2.02.31	Myocardial Strain Imaging		
Original Policy Date:	May 1, 2019	**Effective Date:**	July 1, 2021
Section:	2.0 Medicine	**Page:**	Page 1 of 12

Policy Statement

Myocardial strain imaging in individuals who have exposure to medications or radiation that could result in cardiotoxicity is considered **investigational**.

Myocardial strain imaging is considered **investigational** in all other situations.

NOTE: Refer to Appendix A to see the policy statement changes (if any) from the previous version.

Policy Guidelines

Coding

The following Category I add on code for Myocardial Strain Imaging was created to replace Category III code **0399T**:

- **93356**: Myocardial strain imaging using speckle tracking-derived assessment of myocardial mechanics (List separately in addition to codes for echocardiography imaging)

The following HCPCS codes describes the technology associated with strain-encoded cardiac magnetic resonance imaging:

- **C9762**: Cardiac magnetic resonance imaging for morphology and function, quantification of segmental dysfunction; with strain imaging
- **C9763**: Cardiac magnetic resonance imaging for morphology and function, quantification of segmental dysfunction; with stress imaging

Description

Myocardial strain refers to the deformation (shortening, lengthening, or thickening) of the myocardium through the cardiac cycle. Myocardial strain can be measured by tissue Doppler imaging or, more recently, speckle-tracking echocardiography. Speckle-tracking echocardiography uses imaging software to assess the movement of specific markers in the myocardium that are detected in standard echocardiograms. It is proposed that a reduction in myocardial strain may indicate sub-clinical impairment of the heart and can be used to inform treatment before development of symptoms and irreversible myocardial dysfunction.

Related Policies

- N/A

Benefit Application

Benefit determinations should be based in all cases on the applicable contract language. To the extent there are any conflicts between these guidelines and the contract language, the contract language will control. Please refer to the member's contract benefits in effect at the time of service to determine coverage or non-coverage of these services as it applies to an individual member.

Some state or federal mandates (e.g., Federal Employee Program [FEP]) prohibits plans from denying Food and Drug Administration (FDA)-approved technologies as investigational. In these instances, plans may have to consider the coverage eligibility of FDA-approved technologies on the basis of medical necessity alone.

Regulatory Status

A number of image analysis systems have been cleared for marketing by the U.S. Food and Drug Administration (FDA) through the 510(k) process. Examples of these are shown in Table 1. For example, the EchoInsight software system (Epsilon Imaging) "enables the production and visualization of 2-dimensional tissue motion measurements (including tissue velocities, strains, strain rates) and cardiac structural measurement information derived from tracking speckle in tissue regions visualized in any B mode (including harmonic) imagery loops as captured by most commercial ultrasound systems" (K110447). The FDA determined that this device was substantially equivalent to existing devices (e.g., syngo US Workplace, Siemens, K091286) for analysis of ultrasound imaging of the human heart.

Table 1. Examples of Software That Have Received FDA Clearance

Brand Name	Manufacturer	510(k) Number	FDA Product Code	Clearance Date
Myostrain	Myocardial Solutions	K182756	LNH	02/14/2019
Vivid	GE	K181685	IYN	10/25/2018
Aplio	Toshiba		IYN	01/11/2018
2D CARDIAC PERFORMANCE ANALYSIS	Tomtec	K120135	LLZ	04/13/2012
EchoInsight	Epsilon Imaging	K110447	LLZ	05/27/2011
Q-lab	Phillips	K023877	LLZ	12/23/2002

FDA: Food and Drug Administration.

Rationale

Background

The term strain indicates dimensional or deformational change under force. When used in echocardiography, the term 'strain' is used to describe the magnitude of shortening, thickening, and lengthening of the myocardium through the cardiac cycle. The most frequent measure of myocardial strain is the deformation of the left ventricle in the long axis, termed global longitudinal strain. During systole, ventricular myocardial fibers shorten with movement from the base to the apex. Global longitudinal strain is used as a measure of global left ventricle function and provides a quantitative myocardial deformation analysis of each left ventricle segment. Myocardial strain imaging is intended to detect subclinical changes in left ventricle function in patients with a preserved left ventricle ejection fraction, allowing for early detection of systolic dysfunction. Since strain imaging can identify left ventricle dysfunction earlier than standard methods, this raises the possibility of heart failure prophylaxis and primary prevention before the patient develops symptoms and irreversible myocardial dysfunction. Potential applications of speckle-tracking echocardiography are coronary artery disease, ischemic cardiomyopathy, valvular heart disease, dilated cardiomyopathy, hypertrophic cardiomyopathies, stress cardiomyopathy, and chemotherapy-related cardiotoxicity.

Myocardial Strain Imaging

Myocardial strain can be measured by cardiac magnetic resonance imaging (MRI), tissue Doppler imaging, or by speckle-tracking echocardiography. Tissue Doppler strain imaging has been in use since the 1990s but has limitations that include angle dependency and significant noise. In 2016, Smiseth et al reported that the most widely used method of measuring myocardial strain at the present time is speckle-tracking echocardiography.[1] In speckle-tracking echocardiography, natural acoustic markers generated by the interaction between the ultrasound beam and myocardial fibers form interference patterns (speckles). These markers are stable, and speckle-tracking echocardiography analyzes the spatial dislocation (tracking) of each point (speckle) on routine 2-dimensional sonograms. Echocardiograms are processed using specific acoustic-tracking software on dedicated workstations, with offline semiautomated analysis of myocardial strain. The 2-dimensional displacement is identified by a search with image processing algorithms for similar patterns across 2 frames. When tracked frame-to-frame, the spatiotemporal displacement of the speckles provides information about myocardial deformation across the cardiac cycle. Global longitudinal strain provides a quantitative analysis of each left ventricle segment, which is expressed as a percentage. In addition to global longitudinal strain, speckle-tracking echocardiography allows evaluation of left ventricle rotational and torsional dynamics.

Literature Review

Evidence reviews assess whether a medical test is clinically useful. A useful test provides information to make a clinical management decision that improves the net health outcome. That is, the balance of benefits and harms is better when the test is used to manage the condition than when another test or no test is used to manage the condition.

The first step in assessing a medical test is to formulate the clinical context and purpose of the test. The test must be technically reliable, clinically valid, and clinically useful for that purpose. Evidence reviews assess the evidence on whether a test is clinically valid and clinically useful. Technical reliability is outside the scope of these reviews, and credible information on technical reliability is available from other sources.

Myocardial Strain Imaging to Detect Cardiotoxicity

Clinical Context and Test Purpose

The purpose of myocardial strain imaging in patients who have an indication for a transthoracic echocardiogram is to inform a decision whether to modify monitoring and/or treatment before the patient develops symptoms and irreversible myocardial dysfunction.

In 2019, the American College of Cardiology, American Association for Thoracic Surgery, American Heart Association, American Society of Echocardiography, American Society of Nuclear Cardiology, Heart Rhythm Society, Society for Cardiovascular Angiography and Interventions, Society of Cardiovascular Computed Tomography, Society for Cardiovascular Magnetic Resonance, and the Society of Thoracic Surgeons published appropriate use criteria for multimodality imaging in the assessment of cardiac structure and function in nonvalvular heart disease.[2] In 2019, the American College of Cardiology et al considered strain imaging by speckle or tissue Doppler appropriate for the following indications:

- Initial evaluation prior to exposure to medications/radiation that could result in cardiotoxicity/heart failure,
- Re-evaluation (1 year) in a patient previously or currently undergoing therapy with potentially cardiotoxic agents,
- Periodic re-evaluation in a patient undergoing therapy with cardiotoxic agents with worsening symptoms, and
- Evaluation of suspected hypertrophic cardiomyopathy.

In 2019, the American College of Cardiology et al recommended that myocardial strain imaging "may be appropriate" for indications that are described in Table 2, in the Supplemental Information section.

Cardiovascular complications of cancer treatment can be either acute or chronic (early or delayed) and include heart failure, myocardial ischemia or infarction, hypertension, thromboembolism, and arrhythmias. Presymptomatic detection of cardiotoxicity may allow modification of cancer therapy combinations or use of cardioprotective agents. Therefore, this evidence review will focus on clinical outcomes from use of strain imaging by speckle-tracking echocardiography or tissue Doppler imaging for the initial assessment and follow-up for cardiotoxicity.

The question addressed in this evidence review is: Does myocardial strain imaging improve the net health outcome in individuals exposed to cardiotoxic agents?

The following PICO was used to select literature to inform this review.

Populations
The relevant population of interest is individuals who have been exposed to cardiotoxic medications or radiation.

For patients who are undergoing chemotherapy, current recommendations are to measure ejection fraction prior to chemotherapy, at completion of therapy, and 6 months later. It has been proposed that the measurement of myocardial strain in addition to ejection fraction will be helpful in cases when ejection fraction is in the lower normal range, and in these cases, the finding of subnormal strain should result in closer monitoring of cardiac function, modification of cancer therapy, and/or use of cardioprotective agents.

Interventions
The test being considered is myocardial strain imaging. Strain is a dimensionless measure of tissue deformation (L – L0)/L0, where L is final length and L0 the original length; positive values indicate lengthening, and negative values indicate shortening.[3,]

The most frequent measure of myocardial strain is global longitudinal strain, which averages values over the length of the myocardial wall. Greater deformation is indicated by lower strain values. Cardiac strain in a healthy individual is generally around 20%, indicated in echocardiography by a negative number (-20). In a meta-analysis of 24 studies (2597 healthy volunteers), Yingchoncharoen et al (2013), reported that global longitudinal strain varied from -15.9% to -22.1% (mean -19.7%, 95% confidence interval [CI] -18.9% to -20.4%).[4,] Shortening of more than 20% is generally considered normal.

Comparators
The following tests are currently being used to make decisions about cardiac function:
Tagged magnetic resonance imaging (MRI) is considered the reference standard for myocardial strain imaging. However, its routine use is limited by high cost, limited availability, complexity of acquisitions, and time-consuming image analysis. This evidence review will evaluate whether clinical outcomes are improved by myocardial strain imaging in comparison with ejection fraction.

Outcomes
The general outcomes of interest are symptoms and signs of cardiotoxicity. Cardiotoxicity is typically defined as a decline in ejection fraction, but there is little consensus regarding what level of decline in left ventricle ejection fraction constitutes cardiotoxicity.

The beneficial outcome of a true-positive test result would be an increase in monitoring or modification of treatment that would reduce cardiotoxicity.

The beneficial outcome of a true-negative test result would be avoiding unnecessary treatment.
A harmful outcome of a false-positive test result would be unnecessary therapy.

A harmful outcome of a false-negative test result would be failure to diagnose cardiotoxicity or progression of toxicity.

Cardiotoxicity may be measured by clinical symptoms and ejection fraction at 6 months and after 1, 2 and 3 years.

Study Selection Criteria

For the evaluation of clinical validity of myocardial strain imaging, studies that meet the following eligibility criteria were considered:

- Reported on clinical outcomes
- Included a suitable reference standard (ejection fraction)
- Patient/sample clinical characteristics were described
- Patient/sample selection criteria were described.

Review of Evidence
Clinically Valid
A test must detect the presence or absence of a condition, the risk of developing a condition in the future, or treatment response (beneficial or adverse).

Systematic Review
Thavendiranathan et al (2014) conducted a systematic review of myocardial strain imaging for the early detection of cardiotoxicity in patients during and after cancer chemotherapy.[5] Searches were conducted through November 2013. The reviewers included prospective or retrospective studies of at least 10 patients that used echocardiographic-based myocardial deformation parameters as the primary method to detect cardiotoxicity. Studies had to provide data on changes in deformation parameters and left ventricle ejection fraction during therapy. The authors focused the review on 3 clinical scenarios: 1) detection of early myocardial changes; 2) prediction of subsequent cardiotoxicity; and 3) detection of late consequences of therapy (>1 year posttreatment).

Detection of early myocardial changes: 13 single-center cohort studies (N=384) provided information on myocardial strain imaging parameters to detect early myocardial changes in patients treated with anthracycline-containing regimens. The earlier studies (n=7) used tissue Doppler imaging while more recent studies (n=6) used speckle-tracking echocardiography. There was heterogeneity regarding patient age, types of cancer, strain techniques, and timing of follow-up, but all of the studies found that changes in myocardial deformation occurred earlier than changes in left ventricle ejection fraction. In addition, reductions in myocardial deformation occurred at doses lower than those historically considered cardiotoxic.

Prognosis for early cardiotoxicity: 8 observational studies (n=452) included in the systematic review evaluated the prognostic value of myocardial strain imaging for subsequent cardiotoxicity (left ventricle ejection fraction reduction or the development of heart failure). The studies differed in duration of follow-up (6 months, 12 to 15 months), treatment regimens, and other factors but used a similar definition of cardiotoxicity. The researchers found that an early fall in global longitudinal strain of 10% to 15% using speckle-tracking echocardiography predicted subsequent cardiotoxicity.

Prognosis for late cardiotoxicity: 9 case-control studies (n=436) were identified that compared findings in patients to controls. All of the studies used various myocardial deformation parameters to detect late subclinical cardiac injury, but none provided data on subsequent cardiac events.
The authors identified the following areas for future research:

- Determination of whether strain-based approaches could be reliably implemented in multiple centers, including nonacademic settings
- Study in larger multicenter studies and in cancers other than breast cancer
- Need to determine the optimum sampling (single or multiple)
- Comparison with a traditional left ventricle ejection fraction based approach
- Understanding the long-term effect of strain changes that occur during therapy
- The use of vendor-neutral methods to measure strain
- The prognostic significance of strain abnormalities in survivors of cancer and those receiving radiation therapy
- Whether intervention would change the natural course of the cardiac disease.

Section Summary: Clinical Validity

A systematic review of 13 studies with 384 patients treated for cancer suggests that myocardial strain imaging with tissue Doppler imaging or speckle-tracking echocardiography may be able to identify changes in myocardial deformation that precede changes in left ventricle ejection fraction. Although myocardial strain imaging may detect sub-clinical myocardial changes, the value of these changes in guiding therapy is uncertain. No studies were identified that evaluated the diagnostic accuracy of myocardial strain imaging compared to left ventricle ejection fraction.

Clinically Useful

A test is clinically useful if the use of the results informs management decisions that improve the net health outcome of care. The net health outcome can be improved if patients receive correct therapy, more effective therapy, or avoid unnecessary therapy or testing.

Direct Evidence

Direct evidence of clinical utility is provided by studies that have compared health outcomes for patients managed with and without the test. Because these are intervention studies, the preferred evidence would be from randomized controlled trials (RCTs).

No direct evidence of the clinical utility of myocardial strain imaging is currently available. The Strain Surveillance of Chemotherapy for Improving Cardiovascular Outcomes (SUCCOUR) trial, currently in progress, will be the first RCT of myocardial strain imaging and will provide evidence to inform guidelines regarding the place of myocardial strain imaging for surveillance for cardiotoxicity related to cancer chemotherapy. Preliminary descriptive results on the first 86 patients have been published.[6,]

Chain of Evidence

Indirect evidence on clinical utility rests on clinical validity. If the evidence is insufficient to demonstrate test performance, no inferences can be made about clinical utility.

Evidence is insufficient to determine the clinical validity of myocardial strain imaging.

Summary of Evidence

For individuals who have exposure to medications or radiation that could result in cardiotoxicity who receive myocardial strain imaging, the evidence includes systematic reviews of observational studies. Relevant outcomes include symptoms, morbid events, quality of life, treatment-related mortality, and treatment-related morbidity. A systematic review of 13 studies with 384 patients treated for cancer suggests that myocardial strain imaging with tissue Doppler imaging or speckle-tracking echocardiography may be able to identify changes in myocardial deformation that precede changes in left ventricle ejection fraction. Although myocardial strain imaging may detect sub-clinical myocardial changes, the value of these changes in predicting clinical outcomes or guiding therapy is uncertain. No studies were identified that compared the diagnostic accuracy of myocardial strain imaging to left ventricle ejection fraction. A study that will compare clinical outcomes when therapy is guided by myocardial strain imaging or left ventricle ejection fraction is in progress and will provide direct evidence on the clinical utility of myocardial strain imaging. The evidence is insufficient to determine that the technology results in an improvement in the net health outcome.

Supplemental Information

The purpose of the following information is to provide reference material. Inclusion does not imply endorsement or alignment with the evidence review conclusions.

Practice Guidelines and Position Statements

Guidelines or position statements will be considered for inclusion in 'Supplemental Information' if they were issued by, or jointly by, a US professional society, an international society with US representation, or National Institute for Health and Care Excellence (NICE). Priority will be given to guidelines that are informed by a systematic review, include strength of evidence ratings, and include a description of management of conflict of interest.

American College of Cardiology et al

In 2019, the American College of Cardiology, American Association for Thoracic Surgery, American Heart Association, American Society of Echocardiography, American Society of Nuclear Cardiology, Heart Rhythm Society, Society for Cardiovascular Angiography and Interventions, Society of Cardiovascular Computed Tomography, Society for Cardiovascular Magnetic Resonance, and the Society of Thoracic Surgeons published appropriate use criteria for multimodality imaging in the assessment of cardiac structure and function in nonvalvular heart disease (Table 2).[2,]

Using a modified Delphi approach, the panel rated indications as "appropriate", "may be appropriate", and "not appropriate"[7,] The specific studies that formed the basis of the American College of Cardiology guidelines are not cited, however, they note that they used American College of Cardiology/American Heart Association clinical practice guidelines whenever possible.
Of 81 indications considered for strain rate imaging, the panel rated only 4 as "appropriate" (Table 2). Three of the 4 concerned evaluation (initial or follow-up) in patients prior to and following exposure to potentially cardiotoxic agents. The other indication was follow-up testing to clarify initial diagnostic testing for patients with suspected hypertrophic cardiomyopathy. The guidelines did not separate out imaging with speckle tracking and tissue Doppler and did not make recommendations related to the comparative effectiveness of these imaging modalities. The panel rated 14 other indications "may be appropriate" (Table 2). According to the panel, interventions in this category should be performed depending on individual clinical patient circumstances and patient and provider preferences, including shared decision making.[7,]

Table 2. Summary of ACC Appropriate Use Criteria for Myocardial Strain Imaging

Clinical Scenario and Indication	Rating
Initial evaluation in an asymptomatic patient:	
- Initial evaluation prior to exposure to medications/radiation that could result in cardiotoxicity/heart failure	Appropriate
- Initial cardiac evaluation of a known systemic, congenital, or acquired disease that could be associated with structural heart disease	May be appropriate
- Screening evaluation for structure and function in first-degree relatives of a patient with an inherited cardiomyopathy	May be appropriate
- Preparticipation assessment of an asymptomatic athlete with 1 or more of the following: abnormal examination, abnormal ECG, or definite (or high suspicion for) family history of inheritable heart disease)	May be appropriate
Initial evaluation of a patient with clinical signs and/or symptoms of heart disease:	
- Initial evaluation when symptoms or signs suggest heart disease	May be appropriate
- Arrhythmias or conduction disorders: Newly diagnosed LBBB; Nonsustained VT	May be appropriate
- Palpitations/presyncope/syncope: Clinical symptoms or signs consistent with a cardiac diagnosis known to cause presyncope/syncope (including but not limited to hypertrophic cardiomyopathy and heart failure)	May be appropriate
- Respiratory failure/exertional shortness of breath: Exertional shortness of breath/dyspnea or hypoxemia of uncertain etiology	May be appropriate
- HF/cardiomyopathy: Initial evaluation of known or suspected HF (systolic or diastolic) based on symptoms, signs, or abnormal test results to assess systolic or diastolic function and to assess for possible etiology (CAD, valvular disease); Suspected inherited or acquired cardiomyopathy (e.g., restrictive, infiltrative, dilated, hypertrophic)	May be appropriate
- Device therapy: Known implanted pacing/ICD/CRT device with symptoms possibly due to suboptimal device settings	May be appropriate
- Cardiac transplantation: Monitoring for rejection or coronary arteriopathy in a cardiac transplant recipient	May be appropriate
- Other: Suspected pericardial diseases	May be appropriate

Clinical Scenario and Indication	Rating
Sequential or follow-up testing to clarify initial diagnostic testing:	
- Evaluation of suspected hypertrophic cardiomyopathy	Appropriate
- Re-evaluation (1 y) in a patient previously or currently undergoing therapy with potentially cardiotoxic agents	Appropriate
- Periodic reevaluation in a patient undergoing therapy with cardiotoxic agents and worsening symptoms	Appropriate
- Pulmonary hypertension in the absence of severe valvular disease	May be appropriate
- Comprehensive further evaluation of undefined cardiomyopathy	May be appropriate
- Evaluation of suspected cardiac amyloidosis	May be appropriate
Sequential or follow-up testing: new or worsening symptoms or to guide therapy	
Re-evaluation of known structural heart disease with change in clinical status or cardiac examination or to guide therapy	May be appropriate
Re-evaluation of known cardiomyopathy with a change in clinical status or cardiac examination or to guide therapy	May be appropriate
Re-evaluation of known HF (systolic or diastolic) with a change in clinical status or cardiac examination without a clear precipitating change in medication or diet	May be appropriate
Re-evaluation for CRT device optimization in a patient with worsening HF	May be appropriate

ACC: American College of Cardiology; CAD: coronary artery disease; CRT: cardiac resynchronization therapy: ECG: electrocardiogram; HF: heart failure; ICD: implantable cardioverter-defibrillator; LBBB: left bundle branch block; VT: ventricular tachycardia.
Source: Adapted from Doherty et al (2019).[2]

American Society of Clinical Oncology

In 2017, the American Society of Clinical Oncology noted that measurement of strain has been demonstrated to have some diagnostic and prognostic use in patients with cancer receiving cardiotoxic therapies but that there have been no studies demonstrating that early intervention based on changes in strain alone can result in changes in risk and improved outcomes.[8] The American Society of Clinical Oncology also notes that screening for asymptomatic cardiac dysfunction using advanced imaging could lead to added distress in cancer survivors.

U.S. Preventive Services Task Force Recommendations

Not applicable.

Medicare National Coverage

There is no national coverage determination. In the absence of a national coverage determination, coverage decisions are left to the discretion of local Medicare carriers.

Ongoing and Unpublished Clinical Trials

Some currently ongoing and unpublished trials that might influence this review are listed in Table 3.
The Strain Surveillance of Chemotherapy for Improving Cardiovascular Outcomes (SUCCOUR) is a randomized controlled trial (RCT) that will evaluate clinical outcomes for patients who are monitored by myocardial strain imaging or conventional imaging. Patients with an abnormal test result will receive improved blood pressure and glucose control. Protective therapy with angiotensin-converting enzyme inhibitors and beta-blockers will be titrated to target dose. This will be the first trial to assess clinical outcomes based on myocardial strain imaging compared to conventional imaging (limited to evaluation of ejection fraction and valve disease). The SUCCOUR trial will provide evidence to inform guidelines regarding the place of global longitudinal strain for surveillance for cardiotoxicity.[6]

Table 3. Summary of Key Trials

Study	Trial Name	Planned Enrollment	Completion Date
Ongoing			

Study	Trial Name	Planned Enrollment	Completion Date
ACTRN12614000341628	Strain Surveillance of Chemotherapy for Improving Cardiovascular Outcomes: The SUCCOUR Trial.	320	Aug 2021
NCT03825224	Evaluation of MyoStrain in Clinical Practice	100	Feb 2020
NCT02605512	Early Detection and Prediction of Cardiotoxicity in Radiotherapy-treated Breast Cancer Patients (BACCARAT)	120	Sep 2020
NCT02286908	Global Strain and Mechanical Dispersion May Predict Death and Ventricular Arrhythmias Better Than Ejection Fraction	3100	Dec 2021
NCT03297346	Early Detection of Cardiovascular Changes After Radiotherapy for Breast Cancer (EARLY-HEART)	250	May 2021
NCT04547465	2D Speckle-tracking Echocardiography in Chemotherapy-induced Cardiomyopathy with Cardiovascular Risk Factors	300	Jun 2023
Unpublished			
NCT03543228[a]	MyoStrain CMR for the Detection of Cardiotoxicity (Prefect)	50	Jun 2019

ACTRN: Australia New Zealand Clinical Trials Registration Number; NCT: national clinical trial.
[a] Denotes industry-sponsored or cosponsored trial.

References

1. Smiseth OA, Torp H, Opdahl A, et al. Myocardial strain imaging: how useful is it in clinical decision making?. Eur Heart J. Apr 14 2016; 37(15): 1196-207. PMID 26508168
2. Doherty JU, Kort S, Mehran R, et al. ACC/AATS/AHA/ASE/ASNC/HRS/SCAI/SCCT/SCMR/STS 2019 Appropriate Use Criteria for Multimodality Imaging in the Assessment of Cardiac Structure and Function in Nonvalvular Heart Disease: A Report of the American College of Cardiology Appropriate Use Criteria Task Force, American Association for Thoracic Surgery, American Heart Association, American Society of Echocardiography, American Society of Nuclear Cardiology, Heart Rhythm Society, Society for Cardiovascular Angiography and Interventions, Society of Cardiovascular Computed Tomography, Society for Cardiovascular Magnetic Resonance, and the Society of Thoracic Surgeons. J Am Soc Echocardiogr. May 2019; 32(5): 553-579. PMID 30744922
3. Trivedi SJ, Altman M, Stanton T, et al. Echocardiographic Strain in Clinical Practice. Heart Lung Circ. Sep 2019; 28(9): 1320-1330. PMID 31064715
4. Yingchoncharoen T, Agarwal S, Popovic ZB, et al. Normal ranges of left ventricular strain: a meta-analysis. J Am Soc Echocardiogr. Feb 2013; 26(2): 185-91. PMID 23218891
5. Thavendiranathan P, Poulin F, Lim KD, et al. Use of myocardial strain imaging by echocardiography for the early detection of cardiotoxicity in patients during and after cancer chemotherapy: a systematic review. J Am Coll Cardiol. Jul 01 2014; 63(25 Pt A): 2751-68. PMID 24703918
6. Negishi T, Thavendiranathan P, Negishi K, et al. Rationale and Design of the Strain Surveillance of Chemotherapy for Improving Cardiovascular Outcomes: The SUCCOUR Trial. JACC Cardiovasc Imaging. Aug 2018; 11(8): 1098-1105. PMID 29909105
7. Hendel RC, Lindsay BD, Allen JM, et al. ACC Appropriate Use Criteria Methodology: 2018 Update: A Report of the American College of Cardiology Appropriate Use Criteria Task Force. J Am Coll Cardiol. Feb 27 2018; 71(8): 935-948. PMID 29471942
8. Armenian SH, Lacchetti C, Lenihan D. Prevention and Monitoring of Cardiac Dysfunction in Survivors of Adult Cancers: American Society of Clinical Oncology Clinical Practice Guideline Summary. J Oncol Pract. Apr 2017; 13(4): 270-275. PMID 27922796
9. Blue Cross Blue Shield Association. Medical Policy Reference Manual, No. 2.02.31 (May 2021).

Documentation for Clinical Review

- No records required

Coding

This Policy relates only to the services or supplies described herein. Benefits may vary according to product design; therefore, contract language should be reviewed before applying the terms of the Policy.

The following codes are included below for informational purposes. Inclusion or exclusion of a code(s) does not constitute or imply member coverage or provider reimbursement policy. Policy Statements are intended to provide member coverage information and may include the use of some codes for clarity. The Policy Guidelines section may also provide additional information for how to interpret the Policy Statements and to provide coding guidance in some cases.

Type	Code	Description
CPT®	93356	Myocardial strain imaging using speckle tracking-derived assessment of myocardial mechanics (List separately in addition to codes for echocardiography imaging)
HCPCS	C9762	Cardiac magnetic resonance imaging for morphology and function, quantification of segmental dysfunction; with strain imaging
	C9763	Cardiac magnetic resonance imaging for morphology and function, quantification of segmental dysfunction; with stress imaging

Policy History

This section provides a chronological history of the activities, updates and changes that have occurred with this Medical Policy.

Effective Date	Action
05/01/2019	BCBSA Medical Policy Adoption
03/01/2020	Coding update
05/01/2020	Annual review. Policy statement and literature updated
08/01/2020	Coding update
05/01/2021	Annual review. No change to policy statement.
07/01/2021	No change to policy statement. Literature review updated.

Definitions of Decision Determinations

Medically Necessary: Services that are Medically Necessary include only those which have been established as safe and effective, are furnished under generally accepted professional standards to treat illness, injury or medical condition, and which, as determined by Blue Shield, are: (a) consistent with Blue Shield medical policy; (b) consistent with the symptoms or diagnosis; (c) not furnished primarily for the convenience of the patient, the attending Physician or other provider; (d) furnished at the most appropriate level which can be provided safely and effectively to the patient; and (e) not more costly than an alternative service or sequence of services at least as likely to produce equivalent therapeutic or diagnostic results as to the diagnosis or treatment of the Member's illness, injury, or disease.

Investigational/Experimental: A treatment, procedure, or drug is investigational when it has not been recognized as safe and effective for use in treating the particular condition in accordance with generally accepted professional medical standards. This includes services where approval by the federal or state governmental is required prior to use, but has not yet been granted.

Split Evaluation: Blue Shield of California/Blue Shield of California Life & Health Insurance Company (Blue Shield) policy review can result in a split evaluation, where a treatment, procedure, or drug will be considered to be investigational for certain indications or conditions, but will be deemed safe and effective for other indications or conditions, and therefore potentially medically necessary in those instances.

Prior Authorization Requirements (as applicable to your plan)

Within five days before the actual date of service, the provider must confirm with Blue Shield that the member's health plan coverage is still in effect. Blue Shield reserves the right to revoke an authorization prior to services being rendered based on cancellation of the member's eligibility. Final determination of benefits will be made after review of the claim for limitations or exclusions.

Questions regarding the applicability of this policy should be directed to the Prior Authorization Department at (800) 541-6652, or the Transplant Case Management Department at (800) 637-2066 ext. 3507708 or visit the provider portal at www.blueshieldca.com/provider.

Disclaimer: This medical policy is a guide in evaluating the medical necessity of a particular service or treatment. Blue Shield of California may consider published peer-reviewed scientific literature, national guidelines, and local standards of practice in developing its medical policy. Federal and state law, as well as contract language, including definitions and specific contract provisions/exclusions, take precedence over medical policy and must be considered first in determining covered services. Member contracts may differ in their benefits. Blue Shield reserves the right to review and update policies as appropriate.

Appendix A

POLICY STATEMENT (No changes)	
BEFORE	**AFTER**
Myocardial Strain Imaging 2.02.31 **Policy Statement:** Myocardial strain imaging in individuals who have exposure to medications or radiation that could result in cardiotoxicity is considered **investigational**. Myocardial strain imaging is considered **investigational** in all other situations.	**Myocardial Strain Imaging 2.02.31** **Policy Statement:** Myocardial strain imaging in individuals who have exposure to medications or radiation that could result in cardiotoxicity is considered **investigational**. Myocardial strain imaging is considered **investigational** in all other situations.