmonary vascular resistance
  - Assessment for re-coarctation of the aorta
  - Sinus venosus defects
  - Vascular rings
  - Evaluation of coronary anomalies
  - Quantification of valvular regurgitation

Coding (CD-11.1.3)

Modality	
Echocardiogram	
Transthoracic echocardiogram (TTE)	CPT®
TTE for congenital cardiac anomalies; complete	93303
TTE for congenital cardiac anomalies; limited study	93304
TTE (2D) m-mode recording, complete, with spectral and color flow doppler echocardiography	93306
TTE (2D) with or without m-mode recording; complete	93307
TTE (2D) with or without m-mode recording; limited study	93308
Transesophageal echocardiogram (TEE)	
TEE (2D) including probe placement, imaging, interpretation, and report	93312
TEE for congenital cardiac anomalies; including probe placement, imaging, interpretation, and report	93315
MRI	
cardiac (CMR)	CPT®
Cardiac MRI for morphology and function without contrast	75557
Cardiac MRI for morphology and function without and with contrast	75561
MRI Chest	
MRI Chest without contrast	71550
MRI Chest with contrast	71551

Modality	
MRI Chest with & without contrast	71552
MRI Angiography (MRA) MRA Chest	
MRA Chest (excluding myocardium) with or without contrast	71555
CT	
Cardiac (CCT	CPT®
CT, Heart, with contrast material, for evaluation of cardiac structure and morphology	75572
CT, Heart, with contrast material, for evaluation of cardiac structure and morphology in the setting of congenital heart disease	75573
CT Angiography-cardiac (CCTA)	CPT®
CTA Heart, coronary arteries and bypass grafts (when present), with contrast, including 3D image post-processing	75574
CT-Chest	CPT®
CT Thorax without contrast	71250
CT Thorax with contrast	71260
CT Thorax without & with contrast	71270
CT Angiography-Chest (CTA Chest)	CPT®
CTA Chest without and with contrast	71275
Stress Imaging (echo, MRI, MPI)	
Stress echo	CPT®

Modality	
Echocardiography (TTE), (2D), with or without m-mode, during rest and cardiovascular stress, with interpretation and report	93350
Echocardiography (TTE), (2D), m-mode, during rest and cardiovascular stress test using treadmill, bicycle exercise and/or pharmacologically induced stress, with interpretation	93351
Stress MRI	CPT®
Cardiac MRI for morphology and function without contrast, with stress imaging	75559
Cardiac MRI for morphology and function without and with contrast, with stress imaging	75563
Myocardial perfusion imaging (MPI)	CPT®
MPI, tomographic (SPECT) including attenuation correction, qualitative or quantitative wall motion, ejection fraction by first pass or gated technique, additional quantification, when performed); single study, at rest or stress (exercise or pharmacologic)	78451
MPI, tomographic (SPECT) (including attenuation correction, qualitative or quantitative wall motion, ejection fraction by first pass or gated technique, additional quantification, when performed); multiple studies, at rest and/or stress (exercise or pharmacologic) and/or redistribution and/or rest reinjection	78452
Pulmonary perfusion imaging	CPT®
Pulmonary perfusion imaging (e.g., particulate)	78580
Pulmonary ventilation (e.g., aerosol or gas) and perfusion imaging	78582
Quantitative differential pulmonary perfusion, including imaging when performed	78597
Quantitative differential pulmonary perfusion and ventilation (e.g., aerosol or gas), including imaging when performed	78598

Congenital Heart Disease Imaging Indications

- The following sections are based on the congenital heart lesion. Requests for imaging based on other cardiac conditions, such as CAD, HCM, acquired valvular lesions, should follow the adult cardiac guidelines for those conditions.

Aortopathies with CHD

- Dilated aortic arches are not uncommon with several congenital heart diseases and postoperative procedures including- Aortic stenosis, Ross repair, Tetralogy of Fallot, Transposition of the great arteries (TGA), Pulmonary atresia, hypoplastic left heart syndrome (HLHS), Truncus Arteriosis, single ventricle.

ASD-Atrial septal defects (CD-11.2.1)

CD.CHD.0011.2.1.A
v2.0.2024

Initial studies-Diagnosis, clinical changes, consideration of surgery

- Echocardiogram at time of diagnosis
  - CMR, CCT CPT® 75573), and/or TEE are useful if echo (TTE) is suboptimal and either:
    - ASD is suspected
    - To evaluate pulmonary venous connections in known ASD
  - MRA Chest or CTA Chest may be indicated if echo shows pulmonary venous anomalies
    - If normal, repeat pulmonary vein imaging is not required.
- Transesophageal echocardiogram (TEE) is recommended to guide percutaneous ASD closure
- Diagnostic cath is indicated when there is either:
  - Evidence of pulmonary hypertension
  - Unanswered questions on CMR/CCT for venous drainage.

Post-procedure imaging

- TTE is indicated post ASD device placement:
  - 6 months to evaluate for erosion
  - 1 week (if Amplatzer)
  - 1 month
  - 6 months
  - 12 months
  - then every 1-2 years
- Due to low-risk of erosion in PFO devices- PFO device closure requires follow-up at 6-12 months. No additional evaluation unless PFO not closed

Stress imaging and coronary artery imaging is based on **Stress Testing with Imaging – Indications (CD-1.4)**

Follow-up ASD if surgically closed or if no interventions

Modality	Physiological stage / intervals for routine imaging (months)			
Physiological stage	A	B	C	D
TTE	36	24	12	12

Anomalous Pulmonary Venous Connections (CD-11.2.2)

CD.CHD.0011.2.2.A
v2.0.2024

Initial studies-Diagnosis, clinical changes, consideration of surgery

- Echocardiogram at time of diagnosis
  - CMR and/or MRA Chest, or CT Cardiac and/or CTA Chest at time of diagnosis if any issues with pulmonary veins or RV volume.
  - Cardiac Cath at time of diagnosis for hemodynamic data and issues not answered on other imaging
- Routine stress imaging or coronary artery imaging not required.
- Echo, CMR, CT, per cardiology request for clinical changes
  - Diagnostic heart catheterization if questions unanswered on imaging

Follow-up Anomalous Pulmonary Venous Connections

Modality	Physiological stage / intervals for routine imaging (months)			
Physiological stage	**A**	**B**	**C**	**D**
Echo (TTE)	36	24	12	12

Ventricular Septal Defect (VSD) (CD-11.2.3)

CD.CHD.0011.2.3.A
v2.0.2024

Initial studies-Diagnosis, clinical changes, consideration of surgery

- Echo (TTE) at time of diagnosis
  - CMR or CCT can be performed if questions are unanswered on echo
  - Catheterization at time of diagnosis for hemodynamics if pulmonary hypertension (PHT) or shunt size is a question

Long term follow-up VSD

Modality	Physiological stage / intervals for routine imaging (months)			
Physiological stage	**A**	**B**	**C**	**D**
Echo (TTE)	36	24	12	12

Atrioventricular Septal Defect (AV Canal, AVSD, endocardial cushion defect) (CD-11.2.4)

CD.CHD.0011.2.4.A
v2.0.2024

Initial studies-Diagnosis, clinical changes, consideration of surgery

- Echo (TTE) at time of diagnosis
  - CMR or CT Cardiac at time of diagnosis if there are unanswered questions on echo
  - Cardiac cath at time of diagnosis when CMR and TTE leave questions unanswered that affect individual management
- Stress imaging per **Stress Testing with Imaging – Indications (CD-1.4)**

Long term follow-up -AVSD

Modality	Physiological stage / intervals for routine imaging (months)			
Physiological stage	**A**	**B**	**C**	**D**
Echo (TTE)	24	24	12	12

Patent Ductus Arteriosus (PDA) (CD-11.2.5)

CD.CHD.0011.2.5.A
v2.0.2024

Initial studies-Diagnosis, clinical changes, consideration of surgery

- Echo at time of diagnosis
  - MR Chest or CT Chest if there are questions left unanswered by echo
  - Cardiac Cath for hemodynamics (if planned device closure, diagnostic cardiac cath is not indicated as it is included in the procedure code)
- Stress imaging per **Stress Testing with Imaging – Indications (CD-1.4)**

Long term follow-up PDA

Modality	Physiological stage / intervals for routine imaging (months)			
Physiological stage	**A**	**B**	**C**	**D**
Echo (TTE)	36	24	12	12

Cor Triatriatum (CD-11.2.6)

CD.CHD.0011.2.6.A
v2.0.2024

Initial studies-Diagnosis, clinical changes, consideration of surgery

- Echocardiogram (TTE) at time of diagnosis
  - CMR and/or MRA Chest or CT Cardiac and/or CTA Chest may be approved
  - Diagnostic cath may be approved if additional information is required for medical management

Long term follow-up

- Stress imaging per **Stress Testing with Imaging – Indications (CD-1.4)**

Congenital Mitral Stenosis (CD-11.2.7)

CD.CHD.0011.2.7.A
v2.0.2024

Initial studies-Diagnosis, clinical changes, consideration of surgery

- Echocardiogram (TTE) at time of diagnosis

Long term follow-up congenital mitral stenosis

Modality	Physiological stage / intervals for routine imaging (months)			
Physiological stage	**A**	**B**	**C**	**D**
Echo (TTE)	24	24	12	12

Subaortic Stenosis (SAS) (CD-11.2.8)

CD.CHD.0011.2.8.A

v2.0.2024

This section relates to subaortic stenosis caused by a discrete membrane or tunnel-like obstruction.

Initial imaging/diagnosis, clinical changes, consideration of surgery

Modality	Initial imaging/ diagnosis	Clinical changes	Consideration of surgery
Echo (TTE) (CPT® 93303 or 93304 or 93306 or 93308)	At time of diagnosis	For any clinical changes	If cardiac intervention is being considered
Stress echo or (CPT® 93351 or 93352) OR **Stress MRI (CPT® 75559 or 75563)**	Once at the time of diagnosis	• New or changed signs or symptoms of ischemia • Changes in cardiac function • Any signs or symptoms allowed in **Stress Testing with Imaging – Indications (CD-1.4)**	If cardiac intervention is being considered

Long term follow-up SAS

Modality	Physiological stage / intervals for routine imaging (months)			
Physiological stage	**A**	**B**	**C**	**D**
Echo (TTE)	24	24	12	12
Stress imaging		24	24	12

Congenital Valvular Aortic Stenosis (CD-11.2.9)

CD.CHD.0011.2.9.A
v2.0.2024

Initial studies-Diagnosis, clinical changes, consideration of surgery

- Echocardiogram (TTE) at time of diagnosis
- TEE may be required if TTE limited or equivocal
- MRA Chest or CTA Chest if one of the following:
  - Suspicion of Coarctation based on exam and echocardiogram
  - Proximal ascending aorta not well visualized on TTE

Routine follow-up Congenital Valvular Aortic Stenosis

Modality	Physiological stage / intervals for routine imaging			
Stage (valvular AS)	**Progressive (stage B) Mild Vmax 2.0-2.9 m/s**	**Progressive (stage B) Moderate Vmax 3.0-3.9 m/s**	**Severe (stage C) ≥4.0 m/s**	**Aortic root dilation >4.5 cm**
echo (TTE)	3 years	1 years	6 months	12 months
MRA Chest or CTA				if ascending allowed yearly

Degree of aortic stenosis (AS) severity			
	Mild AS	**Moderate AS**	**Severe AS**
Vmax (m/s)[a] **maximum Doppler velocity**	2.0-2.9	3.0-3.9	≥4.0
Mean gradient (mmHg)[a]	<30	30-49	≥50

Degree of aortic stenosis (AS) severity			
	Mild AS	**Moderate AS**	**Severe AS**
AVA (cm^2) **aortic valve area**	>1.5	1.0-1.5	<1.0
AVAi (cm^2/m^2 BSA) **indexed aortic valve area**	≥1.0	0.6-0.9	<0.6
[a]At normal transvalvular flow, BSA= body surface area			

Adapted from: ESC Guidelines for the management of grown-up congenital heart disease (new version 2010): The Task Force on the Management of Grown-up Congenital Heart Disease of the European Society of Cardiology (ESC).

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Aortic disease in Turner Syndrome (CD-11.2.10)

CD.CHD.0011.2.10.A
v2.0.2024

Dissection more common for a given aortic diameter. Mid-ascending aortic disease more common and my not be reliably seen on echocardiogram

Initial studies-Diagnosis, clinical changes, consideration of surgery

- Echocardiogram (TTE) at time of diagnosis
- MRA Chest or CTA Chest to rule out mid ascending aortic aneurysm if mid aorta was not seen on echocardiogram.

Surveillance

- Echocardiogram (TTE) yearly
  - MRA Chest or CTA if mid ascending aorta not visualized
- For documented thoracic aortic aneurysm (TAA) ≤ 4cm
  - Routine MRA Chest or CTA yearly
- For documented thoracic aortic aneurysm (TAA) # 4cm
  - MRA Chest or CTA every 6 months.

Supravalvular Aortic Stenosis (CD-11.3.1)

CD.CHD.0011.3.1.A
v2.0.2024

Supravalvular aortic stenosis is a relatively rare condition overall but is seen commonly in individuals with Williams syndrome or homozygous familial hypercholesterolemia.

Initial studies-Diagnosis, clinical changes, consideration of surgery

- Echocardiogram (TTE) at time of diagnosis
- MRA Chest or CTA Chest
- Cardiac MRI or CTA Cardiac to assess coronary ostea
- Cardiac cath for any individuals pre-cardiac intervention for coronary arteries
- New cardiac symptoms-any of the following:
  - CT Cardiac or cardiac MR
  - CTA Chest or MRA Chest
  - Stress imaging as per **Stress Testing with Imaging – Indications (CD-1.4)**

Routine follow-up supravalvular AS

Modality	Physiological stage / intervals for routine imaging (months)			
Physiological stage	**A**	**B**	**C**	**D**
TTE	24	24	12	12
CMR or CCT	36	36	36	36

Coarctation of the Aorta (CD-11.3.2)

CD.CHD.0011.3.2.A
v2.0.2024

Coarctation is suspected based on clinical findings:
- BP higher in upper extremities than in the lower extremities
- Absent femoral pulses
- Continuous murmur
- Abdominal bruit
- Berry aneurysm with hemorrhage
- Rib notching on x-ray
- Abnormal thoracic aortic imaging and blood pressures

Initial studies-Diagnosis, clinical changes, consideration of surgery
- Echocardiogram (TTE) at time of diagnosis
  - No further imaging is required if echocardiogram (TTE), blood pressure, and exam rule out Coarctation.
  - If echo and exam are equivocal or positive one of the following is indicated:
    - CTA Chest
    - MRA Chest
  - Individuals with Coarctation of the aorta do not require intra-cardiac MRI unless issue cannot be resolved on echocardiogram.
  - Screening for intracranial aneurysm by MRA or CTA of head is allowed
- ETT for diagnosis of exercise induced hypertension does not require imaging
- Cardiac MRI not required unless issues unresolved by echo for intracardiac anatomy
- Diagnostic cath can be approved prior to stenting of the coarctation
- Stress imaging, TEE, Cardiac MRI or CT, Coronary imaging not routine

Symptomatic
- Individuals with Coarctation are at risk for dissection. When individual has new or worsening symptoms any of the following:
  - Echocardiogram (TTE)
  - MRA Chest or CTA.
- For exertional symptoms, one of the following:
  - Stress imaging-per **Stress Testing with Imaging – Indications (CD-1.4)**
  - Cardiac MRI or CT Cardiac

Routine follow-up Coarctation of the Aorta

Modality	Physiological stage / intervals for routine imaging (months)			
Physiological stage	**A**	**B**	**C**	**D**
TTE	24	24	12	12
MRA Chest or CTA Chest	36	36	12	12

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Valvular Pulmonary Stenosis (CD-11.3.3)

CD.CHD.0011.3.3.A
v2.0.2024

Overview Initial studies-Diagnosis, clinical changes, consideration of surgery

- Echocardiogram (TTE) at time of diagnosis
- For issues affecting management not well visualized on TTE
  - Cardiac MRI or CT Cardiac
  - MRA Chest or CTA Chest

Valvular PS routine follow-up and testing.

- Echocardiogram-stages
  - Mild PS – peak gradient <36 mmHg (peak velocity < 3m/s)
  - Moderate PS- peak gradient 36-64 mmHg (peak velocity 3-4 m/s)
  - Severe PS- peak gradient >64 mmHg (peak velocity > 4 m/s); or mean gradient >35 mmHg.
- Routine stress imaging is not required
- Routine chest or cardiac or ischemia workup not required.

Valvular PS routine imaging

Modality	Physiological stage / intervals for routine imaging (months)			
Physiological stage	**A**	**B**	**C**	**D**
TTE	36	24	12	12

Isolated Pulmonary regurgitation after PS repair-Echo and CMR at same interval as TOF

Modality	Physiological stage / intervals for routine imaging (months)			
Physiological stage	**A**	**B**	**C**	**D**
TTE	24	12	12	12

Modality	Physiological stage / intervals for routine imaging (months)			
Physiological stage	**A**	**B**	**C**	**D**
CMR	36	24	12	12

Branch and Peripheral pulmonary stenosis (CD-11.3.4)

CD.CHD.0011.3.4.A
v2.0.2024

Overview
- Can be seen in newborns as a normal variant in the first 6 months of life
- Can be seen in surgeries of right ventricular outflow (TOF)
  - Noonan
  - Alagille
  - Williams
  - Maternal rubella exposure
  - Keutel syndrome

Initial studies-Diagnosis, clinical changes, consideration of surgery
- Echocardiogram (TTE) at time of diagnosis
- Baseline MRA Chest or CTA Chest
- Cath may be considered if other advanced imaging is not adequate for management
- VQ scan or MRA Chest for differential blood flow

Routine follow-up branch and peripheral pulmonary stenosis

Modality	Physiological stage / intervals for routine imaging (months)			
Physiological stage	**A**	**B**	**C**	**D**
TTE	24	24	12	12
Cardiac MRI or CT Cardiac	36	36	24	24
MRA Chest or CTA Chest	36	36	24	24

Double chambered RV (CD-11.3.5)

CD.CHD.0011.3.5.A
v2.0.2024

Initial studies-Diagnosis, clinical changes, consideration of surgery

- Echocardiogram (TTE) at time of diagnosis

Routine follow-up double chambered right ventricle (RV)

Modality	Physiological stage / intervals for routine imaging (months)			
Physiological stage	**A**	**B**	**C**	**D**
Echo (TTE)	24	24	12	12

Ebstein Anomaly (CD-11.3.6)

CD.CHD.0011.3.6.A
v2.0.2024

Overview Initial studies-Diagnosis, clinical changes, consideration of surgery

- Echocardiogram (TTE) at time of diagnosis
- TEE if either:
  - TTE is not adequate
  - If surgery/intervention planned
- Cardiac MRI or CT Cardiac at time of Diagnosis

Routine follow-up Ebstein Anomaly

Modality	Physiological stage / intervals for routine imaging (months)			
Physiological stage	**A**	**B**	**C**	**D**
Echo (TTE)	12	12	12	12
Cardiac MRI or CT Cardiac	60	36	24	12

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Tetralogy of Fallot (TOF, VSD with PS) (CD-11.3.7)

CD.CHD.0011.3.7.A
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Includes TOF with pulmonary atresia, VSD PA

Initial studies-Diagnosis, clinical changes, consideration of surgery
- Echocardiogram (TTE) at time of diagnosis
- Cardiac MR or CTA Cardiac at time of diagnosis
- MRA Chest or CTA Chest at time of diagnosis
- Cardiac catheterization if other advanced imaging leaves unanswered questions

Prior to cardiac intervention or surgery
- Repeat imaging Echo/MR/CT
- Cath prior to surgery or intervention
  - If planned Catheter Pulmonary Valve replacement, procedure includes diagnostic cath and hemodynamics and diagnostic cath is not billed separately

New or worsening symptoms
- Repeat advanced imaging
  - New or worsening symptoms
  - New EKG changes
- Stress imaging (stress echo, stress MRI, or MPI) allowed for typical chest pain, even if intermediate pretest probability at atypical symptoms in individuals with known or undefined coronary artery (CA) anatomy or CA pathology
- VQ scan or MRA chest for left/right perfusion abnormality

Routine Follow-up Tetralogy of Fallot (TOF)

Modality	Physiological stage / intervals for routine imaging (months)			
Physiological stage	**A**	**B**	**C**	**D**
TTE	24	12	12	12

Modality	Physiological stage / intervals for routine imaging (months)			
Physiological stage	**A**	**B**	**C**	**D**
Cardiac MRI or CCTA	36	24	12	12
CTA Chest or MRA	36	24	12	12

Right Ventricle-to-Pulmonary Artery Conduit (CD-11.3.8)

CD.CHD.0011.3.8.A
v2.0.2024

Initial studies-Diagnosis, clinical changes, consideration of surgery. Surgical repair for many lesions such as TOF/ Truncus /Pulmonary atresia

- Echocardiogram (TTE) at time of diagnosis
- Cardiac MRI or CTA Cardiac
- MRA Chest or CTA Chest
- Prior to interventions or surgery may repeat any of the above imaging
- Cath allowed for new symptoms or with new imaging findings as needed for management
- Stress imaging (stress echo, stress MRI or MPI) as requested for symptoms

Routine follow-up Right Ventricle–to-Pulmonary Artery Conduit

Modality	Physiological stage / intervals for routine imaging (months)			
Physiological stage	**A**	**B**	**C**	**D**
TTE	12	12	12	12
CMR or CCTA	36	36	12	12
MRA Chest or CTA Chest	36	36	12	12

Transposition of the great arteries (TGA) (CD-11.3.9)

CD.CHD.0011.3.9.A
v2.0.2024

Initial studies-Diagnosis, clinical changes, consideration of surgery

- Echocardiogram (TTE) at time of diagnosis
- Baseline Cardiac MRI or CCTA
- Baseline MRA Chest or CTA
- Stress imaging as requested for symptoms or signs of ischemia
- V/Q scan for left to right PA perfusion or MRA Chest
- Symptomatic individuals should be offered stress physiological imaging and repeat anatomic imaging considered if symptoms are suggestive of coronary ischemia (regardless of diamond forester pretest probability category)
- Cath right and left heart when issues not elucidated on advanced imaging

Routine follow-up TGA

Modality	Physiological stage / intervals for routine imaging (months)			
Physiological stage	**A**	**B**	**C**	**D**
TTE	12	12	12	12
CMR or CCTA	36	24	12	12
MRA Chest or CTA Chest	36	24	12	12

Congenitally corrected TGA (CD-11.3.10)

CD.CHD.0011.3.10.A
v2.0.2024

Initial studies-Diagnosis, clinical changes, consideration of surgery

- Echocardiogram (TTE) at time of diagnosis
- Baseline CMR and MRA Chest
- CMR and/or Echo for changes in clinical status

Routine follow-up congenitally corrected TGA

Modality	Physiological stage / intervals for routine imaging (months)			
Physiological stage	**A**	**B**	**C**	**D**
Echo (TTE)	12	12	12	12
CMR or CCTA	36	36	12	12
CTA Chest or MRA Chest	36	36	12	12

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Fontan Palliation of Single Ventricle Physiology (CD-11.3.11)

CD.CHD.0011.3.11.A
v2.0.2024

Including Tricuspid Atresia and Double Inlet Left Ventricle, HLHS, HRHS, PA, Mitral atresia, AVC unbalanced, single ventricle, DIRV, pulmonary atresia, HLHS, Glen procedure, TA, double outlet right ventricle (DORV), and single ventricle physiology

Initial studies-Diagnosis, clinical changes, consideration of surgery

- Echocardiogram (TTE) at time of diagnosis and with any new Symptoms
- CMR or CCTA can be done annually (vs. based on below chart) on individuals who have prior issues that were equivocal on echo, and the data is required (i.e. very poor windows)
  - Cardiac catheterization prior to surgical interventions
- Echo/CMR or CCTA/MRA Chest or CTA Chest/cath with any new signs or symptoms
- V/Q scan or MRA for lung perfusion left vs. right

Routine follow-up Fontan Palliation of Single Ventricle Physiology

Modality	Physiological stage / intervals for routine imaging (months)			
Physiological stage	**A**	**B**	**C**	**D**
Echo (TTE)	12	12	12	12
CMR or CT Cardiac	36	24	24	24
CTA Chest or MRA	36	24	24	24
Cardiac catheterization	120 (10 years)	120 (10 years)	120 (10 years)	120 (10 years)

Severe Pulmonary artery hypertension (PHT) and Eisenmenger syndrome (CD-11.3.12)

CD.CHD.0011.3.12.A
v2.0.2024

Initial studies-Diagnosis, clinical changes, consideration of surgery

- Echo (TTE)
  - Initial diagnosis
  - With new signs or symptoms
- Cardiac cath
  - Echo (TTE) results suggest PHT
  - New signs or symptoms with PHT

Long term follow-up Severe Pulmonary artery hypertension (PHT) and Eisenmenger syndrome

Modality	Physiological stage / intervals for routine imaging (months)			
Physiological stage	**A**	**B**	**C**	**D**
TTE			6	6
CMR or CCT			As needed	As needed
MRA Chest or CTA Chest			As needed	As needed
Cath			As needed	As needed

Coronary artery anomalies (CD-11.3.13)

CD.CHD.0011.3.13.A
v2.0.2024

Initial studies-Diagnosis, clinical changes, consideration of surgery

- Echocardiogram (TTE)
  - At baseline
  - Any signs or symptoms
- Coronary CT/MR/Cath for initial evaluation
- Coronary artery from wrong sinus-baseline stress imaging regardless of symptoms
- Stress imaging for any cardiac signs or symptoms
- For Kawasaki GL regarding echo, Stress imaging, coronary imaging, see pediatric GL **Kawasaki Disease (PEDCD-6)**

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Pregnancy - Maternal Imaging (CD-11.4)

CD.DHC.0011.4.A
v2.0.2024

- Overview
  - World Health Organization (WHO) classification:
    - WHO classification I: no detectable increased risk of maternal mortality and no/mild increase in morbidity.
      - Uncomplicated small or mild pulmonary stenosis
      - Patent Ductus Arteriosus (PDA)
      - Mitral valve prolapse
      - Successfully repaired simple lesions (atrial or ventricular septal defect, patent ductus arteriosus, anomalous pulmonary venous connection)
    - WHO classification II: small increase in maternal risk mortality or moderate increase in morbidity.
      - Unrepaired atrial or ventricular septal defect
      - Repaired tetralogy of Fallot
    - WHO classification II-III (depending on individual)
      - Mild left ventricular impairment
      - Native or tissue valvular heart disease not considered WHO I or IV
      - Marfan syndrome without aortic dilation
      - Aorta <45 mm in association with bicuspid aortic valve disease
      - Repaired coarctation
    - WHO classification III: significantly increased risk of maternal mortality or severe morbidity. Expert counseling required. If pregnancy is decided upon, intensive specialist cardiac and obstetric monitoring needed throughout pregnancy, childbirth and the puerperium.
      - Mechanical valve
      - Systemic right ventricle
      - Fontan circulation
      - Unrepaired cyanotic heart disease
      - Other complex congenital heart disease
      - Aortic dilation 40-45 mm in Marfan syndrome
      - Aortic dilation 45-50 mm in bicuspid aortic valve disease
    - WHO classification IV: extremely high risk of maternal mortality or severe morbidity; pregnancy contraindicated. If pregnancy occurs, termination should be discussed. If pregnancy continues, care as for WHO class III.
      - Pulmonary arterial hypertension from any cause

- Severe systemic ventricular dysfunction (LVEF <30%, NYHA functional class III-IV)
- Severe mitral stenosis; severe symptomatic aortic stenosis
- Marfan syndrome with aorta dilated >45 mm
- Aortic dilation >50 mm in aortic disease associated with bicuspid aortic valve
- Native severe coarctation of the aorta

Adapted from: Elkayam U, Goland S, Pieper PG, Silversides CK. High-Risk Cardiac Disease in Pregnancy. Journal of the American College of Cardiology.

- Congenital heart disease imaging in pregnancy
  - Echocardiogram (TTE) when planning pregnancy
  - TEE if TTE equivocal
  - CMR can be performed prior to planning pregnancy in those lesions where CMR would be routinely performed at some later date
  - CTA Chest or MRA Chest of arch if known disease with aortic involvement or if known dilation
  - Repeat echocardiogram and MR (can be without gad) can be performed based on the WHO classification II, III, IV, or other risk factors
  - Severe complex CHD TTE (93306)
    - Every 2-4 weeks for major physiological changes
    - As often as needed for any of the following:
      - Pulmonary hypertension
      - Changes in function
      - To guide delivery after 24 weeks
  - Echo can be performed if new signs or symptoms during pregnancy
  - Postpartum first year can have more frequent imaging
  - Stress imaging pre/during pregnancy for individuals with known coronary artery anomaly, pulmonary hypertension, LVOT obstruction, cardiac dysfunction, single ventricle.
  - WHO II, III, IV, can have echo/MR/CT/stress imaging prior to pregnancy
  - WHO I- one echocardiogram during pregnancy
  - WHO II- one echocardiogram per trimester during pregnancy
  - WHO II/III- echocardiogram every 2 months during pregnancy
  - WHO III/IV- echocardiogram monthly during pregnancy
    - Individuals may require more (even weekly) if treatment decision, delivery is considered.
- Syndromes that allow cardiac imaging at the time of diagnosis if not previously done. This list is not exhaustive
  - DiGeorge/velocardiofacial (22q11.2)

  - Down syndrome (trisomy 21)
  - Holt Oram (TBX5)
  - Klinefelter syndrome (47 XXY)
  - Noonan (PTPN11, KRAS, SOS1 RAF1, NRAS, BRAF, MAP2K1)
  - Turner (45X)
  - Williams (7q11.23 deletion)
  - Any syndrome associated with congenital heart disease.
- Echocardiogram at time of Diagnosis (either genetic testing or clinical features)
- CMR or CCTA if arch involved in disease.
- See **Maternal Imaging in Cardiovascular Disease (CD-15)**

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Maternal Imaging in Cardiovascular Disease

Guideline

Diagnostic Cardiovascular Imaging Pre-Pregnancy to Post-Partum (CD-15.1)
Maternal imaging in cardiovascular disease (CD-15.2)
Maternal Imaging in Individuals with Aortopathy (CD-15.3)
Imaging in Pregnancy with Congenital Heart Disease (CHD) (CD-15.4)

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Diagnostic Cardiovascular Imaging Pre-Pregnancy to Post-Partum (CD-15.1)

CD.MI.0015.1.A
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Maternal imaging in cardiovascular disease

Ultrasound and magnetic resonance are the preferred imaging modalities to minimize radiation exposure in pregnancy. When imaging using ionizing radiation is necessary, radiation exposure should follow the ALARA principle (As Low As Reasonably Achievable). Shared decision making regarding diagnostic testing should occur in consultation with the individual, cardiologist, and obstetrical team when weighing the risk of fetal exposure to radiation against the need to diagnose or plan treatment for serious illness.

Peripartum Red Flag Signs and Symptoms

Imaging as requested, as listed within **Imaging Modalities in Maternal Imaging** (Echocardiogram, Exercise stress echo, Coronary angiography, Cardiac MRI), is indicated for peripartum individuals for any of the following **red flag** signs or symptoms:

- Chest pain
- Dyspnea
- Orthopnea
- Cough
- Lower extremity edema when there is a concern for heart disease
- Tachycardia
- Unheralded syncope
- Headache
- Acute visual changes
- New onset hypotension
- Hypertension

Imaging Modalities in Maternal Imaging

Transthoracic echocardiography (TTE)

- TTE (CPT® 93306) is the primary cardiac imaging modality in pregnancy. Baseline and surveillance echocardiography is indicated for several conditions as noted in **Maternal imaging in cardiovascular disease (CD-15.2)** Table 1.
- A repeat echocardiogram is indicated when there are new or worsening cardiovascular signs or symptoms, as described in **Peripartum Red Flags**, **Transthoracic Echocardiography (TTE)– Indications/initial evaluation (CD-2.2)** and **Frequency of EchocardiographyTesting (CD-2.3)**, during and after pregnancy.

Exercise Stress Echo

- Exercise stress echo (CPT® 93350, 93351) is indicated pre-conception to assist with risk stratification in individuals with a documented history of **any** of the following:
  - Current left ventricular dysfunction
  - Previous history of left ventricular dysfunction
  - Valvular heart disease of any severity
  - There is a concern for myocardial reserve
- See Stress echocardiogram in **Stress Testing with Imaging – Indications (CD-1.4)** and **Stress echo–indications other than ruling out CAD (CD-2.7)**
- See **Hypertrophic Cardiomyopathy (CD-14)**

Coronary Angiography

- Fetal risk from ionizing radiation is highest before 20 weeks gestational age. When coronary angiography is medically necessary, the ALARA principle should be followed. Invasive management of acute coronary syndrome is associated with lower in-hospital mortality and should be considered. See **Diagnostic Heart Catheterization**

Cardiac MRI

- Cardiac MRI (CPT® 75557) is utilized in pregnant individuals to measure aortic dimensions, wall motion and ventricular function when the echocardiogram is non-diagnostic. Gadolinium-based contrast agents are not necessary in aortic imaging or most other indications in pregnancy. See **Cardiac MRI**.

Background and Supporting Information

- Cardiovascular disease (CVD) in pregnancy has become increasingly prevalent in recent years.
- The increase in plasma volume during pregnancy requires significant physiological adaptation.
- Maternal mortality has increased in the last two decades with CVD accounting for 33% of all deaths.

- Invasive management of myocardial infarction (MI) is associated with lower in-hospital mortality.
- Research has underrepresented females of childbearing age leading to significant deficits in our knowledge of cardiovascular care of these individuals.
- **Cardiac Imaging using ionizing radiation**
  - Multiple imaging modalities expose the pregnant individual and fetus to ionizing radiation.
  - This exposure causes concern for an elevated risk of childhood cancer.
  - Shared decision-making should be employed when weighing the fetal exposure to radiation against the need to diagnose serious illness

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Maternal imaging in cardiovascular disease (CD-15.2)

CD.MI.0015.2.A
v2.0.2024

Table 1: Suggested frequency of echo monitoring during pregnancy

Cardiovascular disease	Monitoring frequency
Hypertensive disorders of pregnancy (BP ≥130/90)	• An echocardiogram (TTE) (CPT® 93303, 93304, 93306, 93307, 93308) is indicated once during pregnancy in all hypertensive disorders of pregnancy. • A repeat TTE is indicated when there are new or worsening cardiovascular signs or symptoms
Valvular disorders/Native and Prosthetic	• One TTE is indicated during the first trimester (weeks 1-12 of pregnancy) for individuals with known or suspected valvular heart disease. • A repeat TTE is indicated when there are new or worsening cardiovascular signs or symptoms
Severe Aortic stenosis (AS)	• A repeat TTE is indicated every 1-2 months or when there are new or worsening cardiovascular signs or symptoms
Mitral stenosis (MS)	• TTE is indicated each trimester (12 weeks) and prior to delivery in individuals with mild MS. • TTE is indicated every 1–2 months in individuals with moderate to severe MS. • A repeat TTE is indicated when there are new or worsening cardiovascular signs or symptoms
Dilated cardiomyopathy	• TTE is indicated during each trimester (12 weeks) • A repeat TTE is indicated when there are new or worsening cardiovascular signs or symptoms
Hypertrophic cardiomyopathy	• TTE is indicated in **asymptomatic** individuals each trimester • TTE is indicated in **symptomatic** individuals every 1-2 months. • A repeat TTE is indicated when there are new or worsening cardiovascular signs or symptoms

Cardiovascular disease	Monitoring frequency
Peripartum cardiomyopathy	TTE is indicated in individuals with signs and symptoms of heart failure. • A repeat TTE is indicated when there are new or worsening cardiovascular signs or symptoms • TTE is indicated in subsequent pregnancies: ◦ At the time of the first prenatal visit ◦ At the end of the first and second trimesters ◦ One month prior to delivery ◦ After delivery prior to discharge ◦ One month postpartum ◦ At any time when there are worsening signs or symptoms of heart failure • Cabergoline
Pulmonary hypertension	• TTE is indicated in individuals with signs and symptoms of pulmonary hypertension • A repeat TTE is indicated at the discretion of the health care provider.

1. O'Kelly AC, Sharma G, Vaught AJ, Zakaria S. The Use of Echocardiography and Advanced Cardiac Ultrasonography During Pregnancy. *Curr Treat Options Cardiovasc Med*. 2019;21(11):71. Published 2019 Nov 21. doi:10.1007/s11936-019-0785-5.
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Maternal Imaging in Individuals with Aortopathy (CD-15.3)

CD.MI.0015.3.A
v2.0.2024

Pre-pregnancy imaging

Individuals at risk for aortic aneurysms (Table 15-3-1) should be evaluated with echocardiogram (TTE) **and** Computed Tomography (CT)/ Magnetic Resonance Imaging (MRI) of the Chest/Abdomen/Pelvis (**Table 15-3-2**) within 1 year prior to conception to evaluate for aortic valve disease and aortic dimensions.

Table 15-3-1

Individuals at risk for aortic aneurysm, aortic dissection, limb-threatening ischemia
Bicuspid Aortic Valve
Turner Syndrome
Coarctation of the Aorta
Marfan Syndrome
Type IV Ehlers-Danlos
Loeys-Dietz
Familial Thoracic Aortic Disease and Aortic Dissection (defined as first-degree relative with history of aortic dissection or thoracic aortic aneurysm or two second-degree relatives with history of aortic dissection or thoracic aortic aneurysm)

Table 15-3-2

Imaging for Aortic conditions	CPT®
CT Chest and/or Abdomen and/or Pelvis	71260 74177 74160 72193

Imaging for Aortic conditions	CPT®
CTA Chest and/or Abdomen and/or Pelvis	71275 74175 72191 74174
MRA Chest and/or Abdomen and/or Pelvis	71555 74185 72198
Transthoracic Echocardiogram (TTE)	93303 93304 93306 93307 93308
Transesophageal Echocardiogram (TEE)	93312 93313 93314 93315 93316 93317
Doppler echocardiography- is indicated as add-on codes for TEE	+93320 +93321 +93325

Surveillance imaging during pregnancy and postpartum

Follow-up imaging with Echocardiogram (TTE) and CTA/MRA. TEE can be substituted if TTE is equivocal.

Suggested Frequency of Aortic Imaging during pregnancy and postpartum in individuals known to be high-risk for aortic aneurysm

Table 15-3-3

Condition	WHO Class	Imaging frequency	Postpartum (up to 42 days after birth)
Turner Syndrome	• II-III: Aortic root <20mm/m^2 with associated risk factors or <25 mm/m without associated risk factors	• Once during pregnancy if normal aortic dimension, or every two months if repaired coarctation	• Once during the postpartum period
	• IV: Aortic root ≥20mm/m2 with associated risk factors or ≥25 mm/m without associated risk factors	• Every 6 weeks if aorta diameter dilated >30mm	• Once during the postpartum period
	• Any patient with Turner who has severe coarctation	• At discretion of provider	• Once during the postpartum period
Marfan Syndrome	• III: Aortic root <45mm, mod-severe Aortic Insufficiency	• Every trimester if <40mm	• Once during the postpartum period
	• IV: Aortic root ≥45mm, history of dissection	• Every 6 weeks if aorta is ≥40mm	• Once during the postpartum period
Vascular Ehlers-Danlos	• Type IV	• Every 6 weeks	• Once during the postpartum period
Loeys-Dietz	• III: Aortic diameter <40mm	• Every 6 weeks	• Once during the postpartum period
	• IV: Aortic diameter ≥40mm	• Every 6 weeks	• Once during the postpartum period

Condition	WHO Class	Imaging frequency	Postpartum (up to 42 days after birth)
Familial thoracic aortic aneurysms and dissections	• III: Aortic diameter <40mm	• Every trimester if <40mm aortic diameter	• Once during the postpartum period
	• IV: Aortic diameter ≥40mm	• Every 6 weeks if ≥40mm aortic diameter	• Once during the postpartum period

Background and supporting information

First-degree relative (sibling, parent, child).

Second-degree relative (aunt/uncles, grandparent, niece, nephew, cousin, or half-sibling of an individual)

1. Lindley KJ, Bairey Merz CN, Asgar AW, et al. Management of Women With Congenital or Inherited Cardiovascular Disease From Pre-Conception Through Pregnancy and Postpartum: JACC Focus Seminar 2/5. *J Am Coll Cardiol*. 2021;77(14):1778-1798. doi:10.1016/j.jacc.2021.02.026.

Imaging in Pregnancy with Congenital Heart Disease (CHD) (CD-15.4)

CD.MI.0015.4.A
v2.0.2024

Pre-pregnancy imaging based on the World Health Organization (WHO) chart for imaging in pregnancy with CHD

Imaging modality and indication	CPT®
Echo (TTE) when planning pregnancy	93306
TEE if TTE equivocal	93312
CMR (cardiac MRI) can be performed prior to pregnancy in those lesions were CMR would be routinely performed at some later date	75557
CTA or MRA of chest if known aortic disease, Pulmonary artery disease, anomalous pulmonary veins, anomalous systemic veins. (also see peripartum aortopathy table.)	71275, 71555
Echo with new signs or symptoms	93303, 93304, 93306, 93308
Postpartum imaging per provider requested frequency	imaging as noted above
Stress imaging pre/during pregnancy when known Coronary artery anomaly, pulmonary hypertension, LVOT obstruction, cardiac dysfunction, single	93350, 93351, 93320, 93325
WHO II, III, IV, can have echo/MR/CT/stress imaging prior to pregnancy	imaging as noted above

Surveillance Imaging

Surveillance imaging after baseline studies.

TTE frequency after initial imaging, (Individuals who also have aortopathy can have Chest MRA in addition to echo at same frequency.) Individuals with known poor/ inadequate imaging on echo, can have CMR in lieu of echocardiogram.

The World Health Organization modified classification of maternal cardiovascular risk

The World Health Organization established a modified classification of maternal cardiovascular risk used as a tool to evaluate risk status for pregnant individuals with various cardiovascular conditions. See **Pregnancy-Maternal Imaging (CD-11.4)**

Class	Risk	Sample Lesions
WHO Class I	No detectable increased risk of maternal mortality and no or mild increase in morbidity.	• Mild Pulmonary stenosis • Small PDA • Mild MVP • Successfully repaired simple lesions (ASD, VSD, PDA, anomalous pulmonary venous drainage) • Isolated PACs or PVCs
WHO Class II	Small increased risk of maternal mortality or moderate increase in morbidity.	• Un-operated ASD or VSD • Repaired TOF (uncomplicated) • Most arrhythmias
WHO Class II-III	Intermediate increased risk of maternal mortality or moderate to severe increase in morbidity.	• Mild left ventricular impairment • Hypertrophic cardiomyopathy • Native or tissue valvular heart disease not considered WHO I or IV • Aorta <45 mm in aortic disease associated with bicuspid aortic valve • Repaired coarctation
WHO Class III	Significantly increased risk of maternal mortality or severe morbidity. • Expert counseling required. • If pregnancy is decided upon, intensive specialist cardiac and obstetric monitoring needed throughout pregnancy, childbirth and the postpartum period.	• Mechanical valve • Systemic right ventricle • Fontan circulation • Unrepaired cyanotic heart disease • Other complex congenital heart disease

Class	Risk	Sample Lesions
WHO Class IV	Extremely high-risk of maternal mortality or severe morbidity. • Pregnancy contraindicated. • If pregnancy occurs, termination should be discussed. • If pregnancy continues, care as for WHO class III.	• Pulmonary arterial hypertension from any cause • Severe systemic ventricular dysfunction (LVEF <30%, NYHA functional class III-IV) • Severe mitral stenosis; severe symptomatic aortic stenosis • Aortic dilation ≥50 mm in aortic disease associated with bicuspid aortic valve • Native severe coarctation of the aorta

1. Steiner JM, Lokken E, Bayley E, et al. Cardiac and Pregnancy Outcomes of Pregnant Patients With Congenital Heart Disease According to Risk Classification System. Am J Cardiol. 2021;161:95-101. doi:10.1016/j.amjcard.2021.08.037.
2. Canobbio MM, Warnes CA, Aboulhosn J, et al. Management of Pregnancy in Patients With Complex Congenital Heart Disease: A Scientific Statement for Healthcare Professionals From the American Heart Association. Circulation. 2017;135(8):e50-e87. doi:10.1161/CIR.0000000000000458.

Condition Specific Imaging

Guideline

Cardiotoxic Agent-Related Cardiac Dysfunction (CD-12)

CD.CS.0012.A
v2.0.2024

Cardiotoxic agent/Cancer Therapeutics-Related Cardiac Dysfunction (CD-12.1)

Transthoracic Echocardiogram (TTE)

Transthoracic Echocardiogram (TTE) is indicated to determine Left Ventricular (LV) function in individuals on cardiotoxic chemotherapeutic drugs

- 3D echocardiography CPT® 93319 is indicated in addition to the primary TTE and is the preferred echocardiography modality for the assessment of left ventricular ejection fraction (LVEF) and cardiac volumes. See **3D Echocardiography (CD 2.9)**
- Myocardial strain imaging (CPT® 93356) to obtain a Global Longitudinal Strain (GLS) is indicated as an important adjunct in screening for CTRCD. See **Myocardial Strain Imaging (CD 12.2)**

Multimodality imaging

- Guidelines support using echocardiography rather than MUGA for the determination of LVEF and/or wall motion EXCEPT in one of the circumstances described previously in **MUGA Study – Cardiac Indications (CD-3.4)**. (see **Background and supporting information** below).
- CT coronary calcium scoring (CPT® 75571) is indicated every 5 years to screen for radiation induced coronary artery disease, unless previous coronary calcium score is >0 in cancer survivors who have received chest radiation therapy.
- Cardiac MRI (CMR) is indicated in the evaluation of CTRCD for the following:
  - TTE is not diagnostic
  - Tissue characterization for cardiomyopathy or myocarditis, particularly when Immune Checkpoint Inhibitor Myocarditis is being questioned.
  - See also **Cardiac MRI and MRA Chest – Indications (CD 5.2)**.

Frequency of CTRCD screening

- Baseline
  - All patients can have a baseline TTE prior to initiation of cardiotoxic agents
- During treatment with cardiotoxic agents

- The frequency of monitoring depends on the agent administered and the patient's baseline cardiovascular toxicity risk. (See **Background and Supporting Information** below)

- Post treatment with cardiotoxic agents surveillance
  - One TTE is indicated 3 to 12 months after completion of therapy
- Adult cancer survivors
  - Long term surveillance TTE is indicated every 5 years, except in those with low risk
  - Additional surveillance TTE, at 1 and 3 years after cancer therapy completion is indicated in those deemed to be high risk for CTRCD
- Adult survivors of childhood and adolescent cancer
  - Surveillance TTE is indicated every 2 years for survivors with indeterminate risk due to unknown cancer therapy history
  - Surveillance TTE is indicated every 2 years for high risk survivors, defined as a history of any of the following:
    - Radiation dose ≥30 Gy
    - Anthracycline dose of <100 mg/m^2 and radiation dose ≥15 Gy
    - Anthracycline dose ≥250 mg/m^2
  - Surveillance TTE is indicated every 5 years for moderate risk survivors, defined as a history of any of the following:
    - Radiation dose ≥15 to <30 Gy
    - Anthracycline dose of < 250 mg/m^2 and radiation dose <15 Gy
  - No screening is indicated in low risk survivors, defined as a history of any of the following:
    - Anthracycline dose of >0 to <100 mg/m^2
    - Radiation dose >0 to <15 Gy
- TTE is indicated for cancer survivors with a history of chest radiotherapy or anthracycline exposure who are pregnant or planning to become pregnant as follows:
  - Baseline exam
  - 12 weeks of pregnancy if missed the baseline TTE or in high risk survivors
  - 20 weeks of pregnancy for high risk survivors
  - TTE can be repeated for any symptoms at any other time as needed during or immediately following pregnancy
- Adults who received anthracyclines in childhood see **Cardiotoxicity and Echocardiography (PEDONC-19.2)**

Background and supporting information

- High value screening protocol to detect CTRCD using TTE (CPT® 93306 or 93308) is contingent upon careful baseline cardiotoxicity risk assessment and stratification into low, moderate and high risk. Currently, there is no universally accepted risk score, documentation of risk by the provider is sufficient to guide screening strategy.
- Advantages of Echocardiography in comparison to MUGA in individuals on cardiotoxic chemotherapy:
  - No ionizing radiation
  - No IV access required when echo contrast is not used
  - Allows view of the pericardium to look for effusion
  - Allows estimate of pulmonary pressure
  - May allow visualization of a clot or tumor in the Inferior Vena Cava (IVC) and/or the right heart

Myocardial Strain Imaging (CD-12.2)

- Myocardial strain imaging (CPT® 93356) in addition to the primary echocardiogram in individuals receiving therapy with cardiotoxic agents for ANY of the following:
  - Initial evaluation-prior to treatment with EITHER:
    - Medications that could result in cardiotoxicity/heart failure
    - Radiation that could result in cardiotoxicity/heart failure
  - Re-evaluation of an individual previously or currently undergoing therapy as per echocardiogram parameters. See **Cardiotoxic agent/Cancer Therapeutics-Related Cardiac Dysfunction (CD-12.1)**
  - Re-evaluation of an individual undergoing therapy with worsening symptoms

Mavacamten for Obstructive Hypertrophic Cardiomyopathy (HCM) (CD-12.3)

Echocardiogram (CPT® 93306) is indicated for individuals treated with mavacamten for class II-III obstructive HCM as follows:

Initiation of treatment

- Baseline-at the beginning of treatment
- 4 weeks after treatment initiation
- 8 weeks after treatment initiation
- 12 weeks after treatment initiation
- Then every 12 weeks while on mavacamten

Changes in treatment

- 4 weeks after any interruption of treatment (any missed dose)
- After any dosage change (including restart of treatment):
  - 4 weeks after dosage change
  - 12 weeks after dosage change
- After initiating a weak CYP2C19 inhibitor (e.g., omeprazole) or moderate CYP3A4 inhibitor (e.g., ciprofloxacin):
  - 4 weeks after start of medication
  - 12 weeks after start of medication
- At any time regardless of timing of prior echo when there are new cardiac signs or symptoms, or worsening of clinical status

See also **Hypertrophic Cardiomyopathy (HCM) (CD-14)**

Background and supporting information

Hypertrophic Cardiomyopathy (HCM) is a clinical diagnosis, established by imaging with 2D echocardiography or cardiovascular magnetic resonance (CMR) showing a maximal end-diastolic wall thickness of ≥ 15 mm anywhere in the left ventricle, in the absence of another cause of hypertrophy in adults. More limited hypertrophy (13–14 mm) can be diagnostic, particularly when present in family members of a patient with HCM or in conjunction with a positive genetic test, and/or associated with typical dynamic outflow obstruction, or distinctly abnormal ECG patterns.

References (CD-12)

CD.CS.0012.A

v2.0.2024

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9. Lyon AR, Wilhelm M, Zamorano JL. et al. 2022 ESC Guidelines on cardio-oncology developed in collaboration with the European Hematology Association (EHA), the European Society for Therapeutic Radiology and Oncology (ESTRO) and the International Cardio-Oncology Society (IC-OS). *Eur Heart J*. 2022 Nov 1;43(41):4229-4361.

Cardiac Sarcoidosis (CD-3.9)

CD.CS.0003.9.A
v2.0.2024

Cardiac Sarcoidosis (CD-3.9)

Suspected cardiac sarcoidosis (see Background and Supporting Information)

- MRI imaging of the heart with gadolinium (CPT® 75561). Initial imaging for identification of suspected cardiac sarcoid should be cardiac MRI with late gadolinium enhancement (LGE) protocol unless there is a contraindication to MRI imaging (non-MRI safe pacemaker, renal failure). Absence of LGE is a strong negative predictor for low rates of cardiac morbidity and mortality from cardiac sarcoid and further testing is not usually indicated.
- PET – Metabolic imaging with F-18 FDG for diagnosis if there is a contraindication to MRI and cardiac sarcoid is suspected. Requires PET with F-18 FDG metabolic study combined with a PET perfusion study (CPT® 78432 or CPT® 78433) *OR* PET metabolic study (CPT® 78459 or CPT® 78429) and SPECT perfusion image (CPT® 78451).
  - For equivocal MRI
  - To confirm diagnosis if suggested by MRI

Monitoring of treatment of established cardiac sarcoidosis

- PET - Cardiac PET metabolic is indicated to monitor therapy in cardiac sarcoidosis. Requires PET with F-18 FDG metabolic study combined with a PET perfusion study (CPT® 78432 or CPT® 78433) OR PET metabolic study (CPT® 78459 or CPT® 78429) and SPECT perfusion image (CPT® 78451).
  -
  - Prior to treatment of cardiac sarcoid
  - PET (heart FDG metabolic with perfusion study as above) can be repeated at 3-6 month intervals if there is active disease or to make therapeutic decisions.

Background and supporting information

- Cardiac imaging is reasonable to detect cardiac sarcoid in the following:
  - Any patient with extra cardiac sarcoid even if no cardiac symptoms
  - Echo with basal thinning of the intraventricular septum, depressed EF <50 or regional wall motion abnormality not associated with CAD
  - Young patients with unexplained ventricular tachycardia, especially monomorphic VT

  - Patients with unexplained cardiomyopathy or heart failure (i.e., CAD has been ruled out)
  - Patients with unexplained arrhythmia especially advanced AV block or VT
- Full body PET/CT (CPT® 78815) is not indicated for the diagnosis or monitoring response to therapy of cardiac sarcoid. It may be considered to assist in diagnosis and/or treatment options in some instances of pulmonary sarcoid. See **Sarcoid (CH-15.1)** in the Chest Imaging Guidelines

References

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Cardiac Trauma Imaging (CD-10.1)

CD.CS.0010.1.A
v2.0.2024

Cardiac Trauma Imaging (CD-10.1)

- One of the following can be used to evaluate cardiac or aortic trauma:
  - Echocardiogram (TTE, TEE)
  - Cardiac MRI Cardiac (CPT® 75557 or CPT® 75561, and CPT® 75565)
  - Cardiac CT Cardiac (CPT® 75572)
  - CCTA (CPT® 75574)
  - Chest CTA Chest (CPT® 71275)
  - Chest CT Chest (CPT® 71260, CPT® 71270)

References (CD-10)

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Congestive Heart Failure (CD-9)

CD.CS.0009.A
v2.0.2024

CHF – Imaging (CD-9.1)

- Congestive heart failure (CHF), including post-cardiac transplant failure:
  - Echocardiogram is the first study after the clinical evaluation for suspected CHF.
  - MUGA, cardiac MRI or cardiac CT may be indicated if the ECHO is limited or does not completely answer the question.
  - Stress test to assess for CAD may be indicated. Follow stress testing guideline: **Stress Testing with Imaging – Indications (CD-1.4)**
- Arteriovenous fistula with "high output" heart failure:
  - CT Chest with contrast (CPT® 71260) and/or CT Abdomen and/or CT Pelvis with contrast (CPT® 74160 or CPT® 72193 or CPT® 74177) **OR**
  - CTA Chest (CPT® 71275) and/or CTA Abdomen and/or CTA Pelvis (CPT® 74175 or CPT® 72191 or CPT® 74174) **OR**
  - MRI Chest and/or MRI Abdomen and/or MRI Pelvis without and with contrast (CPT® 71552 and/or CPT® 74183 and/or CPT® 72197) **OR**
  - MRA Chest and/or MRA Abdomen and/or MRA Pelvis (CPT® 71555 and/or CPT® 74185 and/or CPT® 72198)
- Right-sided congestive heart failure can be a manifestation of pulmonary hypertension or serious lung disease.
  - CT Chest (CPT® 71260) or CTA Chest (CPT® 71275) to evaluate for recurrent pulmonary embolism

Myocardial Sympathetic Innervation Imaging in Heart Failure (CD-3.6)

- Nuclear imaging using I-123-meta-iodobenzylguanidine (I-123-mIBG) in an attempt to image increased myocardial sympathetic activity is considered to be experimental and investigational.
- The AMA has established the following set of Category III codes to report these studies:
  - **CPT® 0331T** - Myocardial sympathetic innervation imaging, planar qualitative and quantitative assessment
  - **CPT® 0332T** - Myocardial sympathetic innervation imaging, planar qualitative and quantitative assessment; with tomographic SPECT.

Background and supporting information

In heart failure, the sympathetic nervous system is activated in order to compensate for the decreased myocardial function. Initially, this is beneficial, however, long-term this compensatory mechanism is detrimental and causes further damage.

Markers have been developed, using radioactive iodine, in an attempt to image this increased myocardial sympathetic activity. Currently, AdreView™ (Iodine-123 meta-iodobenzylguanidine), is the only FDA-approved imaging agent available for this purpose.

Left ventricular assist devices (LVAD) (CD-9.4)

Left ventricular assist devices (LVAD) are implantable devices used in individuals with advanced heart failure refractory to medical therapy as a bridge to transplantation or as a destination therapy.

Pre-LVAD implant

The following imaging studies are indicated for preoperative evaluation prior to planned LVAD implant:

- TTE (CPT® 93306)
- 3D rendering for echocardiography (CPT® 76376 or CPT® 76377)
- Cardiac MRI (CPT® 75557 or CPT® 75561) and CMR velocity flow mapping (CPT® 75565)
- CT Chest (CPT® 71250 or CPT® 71260) or CTA Chest (CPT® 71275) or MRI Chest (CPT® 71552) or MRA Chest (CPT® 71555)
- CTA Abdomen and pelvis (CPT® 74174) or MRA abdomen and pelvis (CPT® 74185 and CPT® 72198)
- CT coronary angiography (CPT® 75574) in individuals post-coronary artery bypass grafting to assess the location and course of the bypass grafts to guide the surgical approach
- Transesophageal echocardiography (CPT® 93312, 93320, 93325)
- Right heart catheterization (CPT® 93451) or Right and left heart catheterization (CPT 93453)

Post LVAD implant

TTE (CPT® 93306) is indicated as follows:

- Post-implant at the following intervals:
  - 2 weeks
  - One month

- Three months
- Six months
- Twelve months
- Every 6 months thereafter

CT

- CTA Chest (CPT® 71275) or CT Chest with contrast (CPT® 71260) is indicated for evaluation of LVAD malfunction
- CT Chest without contrast (CPT® 71250) or CT Chest with contrast (CPT® 71260) indicated for the evaluation of LVAD-related infections

FDG PET/CT for LVAD driveline infection (CPT® 78815 or CPT® 78429)

- Early infection detection for LVAD drivelines is desirable, since once the infection extends to the cannula and pump pocket, eradication becomes difficult. CT findings are nonspecific and metal device artifacts of the driveline itself affects sensitivity.
- FDG PET/CT can be approved for suspected LVAD infection if other studies and examination remain inconclusive.
- See **FDG PET/CT for Infections (CD-6.5)**

Right heart catheterization (RHC)

- RHC (CPT® 93451) or Right and Left heart catheterization (CPT® 93453) as needed for hemodynamic assessment to guide changes to therapy

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Pre-Surgical Cardiac Testing (CD-13)

CD.CS.0013.A
v2.0.2024

Pre-Surgical Cardiac Testing – General Information (CD-13.1)

- It is important to differentiate requests for preoperative CT imaging before cardiac surgery according to type of procedure planned:
  - Primary cardiac operation—individuals who have not had prior heart surgery
  - Redo procedures-individuals who have had a prior procedure (it is important to determine the type of procedure as this may impact which modality is most appropriate for the pre-operative assessment)
  - Minimally invasive procedures, such as minimally invasive aortic valve operations, minimally invasive or robotic mitral operations, TAVR, MitraClip™ or other percutaneous valve procedures (such as valve in valve aortic or mitral, percutaneous tricuspid and TMVR which will be increasing in the future)
- In re-operative cardiac surgery, the benefit of preoperative CT is to assess for aortic calcifications, to evaluate the anatomic relationships in the mediastinum, such as the location of the various cardiac chambers and great vessels and proximity to the sternum, and to assess for the location of prior bypass grafts. Information can then be used to change the operative strategy including non-midline approach, peripheral vascular exposure, and alternative cannulation sites and for establishing cardiopulmonary bypass before re-sternotomy. These techniques can result in decreased incidence of intraoperative injury to heart, great vessels and prior bypass grafts and lower rates of postoperative stroke. IV contrast is necessary with these studies to delineate the anatomic structures. However, in individuals with renal insufficiency, the provider might choose to forgo the contrast if does not want to contrast load the individual prior to placing them on the heart-lung machine.
- Aortic atherosclerosis is recognized as the single most important determinant of postoperative stroke. There is evidence to support that preoperative CT is associated with lower postoperative stroke rates and mortality after primary cardiac surgery.
  - CT Chest without contrast (CPT® 71250) can be performed pre-operatively to allow the surgeon to:
    - Visualize the extent and location of aortic atherosclerosis
    - Change the operative strategy such as those problematic areas are avoided

Primary Cardiac Surgery – No Previous Cardiac Surgery (CD-13.2)

- CT Chest without contrast (CPT® 71250) to evaluate for the presence of ascending aortic calcification may be indicated prior to primary cardiac surgery when there is documented high-risk for aortic calcification including any of the following:
  - Aortic calcification on chest x-ray or other diagnostic test (TEE, fluoroscopy, etc.)
  - Calcific aortic stenosis
  - End stage renal disease (dialysis)

Re-operative cardiac surgery (CD-13.3)

- Individuals undergoing re-operative cardiac surgery may undergo **one** of the following tests for preoperative assessment:
  - CT Chest with contrast
  - CTA Chest
  - CCTA only if prior CABG (this might be in addition to CT with contrast as CCTA will not show the extent of the thoracic aorta that needs to be visualized)
  - CT Heart usually does not provide the necessary information, and is not indicated routinely.

Minimally Invasive Valve Surgery (CD-13.4)

- See **Transcatheter Aortic Valve Replacement (TAVR) (CD-4.8)**
- For an individual undergoing minimally invasive aortic valve surgery and minimally invasive or robotic mitral valve surgery, ONE of the following for preoperative assessment of an individual's suitability for the approach and for subsequent procedure planning:
- CTA Chest, CTA Abdomen and Pelvis
- CT Chest and CT Abdomen and Pelvis with contrast

Percutaneous Mitral Valve Repair (mitral valve clip) (CD-13.5)

- Percutaneous treatment of mitral regurgitation can be accomplished using venous access to apply a clip device (e.g., MitraClip™ currently FDA approved) to provide edge-to-edge mitral leaflet coaptation, approximating opposing sections of the anterior and posterior mitral valve leaflets. FDA approved indications include treatment for individuals with symptomatic, moderate to severe or severe primary mitral regurgitation whose surgical risks are prohibitive, as well as symptomatic moderate to severe or severe secondary mitral regurgitation who have failed optimal

medical therapy. This therapy should include, if indicated, cardiac resynchronization therapy.

- The following imaging may be used to determine if an individual is eligible for the procedure:
  - Transthoracic echo with or without 3D rendering
  - Transesophageal echo with or without 3D rendering
  - Heart catheterization, including right heart cath if requested
- Because this is a venous approach, CTA of Abdomen, Chest, and/or Pelvis **is not** indicated.
- Post-procedure transthoracic echo (TTE) can be performed at the following intervals:
  - One month
  - Six months
  - One year

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Pulmonary Hypertension (PH) (CD-8.1)

CD.CS.0008.1.A
v2.0.2024

Pulmonary Hypertension - Imaging indications

Transthoracic echocardiogram (TTE) (CPT® 93306) should be performed initially as it can help determine the probability of pulmonary hypertension.

Screening

A screening echocardiogram (TTE) for PH is indicated in individuals with documented history of **any** of the following:

- Individuals preoperatively for planned liver transplant.
- Individuals evaluated for transjugular portosystemic shunt
- Portal Hypertension
- Liver disease with signs and symptoms of PH
- Bronchopulmonary dysplasia

Annual screening echo (TTE) is indicated in individuals with a documented history of any of the following:

- Systemic sclerosis (SSc)
- Individuals with PH mutations (e.g., BMPR2)
- First-degree relatives of individuals with PH
- Connective tissue disorder with symptoms consistent with PH
- Individuals with TR velocity ≥2.8 m/s, with no other findings on additional testing
- Individuals being treated with medications associated with PH
- Individuals who have a concern documented for PH and had a negative echocardiogram but still show signs or symptoms of PH

Follow-up testing is not indicated in individuals with TR velocity <2.8 m/s and no other signs, symptoms, or risk factors of PH

Initial imaging

Transthoracic echocardiogram (TTE) (CPT® 93306) is indicated for symptoms and signs of pulmonary hypertension (PH) including **any** of the following:

- Notes documenting clinical concern for pulmonary hypertension
- EKG findings concerning for PH such as **any** of the following:
  - Right ventricular hypertrophy (RVH)

  - Right axis deviation
  - Right atrial enlargement
- Right ventricular hypertrophy or pulmonary artery dilation on other images
- History of pulmonary embolism with persistent or new onset DOE, or exercise limitation
- Suspected PH in individuals with lung disease
- DOE in individuals with connective tissue disorder, HIV, portal hypertension, SSc.
- Symptoms of PH (**any** of the following):
  - Breathlessness
  - SOB
  - Decreased exercise tolerance
  - Fatigue and rapid exhaustion
  - Palpitations
  - Dyspnea on bending forward
  - Hemoptysis
  - Exercise induced abdominal distention and nausea
  - Weight gain due to fluid retention
  - Syncope during or shortly after physical activity
  - Exertional chest pain

Stress Echo (CPT® 93350 or 93351) is indicated for **any** of the following:

- To assess for treatment in the setting of concomitant valvular disease
- As indicated by **Stress Testing with Imaging - Indications (CD-1.4)** or **Stress Echo-Indications Other than Ruling out CAD (CD-2.7)**
- There is documented concern for chronic thrombo-embolic pulmonary hypertension

Cardiac MRI (CPT® 75557) is indicated when there is documentation of **any** of the following:

- TTE is equivocal or unclear (e.g., for RV function) and the information is needed for management
- MRI and TTE may both be required for individuals who need RV pressure and function assessed, and prior RV function cannot be assessed by echocardiogram
- MRI can replace TTE when the issue that makes the imaging by echo unclear is likely to be seen in future echocardiograms

Other advanced imaging is indicated after TTE for the following:

- High-resolution CT Chest (CPT® 71250) is indicated in the setting of hypoxemia to rule out restrictive lung disorders such as pulmonary fibrosis
- CTA Chest (CPT® 71275) or MRA Chest (CPT® 71555) is indicated to evaluate for suspected acute and/or chronic pulmonary embolism

- V/Q scan (CPT® 78580-Pulmonary Perfusion Imaging or CPT® 78582- Pulmonary Ventilation (e.g., Aerosol or Gas) and Perfusion Imaging) is indicated to evaluate for any of the following:
  - Suspected acute pulmonary embolism
  - To evaluate for chronic thromboembolic pulmonary hypertension at 3 to 6 months post pulmonary embolism if both of the following apply:
    - Persistent or new onset dyspnea on exertion or exercise limitation
    - Evidence of pulmonary hypertension on follow up echo
  - To evaluate for chronic thromboembolic pulmonary hypertension in individuals with pulmonary hypertension of uncertain etiology
- SPECT imaging (CPT® 78803) or SPECT/CT imaging (CPT® 78830) can be added to V/Q scan if requested
- Transesophageal (TEE) contrast echocardiography or other imaging techniques (e.g.,CT angiography, cardiac MRI) may be indicated, in addition to 2D Doppler and contrast examinations, to identify CHD to detect or exclude **any** of the following:
  - Sinus venosus
  - Atrial septal defects
  - Patent ductus arteriosus
  - Anomalous pulmonary venous connections

Indications for initial Catheterization

Right heart catheterization (RHC) is indicated for **any** of the following:

- Echo findings
  - TR velocity ≥3.4 m/second
  - TR velocity ≥2.9 m/second and presence of other PH signs on echo or other testing, or risk factors or associated indications
- Individuals with SSc where breathlessness remains unexplained (RHC is recommended despite normal echocardiogram).
- Individuals with connective tissue disorder who have symptoms or concerns for PH with a negative or equivocal echocardiogram.
- When recommended to determine if shunt closure is recommended due to congenital heart disease
- RHC if **moderate** to **severe** PH on echocardiogram (See **Background and Supporting Information** for definitions of mild, moderate and severe PH)
- RHC is indicated prior to starting PH medical therapy.
- Individuals with **low** -risk profile (based on an evidence based PAH Risk Score Calculator such as REVEAL 2.0, ESC/ERS & Compera 2.0) only need cath if indicated for another reason or equivocal studies.(See **Background and Supporting Information** for additional information about PH risk profile)
- RHC allowed when LHC indicated for separate indication.

- RHC preoperative for surgical intervention treating the cause of PH (MV, TV, AV, PV).
- Eisenmenger syndrome – RHC is indicated when requested by provider.

Left heart catheterization (LHC) or **Right and left heart catheterization** as per the following guidelines:

- **Evaluation of Conditions Other than Coronary Artery Disease (CD-7.7)**
- **Diagnostic Left Heart Catheterization (LHC) (CD-7.3)**

Repeat Testing

Follow-up echocardiogram (TTE) on patients with PH

- Every 6 months for surveillance of stable individuals with moderate or severe pulmonary hypertension (pulmonary artery systolic pressure ≥50 mm Hg)
- Prior to planned intubation (e.g., for elective surgery)
- Prior to planned pregnancy
- During pregnancy as often as requested by provider
- Anytime, without regard for the number or timing of previous ECHO studies to evaluate either:
  - Change in therapy
  - Change in clinical findings or symptoms
- Echocardiogram at baseline then every 3 months with therapy changes in stable patients

Pulmonary embolism (PE)

- TTE is indicated 3 to 6 months post pulmonary embolism if **any** of the following apply:
  - Persistent or new onset dyspnea on exertion, or exercise limitation
  - Pulmonary hypertension or right ventricular dysfunction on initial echo at PE diagnosis
  - History of recurrent pulmonary embolism

RHC is indicated for known PH as follows:

- At baseline
- Then every 6 months
- Anytime for clinical changes or with treatment changes

Other related sections

- **Frequency of Echocardiography Testing (CD-2.3)** in the Cardiac Imaging Guidelines
- **Right Heart Catheterization (RHC) (CD-7.4)** in the Cardiac Imaging Guidelines
- **Pulmonary hypertension (PHT) and Eisenmenger syndrome (CD-11.3.12)** in the Cardiac Imaging Guidelines

- **Congenital Heart Disease Modality Considerations (PEDCD-2.3)** in the Pediatric Cardiac Imaging Guidelines
- **Pediatric Pulmonary Hypertension - General (PEDCD-7)** in the Pediatric Cardiac Imaging Guidelines
- **Pulmonary Embolism (PE) (CH-25)** in the Chest Imaging Guidelines

Background and supporting information

Pulmonary hypertension (PH) is a complex, chronic disease with multiple etiologies, that requires extensive evaluation, including ECG (right ventricular hypertrophy with/without strain, right atrial dilatation); chest x-ray; arterial blood gas, pulmonary function testing, CT angiography based on the etiology.

PH can be subdivided into the following five groups based on the underlying cause:
- Pulmonary arterial hypertension (PAH)
- PH due to left heart disease
- PH due to lung disease
- Chronic thromboembolic PH (CTEPH)
- PH with unclear and/or multifactorial mechanisms

Probability of PH is assessed at initial evaluation:
- **High** probability:
  - TR velocity ≥3.4 m/s
  - TR velocity between 2.9 to 3.4 m/s and **one** of the following:
    - Right ventricle or pulmonary artery enlargement
    - Interventricular septum flattening
    - Right ventricular systolic dysfunction
- **Intermediate** probability:
  - TR velocity between 2.9 to 3.4 m/s in the absence of other signs of PH
- **Low** probability:
  - TR velocity <2.8 m/s

Peak TR velocity ≥2.8 m/s may suggest PH; however, the presence or absence of PH cannot be reliably determined by TR velocity alone

In addition to the tricuspid regurgitation velocity, other findings on echo can increase the probability of PH, examples of these findings include:
- Abnormal tricuspid annular plane systolic excursion (TAPSE)
- Abnormal RV fractional area change (RV-FAC)
- Abnormal RV free-wall strain
- Abnormal tricuspid annulus velocity (S′ wave) derived from tissue Doppler imaging
- Abnormal RV ejection fraction (RVEF) derived from 3D echocardiography

MRI can be a useful test especially with respect to RV function

Right heart cath is the gold standard for diagnosing PH

See **Severe Pulmonary Artery Hypertension (PH) and Eisenmenger Syndrome (CD-11.3.12)** for additional information regarding Eisenmenger Syndrome

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Pulmonary Vein Imaging – Indications (CD-8.2)

CD.CS.0008.2.A
v2.0.2024

Indications

- MRI Cardiac (CPT® 75557 or CPT® 75561), MRV Chest (CPT® 71555), CTV Chest (CPT® 71275), or CT Cardiac (CPT® 75572) to evaluate anatomy of the pulmonary veins:
  - Prior to planned atrial fibrillation ablation/pulmonary vein isolation procedure
  - Post-procedure between 3-6 months after ablation because of a 1% to 2% incidence of asymptomatic pulmonary vein stenosis
    - If no pulmonary vein stenosis is present, no further follow-up imaging is required
    - If pulmonary vein stenosis is present on imaging following ablation and symptoms of pulmonary vein stenosis (usually shortness of breath) are present, can be imaged at 1, 3, 6, and 12 months

Background and Supporting Information

The majority (81%) of pulmonary vein stenosis remain stable over 1 year. Progression occurs in 8.8% and regression occurs in a small percentage.

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Hypertrophic Cardiomyopathy (HCM) (CD-14)

CD.CS.0014.A
v2.0.2024

Hypertrophic Cardiomyopathy (HCM) (CD-14)

Hypertrophic Cardiomyopathy (HCM) is a clinical diagnosis, established by imaging with 2D echocardiography or cardiovascular magnetic resonance (CMR) showing a maximal end-diastolic wall thickness of ≥ 15 mm anywhere in the left ventricle, in the absence of another cause of hypertrophy in adults. More limited hypertrophy (13–14 mm) can be diagnostic, particularly when present in family members of a patient with HCM or in conjunction with a positive genetic test, and/or associated with typical dynamic outflow obstruction, or distinctly abnormal ECG patterns.

Screening

- Screening for inherited hypertrophic cardiomyopathy see **Transthoracic Echocardiography (TTE) – Indications (CD-2.2)** and **Frequency of Echocardiography Testing (CD-2.3)**

Initial imaging, new or changed symptoms

TTE

- TTE is indicated for the initial evaluation of a genotype positive individual with inherited hypertrophic cardiomyopathy

Stress echocardiogram

- Exercise stress echo (CPT® 93351 or 93350) is indicated for the detection and quantification of dynamic left ventricular outflow tract obstruction in symptomatic individuals with HCM who do **not** have a resting or provocable outflow tract gradient ≥50 mm Hg on TTE.
- Stress echo can be repeated when there is documentation of **any** of the following:
  - In 1 to 2 years if the resting or provocable outflow tract gradient is < 30 mm Hg on prior stress echo
  - Worsening symptoms
  - There has been a therapeutic change (i.e., change in medication, surgical procedure performed).

CCTA (CPT® 75574)

- Initial imaging study in individuals with hypertrophic cardiomyopathy and stable anginal symptoms.
  - Chest discomfort is common in individuals with hypertrophic cardiomyopathy. The incidence of false positive myocardial perfusion imaging abnormalities is higher in these individuals, whereas the incidence of severe coronary artery stenosis is low.

Cardiac MRI (CMR)

- Cardiac MRI (CPT® 75557 or CPT® 75561) for assessment of global ventricular function, myocardial composition and mass if a specific clinical question is left unanswered by a recent echocardiogram and results will affect patient management.

Surveillance imaging

- TTE is indicated every year when there is no change in clinical status or treatment

Monitoring treatment

Repeat TTE (CPT® 93306) is indicated in individuals with Obstructive Hypertrophic Cardiomyopathy (HCM) for the following:

Mavacamten for obstructive hypertrophic cardiomyopathy

Initiation of treatment

- Baseline-at the beginning of treatment
- 4 weeks after treatment initiation
- 8 weeks after treatment initiation
- 12 weeks after treatment initiation
- Then every 12 weeks while on mavacamten

Changes in treatment

- 4 weeks after any interruption of treatment (any missed dose)
- After any dosage change (including restart of treatment):
  - 4 weeks after dosage change
  - 12 weeks after dosage change
- After initiating a weak CYP2C19 inhibitor (e.g., omeprazole) or moderate CYP3A4 inhibitor (e.g., ciprofloxacin):
  - 4 weeks after start of medication
  - 12 weeks after start of medication
- At any time regardless of timing of prior echo when there are new cardiac signs or symptoms, or worsening of clinical status

Post- Septal Reduction Therapy (SRT)

TTE is indicated within 3 to 6 months after SRT (surgical myectomy or alcohol septal ablation) to evaluate the procedural results in individuals with hypertrophic cardiomyopathy

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Policy History and Instructions for Use

Guideline

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v2.0.2024

Instructions for Use

This Medical Policy provides assistance in interpreting United HealthCare Services, Inc. standard benefit plans. When deciding coverage, the federal, state (Ohio Administrative Code [OAC]) or contractual requirements for benefit plan coverage must be referenced as the terms of the federal, state (OAC) or contractual requirements for benefit plan coverage may differ from the standard benefit plan. In the event of a conflict, the federal, state (OAC) or contractual requirements for benefit plan coverage govern.

Before using this policy, please check the federal, state (OAC) or contractual requirements for benefit plan coverage. United HealthCare Services, Inc. reserves the right to modify its Policies and Guidelines as necessary. This Medical Policy is provided for informational purposes. It does not constitute medical advice.

United HealthCare Services, Inc. uses InterQual® for the primary medical/surgical criteria, and the American Society of Addiction Medicine (ASAM) for substance use, in administering health benefits. If InterQual® does not have applicable criteria, United HealthCare Services, Inc. may also use United HealthCare Services, Inc.'s Medical Policies, Coverage Determination Guidelines, and/or Utilization Review Guidelines that have been approved by the Ohio Department for Medicaid Services. The United HealthCare Services, Inc.'s Medical Policies, Coverage Determination Guidelines, and Utilization Review Guidelines are intended to be used in connection with the independent professional medical judgment of a qualified health care provider and do not constitute the practice of medicine or medical advice.

Policy History/Revision Information

Date	Summary of Changes
02/01/2024	Annual evidence-based updates
07/01/2024	Interim evidence-based updates