Screening for Coronary Heart Disease

Recommendation Statement

U.S. Preventive Services Task Force

This statement summarizes the current U.S. Preventive Services Task Force (USPSTF) recommendations on screening for coronary heart disease and the supporting scientific evidence, and updates the 1996 recommendations contained in the *Guide to Clinical Preventive Services,* second edition.[1] Explanations of the ratings and of the strength of overall evidence are given in Appendix A and Appendix B, respectively. The complete information on which this statement is based, including evidence tables and references, is available in the summary article[2] and the systematic evidence review[3] on this topic, available through the USPSTF Web site (www.preventiveservices.ahrq.gov) and through the National Guideline Clearinghouse™ (www.guideline.gov). The summary article and the recommendation statement are also available from the Agency for Healthcare Research and Quality (AHRQ) Publications Clearinghouse in print through subscription to the *Guide to Clinical Preventive Services, Third Edition: Periodic Updates*. To order, contact the Clearinghouse at 1-800-358-9295 or e-mail ahrqpubs@ahrq.gov.

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Summary of Recommendations

The U.S. Preventive Services Task Force (USPSTF) recommends against routine screening with resting electrocardiography (ECG), exercise treadmill test (ETT), or electron-beam computerized tomography (EBCT) scanning for coronary calcium for either the presence of severe coronary artery stenosis (CAS) or the prediction of coronary heart disease (CHD) events in adults at low risk for CHD events. **D recommendation**.

*The USPSTF found at least fair evidence that ECG or ETT can detect some asymptomatic adults at increased risk for CHD events independent of conventional CHD risk factors (*see Clinical Considerations*), and that ETT can detect severe CAS in a small number of asymptomatic adults. Similar evidence for EBCT is limited. In the absence of evidence that such detection by ECG, ETT, or EBCT among adults at low risk for CHD events ultimately results in improved health outcomes, and because false-positive tests are likely to cause harm, including unnecessary invasive procedures, over-treatment, and labeling, the USPSTF concluded that the potential harms of routine screening for CHD in this population exceed the potential benefits.*

The USPSTF found insufficient evidence to recommend for or against routine screening with ECG, ETT, or EBCT scanning for coronary calcium for either the presence of severe CAS or the prediction of CHD events in adults at increased risk for CHD events. **I recommendation**.

The USPSTF found inadequate evidence to determine the extent to which the added detection offered by ECG, ETT, or EBCT (beyond that obtained by ascertainment of conventional CHD risk factors; see Clinical Considerations) *would result in interventions that lead to improved CHD-related health outcomes among adults at increased risk for CHD events. Although there is limited evidence to determine the magnitude of harms from screening this population, harms from false-positive tests (ie, unnecessary invasive procedures, over-treatment, and labeling) are likely to occur. As a result, the USPSTF could not determine*

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the balance between benefits and harms of screening this population for CHD.

Clinical Considerations

- Several factors are associated with a higher risk for CHD events (the major ones are nonfatal myocardial infarction and coronary death), including older age, male gender, high blood pressure, smoking, abnormal lipid levels, diabetes, obesity, and sedentary lifestyle. A person's risk for CHD events can be estimated based on the presence of these factors. Calculators are available to ascertain a person's risk for having a CHD event; for example, a calculator to estimate a person's risk for a CHD event in the next 10 years can be accessed at http://hin.nhlbi.nih.gov/atpiii/calculator.asp?usertype=prof. Although the exact risk factors that constitute each of these categories (low or increased risk) have not been established, younger adults (ie, men<50 years and women <60 years) who have no other risk factors for CHD (<5%–10% 10-year risk) are considered to be at low risk. Older adults, or younger adults with 1 or more risk factors (>15%–20% 10-year risk), are considered to be at increased risk.
- Screening with ECG, ETT, and EBCT could potentially reduce CHD events in 2 ways: either by detecting people at high risk for CHD events who could benefit from more aggressive risk factor modification, or by detecting people with existing severe CAS whose life could be prolonged by coronary artery bypass grafting (CABG) surgery. However, the evidence is inadequate to determine the extent to which people detected through screening in either situation would benefit from either type of intervention.
- The consequences of false-positive tests may potentially outweigh the benefits of screening. False-positive tests are common among asymptomatic adults, especially women, and may lead to unnecessary diagnostic testing, over-treatment, and labeling.
- Because the sensitivity of these tests is limited, screening could also result in false-negative results. A negative test does not rule out the presence of severe CAS or a future CHD event.
- For people in certain occupations, such as pilots and heavy equipment operators (for whom sudden incapacitation or sudden death may endanger the safety of others), considerations other than the health benefit to the individual patient may influence the decision to screen for CHD.
- Although some exercise programs initially screen asymptomatic participants with ETT, there is not enough evidence to determine the balance of benefits and harms of this practice.

Discussion

CHD is the leading cause of death in the United States; more than 700,000 of the deaths in 2000 were due to heart disease.[4] The overall costs of CHD and stroke in 2003 are estimated to be greater than $350 billion.[5]

Many clinicians ascertain a person's overall risk for CHD events by screening for cardiac risk factors and incorporating that information into risk prediction equations derived from the Framingham or other cohort studies.[3,6] Asymptomatic adults clearly benefit from risk factor modification proportional to their degree of CHD risk (ie, more intensive risk factor modification for people at higher risk).[7] Since those at high risk for CHD may already be receiving interventions to maximally reduce their risk for CHD events, screening may potentially be of greatest benefit to those presumed to be at intermediate risk for CHD who could be reclassified as being at high risk (and thus treated more aggressively) after additional testing. In addition to risk factor reduction, persons with symptoms of CHD who have severe CAS (defined as either triple vessel or left main coronary artery atherosclerotic disease with poor left ventricular function) clearly benefit from CABG or percutaneous transluminal coronary angioplasty (PTCA).[8–10] Among the asymptomatic population, those at higher risk for CHD events have a higher prevalence of severe CAS; thus, the yield of screening is expected to be greater in this population. However, it is uncertain whether this increased yield increases the detection of people with severe CAS to an important degree, and whether invasive revascularization procedures would benefit those who are asymptomatic as much as those who have symptoms of CAS.

The USPSTF reviewed the evidence as to whether supplementing the conventional CHD risk ascertainment strategy with additional screening using ECG, ETT, or EBCT, or using these 3 tests to identify people with severe CAS earlier, would lead to improved health outcomes in asymptomatic persons. The USPSTF found no randomized controlled trials with health outcomes that examined the extent to which ECG, ETT, or EBCT scanning for coronary calcium provided additional prognostic information beyond the currently used risk factor calculations. The Task Force further found that the 3 screening tests—ECG, ETT, and EBCT—have poor to fair accuracy in predicting CHD events.

Systematic reviews have reported that the sensitivity of resting ECG abnormalities for CHD events is low.[3,11] The prevalence of the most common ECG abnormalities (Q waves, left ventricular hypertrophy, bundle-branch blocks, and ST-segment depression) ranges from 1% to 10%.[3] Only a few studies have examined ECG abnormalities in the black population. Although major ECG abnormalities may be more prevalent in black men than in white men, these abnormalities may not confer the same risk for CHD death in black men (relative risk [RR], 1.95; 95% confidence interval [CI], 0.93–4.11) as in white men (RR, 2.72; 95% CI, 1.47–5.04).[12]

The sensitivity of ETT for the prediction of CHD events 3 to 12 years in the future ranges from 40% to 62%; the positive predictive value (PPV) ranges from 6% to 48%. The higher sensitivity of ETT reported in older studies may not be accurate because of the possibility of spectrum bias.[13,14] The prevalence of an abnormal ETT (ST-segment depression of ≥1 mm) reportedly ranges from 5% to 25%.[3] The yield of ETT in detecting severe CAS in asymptomatic middle-aged men is estimated to be 0.5%.[3,15] The PPV for future CHD in recent cohort studies (most of them conducted with asymptomatic men) is low (range, 6%–48%).[3] Adding nuclear perfusion to ECG analysis may increase sensitivity somewhat; however, the low PPV of ETT is due mainly to the low prevalence of CHD in asymptomatic persons and cannot be corrected simply by improving test accuracy.

For patients with symptoms of CHD, EBCT has a sensitivity of 80% and a specificity of 40% for detecting angiographically demonstrated CAS;[16] similar data for those who have no symptoms are lacking. A systematic review reported that higher calcium scores on EBCT were associated with higher risk for CHD events.[3] This review concluded that EBCT may have a role in better defining risk for CHD events in those who have been identified as being at intermediate risk based on traditional risk factors, but no study has examined the effect of EBCT data on clinical decision-making.[3]

Potential harms of screening asymptomatic patients for CHD include unnecessary invasive testing (eg, coronary angiography) and "labeling" of those who have had false-positive test results. In low-risk asymptomatic populations, most positive ECG test results occur in those who will not have a CHD event in the next 5 to 10 years.[3] One study reported that 71% of those without symptoms who had an abnormal ETT had no angiographically demonstrable CAS.[17] While the yield of screening is low in those at low risk for CHD, the potential for harm from false-positive tests is high. The USPSTF judged that the benefits of screening people at low risk for CHD would not outweigh the potential harms.

Due to the limited sensitivity of resting ECG and the low prevalence of CHD in asymptomatic adults, a majority of CHD events will occur among those with an initially normal ECG (ie, those who test false negative).[18] ETT can be normal or non-diagnostic in a large proportion of patients who will go on to have a CHD event, which may be explained partly by the fact that many acute CHD events result from sudden occlusion of a previously unobstructed artery segment.[19]

A large study, the Multi-Ethnic Study of Atherosclerosis (MESA), is ongoing. Data from this study will help to examine the independent prognostic information derived from EBCT in the context of accurate measurement of traditional risk factors and extended follow-up.[20] In the absence of such data for ECG, ETT, or EBCT, the USPSTF concluded that there is insufficient evidence to recommend for or against screening for CHD.

Recommendations of Others

The American College of Cardiology/American Heart Association (ACC/AHA) gave a class III recommendation for screening with exercise testing in asymptomatic persons without known coronary artery disease (CAD). For the evaluation of those with multiple risk factors as a guide to risk-reduction therapy, and for the evaluation of asymptomatic men older than 45 and women older than 55 who a) plan to start vigorous exercise, b) are involved in occupations in which impairment might impact public safety, or c) are at high risk for CAD due to other diseases, the ACC/AHA gave screening with exercise testing a class IIb recommendation. For the evaluation of asymptomatic persons with diabetes who plan to start vigorous exercise, the ACC/AHA gave screening with exercise testing a class IIa recommendation.[21] The ACC/AHA Writing Group does not recommend EBCT to diagnose obstructive CAD.[16] The American Academy of Family Physicians does not recommend use of routine ECG as part of a periodic health or a pre-participation physical exam in either asymptomatic children or adults.[22]

References

1. U.S. Preventive Services Task Force. *Guide to Clinical Preventive Services*. 2nd ed. Washington, DC: Office of Disease Prevention and Health Promotion; 1996.

2. Fowler-Brown A, Pignone M, Pletcher M, Tice JA, Sutton S, Lohr KN. Exercise tolerance testing to screen for coronary heart disease: a systematic review for the technical support for the U.S. Preventive Services Task Force. *Ann Intern Med.* 2004;140:W-9-W-24. Available at http://www.annals.org/cgi/content/full/140/7/W-9.

3. Pignone M, Fowler-Brown A, Pletcher M, Tice JA. *Screening for Asymptomatic Coronary Artery Disease.* Systematic Evidence Review No. 22 (Prepared by the Research Triangle Institute—University of North Carolina Evidence-based Practice Center under Contract No. 290-97-0011). Rockville, MD: Agency for Healthcare Research and Quality. February 2003. (Available on the AHRQ Web site at: www.ahrq.gov/clinic/serfiles.htm.)

4. National Center for Health Statistics, Centers for Disease Control and Prevention, U.S. Department of Health and Human Services. Fast Stats A to Z: Leading Causes of Death. Available at: http://www.cdc.gov/nchs/fastats/lcod.htm. Accessed April 4, 2003.

5. American Heart Association. Cardiovascular Disease Cost. Available at: http://www.americanheart.org/presenter.jhtml?identifier=4475. Accessed November 25, 2003.

6. Wilson PW, D'Agostino RB, Levy D, Belanger AM, Silbershatz H, Kannel WB. Prediction of coronary heart disease using risk factor categories. *Circulation*. 1998;97(18):1837–1847.

7. 27th Bethesda Conference. Matching the Intensity of Risk Factor Management with the Hazard for Coronary Disease Events. September 14–15, 1995. *J Am Coll Cardiol*. 1996;27(5):957–1047.

8. Coronary artery surgery study (CASS): a randomized trial of coronary artery bypass surgery. Survival data. *Circulation*. 1983;68(5):939–950.

9. Parisi AF, Folland ED, Hartigan P. A comparison of angioplasty with medical therapy in the treatment of single-vessel coronary artery disease. Veterans Affairs ACME Investigators. *N Engl J Med*. 1992; 326(1):10–16.

10. Coronary angioplasty versus coronary artery bypass surgery: the Randomized Intervention Treatment of Angina (RITA) trial. *Lancet*. 1993;341(8845): 573–580.

11. Ashley EA, Raxwal V, Froelicher V. An evidence-based review of the resting electrocardiogram as a screening technique for heart disease. *Prog Cardiovasc Dis*. 2001;44(1):55–67.

12. Kannel WB, Anderson K, McGee DL, Degatano LS, Stampfer MJ. Nonspecific electrocardiographic abnormality as a predictor of coronary heart disease: the Framingham Study. *Am Heart J*. 1987; 113(2 Pt 1):370–376.

13. Ashley EA, Myers J, Froelicher V. Exercise testing in clinical medicine. *Lancet*. 2000;356(9241): 1592–1597.

14. Froelicher VF, Callaham PR, Angelo J, Lehmann KG. Treadmill exercise testing and silent myocardial ischemia. *Isr J Med Sci*. 1989;25(9):495–502.

15. Blair SN 3rd, Kohl HW, Barlow CE, Paffenbarger RS Jr, Gibbons LW, Macera CA. Changes in physical fitness and all-cause mortality. A prospective study of healthy and unhealthy men. *JAMA*. 1995;273(14):1093–1098.

16. O'Rourke RA, Brundage BH, Froelicher VF, et al. American College of Cardiology/American Heart Association Expert Consensus document on electron-beam computed tomography for the diagnosis and prognosis of coronary artery disease. *Circulation*. 2000;102(1):126–140.

17. Hopkirk JA, Leader S, Uhl GS, Hickman JR Jr, Fischer J. Limitation of exercise-induced R wave amplitude changes in detecting coronary artery disease in asymptomatic men. *J Am Coll Cardiol*. 1984;3(3):821–826.

18. Sox HC Jr, Garber AM, Littenberg B. The resting electrocardiogram as a screening test. A clinical analysis. *Ann Intern Med*. 1989;111(6):489–502.

19. Coplan NL, Fuster V. Limitations of the exercise test as a screen for acute cardiac events in asymptomatic patients. *Am Heart J*. 1990;119(4):987–990.

20. Bild DE, Bluemke DA, Burke GL, et al. Multi-ethnic study of atherosclerosis: objectives and design. *Am J Epidemiol*. 2002;156:871–881.

21. Gibbons RJ, Balady GJ, Bricker JT, et al. 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). *Circulation*. 2002;106(14):1883–1892.

22. American Academy of Family Physicians. Clinical Care and Research. Leawood, Kansas. Available at: http://www.aafp.org/x10593.xml. Accessed November 20, 2003.

Appendix A
U.S. Preventive Services Task Force—Recommendations and Ratings

The Task Force grades its recommendations according to one of 5 classifications (A, B, C, D, I) reflecting the strength of evidence and magnitude of net benefit (benefits minus harms):

A. The USPSTF strongly recommends that clinicians provide [the service] to eligible patients. *The USPSTF found good evidence that [the service] improves important health outcomes and concludes that benefits substantially outweigh harms.*

B. The USPSTF recommends that clinicians provide [the service] to eligible patients. *The USPSTF found at least fair evidence that [the service] improves important health outcomes and concludes that benefits outweigh harms.*

C. The USPSTF makes no recommendation for or against routine provision of [the service]. *The USPSTF found at least fair evidence that [the service] can improve health outcomes but concludes that the balance of benefits and harms is too close to justify a general recommendation.*

D. The USPSTF recommends against routinely providing [the service] to asymptomatic patients. *The USPSTF found at least fair evidence that [the service] is ineffective or that harms outweigh benefits.*

I. The USPSTF concludes that the evidence is insufficient to recommend for or against routinely providing [the service]. *Evidence that [the service] is effective is lacking, of poor quality, or conflicting and the balance of benefits and harms cannot be determined.*

Appendix B
U.S. Preventive Services Task Force—Strength of Overall Evidence

The USPSTF grades the quality of the overall evidence for a service on a 3-point scale (good, fair, poor):

Good: Evidence includes consistent results from well-designed, well-conducted studies in representative populations that directly assess effects on health outcomes.

Fair: Evidence is sufficient to determine effects on health outcomes, but the strength of the evidence is limited by the number, quality, or consistency of the individual studies, generalizability to routine practice, or indirect nature of the evidence on health outcomes.

Poor: Evidence is insufficient to assess the effects on health outcomes because of limited number or power of studies, important flaws in their design or conduct, gaps in the chain of evidence, or lack of information on important health outcomes.

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