Complete Summary

GUIDELINE TITLE

Cardiac stress test supplement.

BIBLIOGRAPHIC SOURCE(S)

Institute for Clinical Systems Improvement (ICSI). Cardiac stress test supplement. Bloomington (MN): Institute for Clinical Systems Improvement (ICSI); 2007 Feb. 20 p. [26 references]

GUIDELINE STATUS

This is the current release of the guideline.

This guideline updates a previous version: Cardiac stress test supplement. Bloomington (MN): Institute for Clinical Systems Improvement (ICSI); 2004 Nov. 21 p.

COMPLETE SUMMARY CONTENT

SCOPE

DISEASE/CONDITION(S)

- Chest pain, including typical angina, atypical angina, or nonanginal chest pain
- Acute coronary syndrome (ACS)
- Coronary artery disease (CAD)
- Myocardial infarction (MI)
- Congestive heart failure (CHF)

GUIDELINE CATEGORY

Diagnosis
Risk Assessment

CLINICAL SPECIALTY

Cardiology
Family Practice
Internal Medicine
Nuclear Medicine

INTENDED USERS

Advanced Practice Nurses
Allied Health Personnel
Health Care Providers
Health Plans
Hospitals
Managed Care Organizations
Nurses
Physician Assistants
Physicians

GUIDELINE OBJECTIVE(S)

To aid the clinician in selecting the type of stress test for an individual patient in a specific clinical situation

TARGET POPULATION

All patients recommended for a cardiac stress test based on the Institute for Clinical Systems Improvement (ICSI) guidelines for Heart Failure in Adults; Stable Coronary Artery Disease; and Preoperative Evaluation.

INTERVENTIONS AND PRACTICES CONSIDERED

1. Cardiac stress testing, including standard exercise treadmill testing, and exercise or pharmacologic imaging (e.g., echocardiogram or nuclear perfusion imaging)
2. Medications for pharmacologic stress testing, including dobutamine, adenosine, and dipyridamole

MAJOR OUTCOMES CONSIDERED

Sensitivity and specificity of cardiac stress tests

METHODOLOGY

METHODS USED TO COLLECT/SELECT EVIDENCE

Searches of Electronic Databases

DESCRIPTION OF METHODS USED TO COLLECT/SELECT THE EVIDENCE

Not stated

NUMBER OF SOURCE DOCUMENTS

Not stated

METHODS USED TO ASSESS THE QUALITY AND STRENGTH OF THE EVIDENCE

Not stated

RATING SCHEME FOR THE STRENGTH OF THE EVIDENCE

Not applicable

METHODS USED TO ANALYZE THE EVIDENCE

Review of Published Meta-Analyses
Systematic Review

DESCRIPTION OF THE METHODS USED TO ANALYZE THE EVIDENCE

Not stated

METHODS USED TO FORMULATE THE RECOMMENDATIONS

Not stated

RATING SCHEME FOR THE STRENGTH OF THE RECOMMENDATIONS

Not applicable

COST ANALYSIS

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

METHOD OF GUIDELINE VALIDATION

Clinical Validation-Pilot Testing
Comparison with Guidelines from Other Groups
Internal Peer Review

DESCRIPTION OF METHOD OF GUIDELINE VALIDATION

Institute Partners: System-Wide Review

The guideline annotation, discussion, and measurement specification documents undergo thorough review. Written comments are solicited from clinical, measurement, and management experts from within the member groups during an eight-week review period.

Each of the Institute's participating member groups determines its own process for distributing the guideline and obtaining feedback. Clinicians are asked to suggest modifications based on their understanding of the clinical literature coupled with their clinical expertise. Representatives from all departments involved in implementation and measurement review the guideline to determine its operational impact. Measurement specifications for selected measures are developed by the Institute for Clinical Systems Improvement (ICSI) in collaboration with participating member groups following implementation of the guideline. The specifications suggest approaches to operationalizing the measure.

Guideline Work Group

Following the completion of the review period, the guideline work group meets 1 to 2 times to review the input received. The original guideline is revised as necessary, and a written response is prepared to address each of the responses received from member groups. Two members of the Cardiovascular Steering Committee carefully review the input, the work group responses, and the revised draft of the guideline. They report to the entire committee their assessment of four questions: (1) Is there consensus among all ICSI member groups and hospitals on the content of the guideline document? (2) Has the drafting work group answered all criticisms reasonably from the member groups? (3) Within the knowledge of the appointed reviewer, is the evidence cited in the document current and not out-of-date? (4) Is the document sufficiently similar to the prior edition that a more thorough review (critical review) is not needed by the member group? The committee then either approves the guideline for release as submitted or negotiates changes with the work group representative present at the meeting.

Pilot Test

Member groups may introduce the guideline at pilot sites, providing training to the clinical staff and incorporating it into the organization's scheduling, computer, and other practice systems. Evaluation and assessment occur throughout the pilot test phase, which usually lasts for three-six months. At the end of the pilot test phase, ICSI staff and the leader of the work group conduct an interview with the member groups participating in the pilot test phase to review their experience and gather comments, suggestions, and implementation tools.

The guideline work group meets to review the pilot sites' experiences and makes the necessary revisions to the guideline, and the Cardiovascular Steering Committee reviews the revised guideline and approves it for release.

RECOMMENDATIONS

RECOMMENDATIONS

MAJOR RECOMMENDATIONS

Note from the National Guideline Clearinghouse (NGC) and the Institute for Clinical Systems Improvement (ICSI): For a description of what has changed since the previous version of this guidance, refer to "Summary of Changes Report -- February 2007."

The recommendations for the selection of a particular cardiac stress test are presented in multiple tables, accompanied by detailed annotations. Clinical highlights and selected annotations follow. The reader is directed to the original guideline document for further discussion of each of the following topics.

Class of evidence (A-D, M, R, X) definitions are provided at the end of the "Major Recommendations" field.

Clinical Highlights

The following principles apply to both genders and should always be considered when using stress testing in any clinical situation: (*Annotation 1A*)

- Only order a test if the results will affect clinical management of the patient. (*Annotation 1A*)
- The likelihood of having coronary artery disease (CAD) should always be considered when applying the test results to the patient. (*Annotation 1B*)
- An important use of stress testing is to identify patients at high risk of cardiac death (those with left main or three vessel CAD). (*Annotation 1C*)
- A comprehensive stress test report includes information on several important diagnostic and prognostic variables and does not simply report the study as positive or negative on the basis of the exercise electrocardiogram (ECG) or images result. (*Annotation 1D*)
- Most patients without prior revascularization with a normal or near-normal resting ECG who are able to exercise adequately should undergo standard exercise treadmill testing rather than exercise or pharmacologic imaging (echo or nuclear imaging). (*Annotations 1E*)
- Diagnostic goal and other ECG findings indicate which stress imaging study to order. (*Annotation 3*)
- Associated medical conditions determine which pharmacologic stress testing to use. (*Annotation 4*)

These recommendations on stress test selection supplement the recommendations on stress test indications as provided in the Institute for Clinical Systems Improvement (ICSI) guidelines for: Heart Failure in Adults; Diagnosis and Treatment of Chest Pain and Acute Coronary Syndrome (ACS); Stable Coronary Artery Disease; and Preoperative Evaluation.

1. **General Principles and Philosophies Regarding Stress Testing**
    - **Only order a test if the results will affect clinical management of the patient.**

      Test results are unlikely to affect management decisions in certain clinical situations. For instance, patients at low probability of coronary artery disease (CAD) who are asymptomatic or have vague symptoms should not undergo stress testing since the large majority of these patients will have normal test results. Of the small percentage of

patients with a positive test, most will be false-positives. At the other extreme, an 80-year-old patient with multiple risk factors who develops typical angina walking only a few feet also should not undergo stress testing. This patient's clinical characteristics alone place him at high risk of left main or three-vessel CAD. The results of the exercise test in this case would not alter the clinician's diagnostic impression or the patient's risk classification. This patient should be either empirically treated with medical therapy or, if deemed a suitable candidate for revascularization, undergo coronary angiography.

- **The likelihood of having coronary artery disease (CAD) should always be considered when applying the test results to the patient.**

  The posttest probability of disease is the product of the pretest probability of disease and the probability that the test results are accurate. The clinician can estimate the patient's pretest probability of disease from clinical variables. The variables that have been shown to be most predictive are age, gender, and character of chest pain. Risk factors are not as strong predictors as these three variables, but the presence of risk factors, especially multiple risk factors, does increase the likelihood of coronary artery disease. Diabetes is the most important risk factor among the individual risk factors. See the original guideline document for the table titled "Pretest Probability of Coronary Artery Disease by Age, Gender, and Symptoms."

  The test is most useful for diagnostic purposes in patients whose pre-test probability of disease is in the intermediate range of coronary disease (e.g., a middle-aged man with atypical chest pain or a middle-aged woman with typical angina). The results of a stress test do not provide a definitive answer as to whether CAD is present or absent but only alter the probability that CAD is present or absent.

  Evidence supporting this recommendation is of class: R

- **An important use of stress testing is to identify patients at high risk of cardiac death (those with left main or three-vessel CAD).**

  In the current era the value of diagnostic modalities and therapeutic interventions is measured by their impact on patient prognosis. Although exercise testing is commonly performed for diagnostic purposes (i.e., to determine whether any CAD is present), a more important goal is to predict a patient's outcome. The Duke treadmill score is the most widely used method of prognostication. It may not apply to all patients being considered for stress testing (e.g., patients with recent infarction, previous cardiac surgery, or revascularization, and possibly asymptomatic patients). Nevertheless, the Duke treadmill score nomogram may be useful in estimating prognosis in other symptomatic patients.

The Duke Treadmill Scoring System can be determined by two methods:

Nomogram

See the original guideline document for a nomogram of the prognostic relations embodied in the treadmill score and a discussion of its use.

Equation

Treadmill score = duration of exercise in minutes on the Bruce protocol

- (minus) 5x maximal mm ST deviation

- (minus) 4x treadmill angina index

Treadmill Angina Index:

0 if no angina

1 if non-limiting angina

2 if limiting angina

High Risk = treadmill score less than -10
79% four-year survival

Moderate Risk = treadmill score -10 to +4
95% four-year survival

Low Risk = treadmill score greater than or equal to +5
99% four-year survival

Patients categorized as high-risk have a poor prognosis and generally should undergo coronary angiography. Many of these patients will have severe (left main or three-vessel) CAD. The three large randomized trails (Veterans Administration Study, European Cooperative Study, Coronary Artery Surgery Study) comparing medical therapy to coronary artery bypass surgery demonstrated that only patients with severe CAD demonstrated a survival benefit when treated with bypass surgery. On the other hand, patients categorized as low-risk have an excellent prognosis and are unlikely to benefit from an aggressive approach. These patients generally can be reassured and observed, or treated medically, if their chest pain is felt to be angina. Management of intermediate-risk patients is more problematic. Some of these patients may need to

undergo further evaluation, either coronary angiography or stress imaging.

Several studies have demonstrated that myocardial perfusion imaging and stress echo are useful for prognostic purposes. Many studies have shown that the imaging results provide independent and/or incremental prognostic information to clinical and exercise variables. The most useful prognostic information from nuclear imaging is provided by the extent and severity of the perfusion defect on the stress images (a variable referred to as the summed stress score). For echocardiography important prognostic variables are an increase (or no change) in end-systolic volume or a decrease in ejection fraction with stress compared to rest and the number of segments with abnormal wall motion and the severity of the wall motion abnormality within those segments (for instance, dyskinesis is more severe than hypokinesis) on the stress images.

Evidence supporting this recommendation is of classes: B, C, R

- **A comprehensive stress test report includes information on several important diagnostic and prognostic variables and does not simply report the study as positive or negative on the basis of the exercise ECG or images result.**

The most widely used criteria to define an abnormal study include 1-mm horizontal or downsloping ST-segment depression 0.08 seconds after the J point by standard treadmill testing, a perfusion defect by myocardial perfusion imaging, and worsening regional wall motion by echocardiography. A test should not be viewed as simply positive or negative by these criteria.

Several parameters should be examined, both during exercise and in the recovery period:

Exercise	Recovery
• Duration • Time of onset of ST depression rate • Magnitude of ST depression • Impaired heart rate increase (chronotropic incompetence) • Frequent ventricular ectopy • Decrease in systolic blood pressure	• Impaired heart rate recovery (persistently elevated heart rate) • Impaired blood pressure recovery (persistently elevated systolic blood pressure) • Frequent ventricular ectopy

Several of these variables, including limited exercise capacity (less than 85% of predicted), chronotropic incompetence (less than or equal to 80% of predicted heart rate reserve for patients not taking beta-blockers), impaired heart rate recovery (less than or equal to 12 beats/minute one minute into recovery when performing cool-down), and complex ectopy (greater than 7 beats/minute or complex forms), have been reported to predict mortality.

These variables should be considered along with the patient's clinical characteristics when using the test for diagnostic purposes and especially for risk stratification. For diagnostic purposes, the double product (systolic blood pressure x heart rate) and percent predicted maximum heart rate are helpful to assure that the patient has achieved an adequate level of myocardial "stress." For prognostic purposes, duration is more important, as applied in the Duke treadmill score. A common mistake when applying the results of stress imaging to patient management is to over-rely on the imaging results at the expense of the clinical and exercise data. Occasionally, patients with severe CAD will have normal or near-normal images. For instance, a diabetic patient with typical angina who develops ST-segment depression at a low workload but whose perfusion or echo images are normal should not be considered to be a low-risk patient. Such a patient still is at high risk of severe CAD despite the image results.

Evidence supporting this recommendation is of classes: B, R

- **Most patients without prior revascularization with a normal or near-normal resting ECG who are able to exercise adequately should undergo standard exercise treadmill testing rather than exercise or pharmacologic imaging (echocardiogram or nuclear imaging).**

  Standard exercise treadmill tests are currently underutilized in favor of more expensive imaging tests. Most patients with a normal or near-normal (less than 1-mm ST-segment depression) resting ECG who are able to exercise adequately (estimated 5 minutes or more of the Bruce protocol) should undergo standard exercise treadmill testing for the following reasons:

  - Ninety five percent of patients with a normal resting ECG have normal resting left ventricular ejection fraction. Therefore, most patients do not need to undergo an imaging procedure simply to measure ejection fraction.
  - The exercise ECG has similar sensitivity and much higher specificity in patients with a normal resting ECG as opposed to those with resting ST-T abnormalities. Therefore, the exercise ECG is highly accurate in patients with a normal resting ECG because there are less false-positive tests.
  - In patients with a normal resting ECG, the standard exercise test is nearly as accurate as the imaging procedures for correctly identifying patients with left main or three-vessel CAD and for predicting outcomes. The higher sensitivity of the

imaging procedures is due to the detection of more patients with one- or two-vessel CAD. However, the exercise ECG is nearly as accurate for correctly identifying the high-risk patients.

These recommendations are in agreement with other national guidelines to perform a standard treadmill test as the initial test in patients with a normal or near-normal resting ECG.

Preliminary data indicate that a small percentage of patients who are classified as low-risk by the Duke treadmill score are incorrectly classified and in fact, are at higher risk. These patients can be correctly classified as higher risk by nuclear imaging. These patients can be recognized on the basis of clinical variables before any stress testing is performed. The clinical variables that identify higher risk patients include a combination of advanced age, male gender, history of myocardial infarction, the presence of angina, and diabetes. If these findings can be confirmed in other studies, stress imaging may become the recommended initial stress test to evaluate patients with high risk clinical parameters.

The imaging procedures do have advantages over standard treadmill testing which can be beneficial in selected patients, including higher sensitivity, direct measurement of left ventricular resting ejection fraction, greater accuracy when the resting ECG precludes accurate interpretation during exercise (left bundle branch block [LBBB], paced ventricular rhythm, Wolff-Parkinson-White [WPW] syndrome, left ventricular hypertrophy [LVH] with strain, greater than 1-mm ST-segment depression), the ability to localize ischemia, and the provision of useful information when combined with pharmacologic stress. On the other hand, the standard exercise treadmill test is more widely available and can be performed at considerably lower cost.

Evidence supporting this recommendation is of classes: B, C, D, R

- **These principles apply to both genders.**

The exercise ECG has been shown to be useful for diagnostic and prognostic purposes in women but its accuracy is generally believed to be lower than that in men. The reported sensitivity and specificity in women from individual studies has been highly variable. Many studies have enrolled relatively few women. The major concern is the higher false-positive rate in women versus men. However, at the present time there are insufficient data to recommend stress imaging as the initial study for evaluation of CAD in women with normal or near-normal resting ECG. The principles discussed above should be applicable to both genders.

Evidence supporting this recommendation is of classes: C, R

2. **Contraindications to Stress Testing**

- Absolute Contraindications
    - Acute myocardial infarction (within 48 hours)
    - Unstable angina not previously stabilized by medical therapy - appropriate timing of testing depends on level of risk of unstable angina. In the absence of definitive evidence but in keeping with local practice, the work group suggests a minimum of six hours after unstable angina is stabilized.
    - Uncontrolled cardiac arrhythmias causing symptoms or hemodynamic compromise
    - Symptomatic severe aortic stenosis
    - Uncontrolled symptomatic heart failure
    - Acute pulmonary embolus or pulmonary infarction
    - Acute myocarditis or pericarditis
    - Acute aortic dissection
- Relative Contraindications

  Relative contraindications can be superseded if the benefits of exercise outweigh the risks.

    - Left main coronary stenosis
    - Moderate stenotic valvular heart disease
    - Electrolyte abnormalities
    - Severe arterial hypertension - in the absence of definitive evidence, the committee suggests systolic blood pressure of greater than 200 mm Hg and/or diastolic blood pressure of greater than 110 mm Hg
    - Tachyarrhythmias or bradyarrhythmias
    - Hypertrophic cardiomyopathy and other forms of outflow tract obstruction
    - Mental or physical impairment leading to inability to exercise adequately
    - High-degree atrioventricular block

Evidence supporting this recommendation is of class: R

3. **Deciding Which Stress Imaging Study to Order**

Expertise with the various imaging modalities should be the most important factor determining selection of a specific modality in an individual patient. All of the imaging modalities must be carefully performed and interpreted, preferably by personnel specifically trained in these techniques, to assure a high level of accuracy. If more than one technique is available in a given practice or institution, the technique that has been found to be most accurate should generally be the modality of choice.

Many factors may influence the selection of an imaging study in an individual patient. See the section titled "Benefits of Stress Test Selection" below. Cost is also a consideration. The charges for echocardiography are less than the charges for nuclear imaging in the Medicare population. Charges vary widely in the non-Medicare population. Chart #2, "Comparative Advantages of Stress Echocardiography and Nuclear Perfusion Imaging in Diagnosis of CAD," below, is intended to address the major factors that are considered in test selection

and to indicate if the imaging modalities are of similar value for each factor or if one of the modalities is better validated or considered to be superior to the others for a given factor.

Chart #1

Benefits of Stress Test Selection		
Most patients without prior revascularization with a normal or near-normal resting ECG and who are able to exercise adequately should undergo standard exercise treadmill testing rather than exercise or pharmacologic imaging (echocardiogram or nuclear imaging) for diagnostic and prognostic purposes. **Key:** **Yes = Useful** **No = Not Useful**		
Goal of Imaging Test	**Echo**	**Nuclear Perfusion Imaging**
Diagnosis of coronary artery disease (CAD)	Yes	Yes
Evidence supporting this recommendation is of classes: B, C, M, R		
Assess severe CAD/prognosis chronic CAD	Yes	Yes
Evidence supporting this recommendation is of classes: B, C, R		
Prognosis post myocardial infarction (MI)	Yes	Yes
Evidence supporting this recommendation is of classes: B, M, R		
Measure resting left ventricular ejection fraction (LVEF)	Yes	Yes
Evidence supporting this recommendation is of class: R		
Assess preoperative risk	Yes	Yes
Evidence supporting this recommendation is of class: M, R		
Identify viable myocardium	Yes	Yes
Evidence supporting this recommendation is of class: R		
Evaluate for cardiac etiology of exertional dyspnea	Yes	Yes
Evidence supporting this recommendation is of class: R		
Evaluate post coronary artery bypass graft (CABG)	Yes	Yes
Evidence supporting this recommendation is of classes: B, C, R		
Evaluate post percutaneous coronary intervention (PCI), which includes angioplasty, stents, etc.	Yes	Yes
Evidence supporting this recommendation is of classes: B, C, R		
Localize ischemia	Yes	Yes
Evidence supporting this recommendation is of class: R		
Patient and ECG factors		
Resting ST-T, Wolff-Parkinson-White (WPW) syndrome, left ventricular hypertrophy (LVH) strain	Yes	Yes

Benefits of Stress Test Selection		
Most patients without prior revascularization with a normal or near-normal resting ECG and who are able to exercise adequately should undergo standard exercise treadmill testing rather than exercise or pharmacologic imaging (echocardiogram or nuclear imaging) for diagnostic and prognostic purposes. **Key:** **Yes = Useful** **No = Not Useful**		
Goal of Imaging Test	**Echo**	**Nuclear Perfusion Imaging**
Evidence supporting this recommendation is of classes: R		
Left bundle-branch block (LBBB), ventricular pacing	Yes, with dobutamine	Yes, with adenosine or dipyridamole
Evidence supporting this recommendation is of classes: B, C, R		
Left ventricular ejection fraction in atrial fibrillation	Yes	No
Unable to lie supine for 10 minutes	Yes	No
Severe chronic obstructive pulmonary disease (COPD)	Lower technical success rate; contrast enhancement may increase technical success	Yes
Severe obesity	Lower technical success rate; contrast enhancement may increase technical success	Yes. Lower specificity due to breast/diaphragm artifact. Consider two-day single photon emission computed tomography (SPECT) or positron emission tomography (PET) if available.

Chart #2

Comparative Advantages of Stress Echocardiography and Nuclear Perfusion Imaging in Diagnosis of Coronary Artery Disease (CAD)	
Advantages of Stress Echocardiography	**Advantages of Nuclear Perfusion Imaging**
1. Higher specificity	1. Higher technical success rate
2. Versatility - more extensive	2. Higher sensitivity - especially for

Comparative Advantages of Stress Echocardiography and Nuclear Perfusion Imaging in Diagnosis of Coronary Artery Disease (CAD)	
Advantages of Stress Echocardiography	**Advantages of Nuclear Perfusion Imaging**
evaluation of cardiac anatomy and function	single-vessel coronary disease involving the left circumflex
3. Greater convenience/efficacy/availability	3. Better accuracy in evaluating possible ischemia when multiple resting left ventricular wall motion abnormalities are present
4. Lower cost	4. More extensive published data base - especially in evaluation of prognosis

Evidence supporting this recommendation is of classes: C, R

4. **Medications for Pharmacologic Stress Testing**

	Medications for Pharmacologic Stress Testing		
Patient-Related Factors	**Dobutamine**	**Adenosine[1]**	**Dipyridamole[1]**
Associated Medical Conditions (see the original guideline document for details on medical conditions)			
a) Severe chronic obstructive pulmonary disease (COPD) or asthma	Indicated	Contraindicated	Contraindicated
b) Heart block (second degree or third degree)	Indicated	Contraindicated	Contraindicated
c) Poorly controlled hypertension (HTN)	Contraindicated[2]	Indicated	Indicated
d) Relative hypotension	Contraindicated[2]	Indicated	Contraindicated
e) Unstable carotid cerebrovascular[4] disease	Contraindicated[2]	Indicated	Contraindicated
f) Significant ventricular ectopy	Contraindicated[2]	Indicated	Indicated
g) Glaucoma[3]	Contraindicated	Indicated	Indicated
Medical Therapies			
h) Theophylline	Indicated	Contraindicated	Contraindicated
i) Dipyridamole by mouth	Indicated	Contraindicated	Indicated
j) Beta-blocker[5]	Indicated	Indicated	Indicated

5. [1]For adenosine/dipyridamole withhold caffeinated products (e.g., chocolate, coffee) 24 hours
[2]These are not absolute contraindications but serious consideration of potential adverse effects should be given before ordering these tests.
[3]Not a contraindication to dobutamine but a contraindication to atropine.

[4]Recent transient ischemic attacks (TIAs) or stroke
[5]Beta-blockers are not contraindicated with dobutamine but they may require higher doses of dobutamine and/or earlier and higher doses of atropine. Vasodilator testing has decreased sensitivity in patients taking beta blockers.

Definitions:

Classes of Research Reports:

A. Primary Reports of New Data Collection:

Class A:

- Randomized, controlled trial

Class B:

- Cohort study

Class C:

- Non-randomized trial with concurrent or historical controls
- Case-control study
- Study of sensitivity and specificity of a diagnostic test
- Population-based descriptive study

Class D:

- Cross-sectional study
- Case series
- Case report

B. Reports that Synthesize or Reflect upon Collections of Primary Reports:

Class M:

- Meta-analysis
- Systematic review
- Decision analysis
- Cost-effectiveness analysis

Class R:

- Consensus statement
- Consensus report
- Narrative review

Class X:

- Medical opinion

CLINICAL ALGORITHM(S)

None provided

EVIDENCE SUPPORTING THE RECOMMENDATIONS

TYPE OF EVIDENCE SUPPORTING THE RECOMMENDATIONS

These guidelines are based on the American College of Cardiology/American Heart Association (ACC/AHA) guidelines: ACC/AHA 2002 guideline update for exercise testing: summary article. A report of the American College of Cardiology/American Heart Association Task Force on Practice Guidelines (Committee to Update the 1997 Exercise Testing Guidelines). J Am Coll Cardiol. 2002 Oct 16;40(8):1531-40.

The type of supporting evidence is classified for selected recommendations (see "Major Recommendations").

BENEFITS/HARMS OF IMPLEMENTING THE GUIDELINE RECOMMENDATIONS

POTENTIAL BENEFITS

- Appropriate utilization and interpretation of cardiac stress imaging studies
- Selection of appropriate stress imaging studies based on the goal of the imaging test and patient and electrocardiogram (ECG) factors
- Selection of appropriate medications for pharmacologic stress testing, taking into consideration patient-related factors and medical therapies

POTENTIAL HARMS

For patients with certain medical conditions, such as poorly controlled hypertension, relative hypotension, unstable carotid cerebrovascular disease, and significant ventricular ectopy, serious consideration of potential adverse effects should be given before using dobutamine for pharmacologic stress testing. Please refer to the original guideline for details on use of pharmacologic stress testing in these patient groups.

CONTRAINDICATIONS

CONTRAINDICATIONS

Refer to the Major Recommendations field for absolute and relative contraindications to stress testing as well as contraindications to the use of pharmacologic stress testing based on patient-related factors (associated medical conditions and medical therapies).

QUALIFYING STATEMENTS

QUALIFYING STATEMENTS

- These clinical guidelines are designed to assist clinicians by providing an analytical framework for the evaluation and treatment of patients, and are not intended either to replace a clinician's judgment or to establish a protocol for all patients with a particular condition. A guideline will rarely establish the only approach to a problem.
- This clinical guideline should not be construed as medical advice or medical opinion related to any specific facts or circumstances. Patients are urged to consult a health care professional regarding their own situation and any specific medical questions they may have.

IMPLEMENTATION OF THE GUIDELINE

DESCRIPTION OF IMPLEMENTATION STRATEGY

An implementation strategy was not provided.

IMPLEMENTATION TOOLS

Pocket Guide/Reference Cards

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

INSTITUTE OF MEDICINE (IOM) NATIONAL HEALTHCARE QUALITY REPORT CATEGORIES

IOM CARE NEED

Living with Illness

IOM DOMAIN

Effectiveness

IDENTIFYING INFORMATION AND AVAILABILITY

BIBLIOGRAPHIC SOURCE(S)

Institute for Clinical Systems Improvement (ICSI). Cardiac stress test supplement. Bloomington (MN): Institute for Clinical Systems Improvement (ICSI); 2007 Feb. 20 p. [26 references]

ADAPTATION

These guidelines are based on the American College of Cardiology/American Heart Association (ACC/AHA) guidelines: ACC/AHA 2002 guideline update for exercise testing: summary article. A report of the American College of Cardiology/American Heart Association Task Force on Practice Guidelines (Committee to Update the 1997 Exercise Testing Guidelines). J Am Coll Cardiol. 2002 Oct 16;40(8):1531-40.

DATE RELEASED

1999 Jun (revised 2007 Feb)

GUIDELINE DEVELOPER(S)

Institute for Clinical Systems Improvement - Private Nonprofit Organization

GUIDELINE DEVELOPER COMMENT

Organizations participating in the Institute for Clinical Systems Improvement (ICSI): Affiliated Community Medical Centers, Allina Medical Clinic, Altru Health System, Aspen Medical Group, Avera Health, CentraCare, Columbia Park Medical Group, Community-University Health Care Center, Dakota Clinic, ENT Specialty Care, Fairview Health Services, Family HealthServices Minnesota, Family Practice Medical Center, Gateway Family Health Clinic, Gillette Children's Specialty Healthcare, Grand Itasca Clinic and Hospital, HealthEast Care System, HealthPartners Central Minnesota Clinics, HealthPartners Medical Group and Clinics, Hutchinson Area Health Care, Hutchinson Medical Center, Lakeview Clinic, Mayo Clinic, Mercy Hospital and Health Care Center, MeritCare, Mille Lacs Health System, Minnesota Gastroenterology, Montevideo Clinic, North Clinic, North Memorial Care System, North Suburban Family Physicians, Northwest Family Physicians, Olmsted Medical Center, Park Nicollet Health Services, Pilot City Health Center, Quello Clinic, Ridgeview Medical Center, River Falls Medical Clinic, Saint Mary's/Duluth Clinic Health System, St. Paul Heart Clinic, Sioux Valley Hospitals and Health System, Southside Community Health Services, Stillwater Medical Group, SuperiorHealth Medical Group, University of Minnesota Physicians, Winona Clinic, Ltd., Winona Health

ICSI, 8009 34th Avenue South, Suite 1200, Bloomington, MN 55425; telephone, (952) 814-7060; fax, (952) 858-9675; e-mail: icsi.info@icsi.org; Web site: www.icsi.org.

SOURCE(S) OF FUNDING

The following Minnesota health plans provide direct financial support: Blue Cross and Blue Shield of Minnesota, HealthPartners, Medica, Metropolitan Health Plan, PreferredOne and UCare Minnesota. In-kind support is provided by the Institute for Clinical Systems Improvement's (ICSI) members.

GUIDELINE COMMITTEE

Cardiovascular Steering Committee

COMPOSITION OF GROUP THAT AUTHORED THE GUIDELINE

Work Group Members: Todd Miller, MD (Work Group Leader) (Mayo Clinic) (Nuclear Cardiology); John McBride, MD (HealthPartners Medical Group) (Echocardiology); John Basset, MD (Aspen Medical Group) (General Cardiology); Sai Haranath, MD (MeritCare) (Internal Medicine); Ann-Marie Evenson, BS (Institute for Clinical Systems Improvement) (Facilitator)

FINANCIAL DISCLOSURES/CONFLICTS OF INTEREST

In the interest of full disclosure, ICSI has adopted the policy of revealing relationships work group members have with companies that sell products or services that are relevant to this guideline topic. The reader should not assume that these financial interests will have an adverse impact on the content of the guideline, but they are noted here to fully inform readers. Readers of the guideline may assume that only work group members listed below have potential conflicts of interest to disclose.

Todd Miller, MD, over the past 12 months, has received research grant support from Bristol/Myers Squibb.

No other work group members have potential conflicts of interest to disclose.

ICSI's conflict of interest policy and procedures are available for review on ICSI's website at www.icsi.org.

GUIDELINE STATUS

This is the current release of the guideline.

This guideline updates a previous version: Cardiac stress test supplement. Bloomington (MN): Institute for Clinical Systems Improvement (ICSI); 2004 Nov. 21 p.

GUIDELINE AVAILABILITY

Electronic copies: Available from the Institute for Clinical Systems Improvement (ICSI) Web site.

Print copies: Available from ICSI, 8009 34th Avenue South, Suite 1200, Bloomington, MN 55425; telephone, (952) 814-7060; fax, (952) 858-9675; Web site: www.icsi.org; e-mail: icsi.info@icsi.org.

AVAILABILITY OF COMPANION DOCUMENTS

The following is available:

- Cardiac stress test supplement. Executive summary. Bloomington (MN): Institute for Clinical Systems Improvement, 2007 Feb. 1 p. Electronic copies: Available from the Institute for Clinical Systems Improvement (ICSI) Web site.
- ICSI pocket guidelines. April 2006 edition. Bloomington (MN): Institute for Clinical Systems Improvement, 2006. 298 p.

Print copies: Available from ICSI, 8009 34th Avenue South, Suite 1200, Bloomington, MN 55425; telephone, (952) 814-7060; fax, (952) 858-9675; Web site: www.icsi.org; e-mail: icsi.info@icsi.org.

PATIENT RESOURCES

None available

NGC STATUS

This summary was completed by ECRI on February 15, 2000. The information was verified by the guideline developer as of March 15, 2000. This summary was updated by ECRI on April 19, 2001. The information was verified by the guideline developer as of June 28, 2001. This summary was updated again by ECRI on May 7, 2002. The information was verified by the guideline developer on June 3, 2002. This summary was updated again by ECRI Institute on April 23, 2004, January 13, 2005 and on June 4, 2007.

COPYRIGHT STATEMENT

DISCLAIMER

NGC DISCLAIMER

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

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

Date Modified: 11/3/2008