Review: Echocardiography, SPECT, and immediate angiography are cost-effective for detecting CAD

Garber AM, Solomon NA. **Cost-effectiveness of alternative test strategies for the diagnosis of coronary artery disease.** Ann Intern Med. 1999 May 4;130:719-28.

Question

How accurate and cost-effective are 5 diagnostic imaging tests for coronary artery disease (CAD) in patients with an intermediate pretest probability of having CAD (25% to 75%)?

Data sources

Studies of exercise electrocardiography (ECG), planar thallium imaging, single-photon emission computed tomography (SPECT), stress echocardiography, and positron emission tomography (PET) were identified by searching MEDLINE using the terms cardiac and sensitivity and terms related to each test and by searching bibliographies.

Study selection

English-language, blinded studies were included if patients had coronary angiography and ≥ 1 of the 5 noninvasive tests listed above; patients were the unit of analysis; stress was induced by exercise or pharmaceutical agents; and either ^{201}thallium or ^{99m}technetium was used for scintigraphic tests.

Data extraction

Patient and test characteristics, sensitivity, specificity, and costs in 1996 U.S. dollars discounted at 3%. Data on ECG came from a previous meta-analysis.

Main results

27 studies and 1 meta-analysis met the inclusion criteria. Weighted mean results of the meta-analysis are listed in the Table. A Markov model was used to estimate the test effects on costs of care; life expectancy; quality-adjusted life-years (QALYs); and costs/QALY for a 45-, 55- and 65-year-old man or woman with a 50% pretest probability of CAD based on a 30-year time horizon from a societal perspective. Tests showed small differences in sensitivity, specificity, cost, and health outcomes. Echocardiography, SPECT, and immediate angiography produced more QALYs than planar thallium imaging and ECG at an acceptable cost-effectiveness ratio; PET produced slightly better outcomes than SPECT, but at much greater cost. For a 55-year-old man, the cost-effectiveness ratio was $75 000/QALY for SPECT compared with echocardiography, $640 000/QALY for PET compared with SPECT, and $94 000/QALY for immediate angiography compared with SPECT.

Conclusion

Echocardiography, single-photon emission computed tomography, and immediate angiography are as accurate as, and more cost-effective than, other tests for diagnosing coronary artery disease in patients with an intermediate pretest probability of CAD.

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Weighted mean diagnostic test performances for diagnosis of coronary artery disease (CAD)*

Test	Number of studies	Patients with CAD	Sensitivity (range)	Specificity (range)	+LR	–LR
Planar thallium imaging	6	66%	79% (70 to 94)	73% (43 to 97)	2.9	0.3
SPECT	8	70%	88% (73 to 98)	77% (53 to 96)	3.8	0.2
Echocardiography	10	64%	76% (40 to 100)	88% (80 to 95)	6.3	0.3
PET	3	68%	91% (69 to 100)	82% (73 to 88)	5.1	0.1
Electrocardiography	132	66%	68%	77%	3.0	0.4

*PET = positron emission tomography; SPECT = single-photon emission computed tomography. LRs defined in Glossary and calculated from data in article.

Commentary

This economic decision analysis appropriately used pooled data from diagnostic test studies and other high-quality evidence to estimate the incremental costs and effectiveness of various methods of diagnosing suspected CAD.

The different diagnostic tests for CAD had strikingly similar sensitivities, specificities, and likelihood ratios. Although point estimates varied for each test, the ranges of sensitivity and specificity overlapped closely. This observation leads us to question whether the differences described are real. In addition, the observed gains in QALYs for each test were small; the differences between the tests were likely below the precision of each estimate of QALY.

Furthermore, the incremental cost per QALY gained for each test seems relatively large. For example, the cost-effectiveness ratio for SPECT compared with echocardiography, which is not even the baseline strategy, is $64 000/QALY. One may conclude from these observations that we are paying too much for comparatively little gain in the diagnosis of CAD.

This does not necessarily mean that we should abandon our current approach to diagnosis of suspected CAD. Other reasons may justify the expenses associated with testing, such as the reduction in uncertainty for patient and clinician from a negative test result. This sort of gain is rarely captured in decision analyses. An important feature of these tests is showing that patients are "normal." The economic attractiveness of the current strategy for diagnosing CAD, as a whole, may depend more on this type of hidden benefit than on any differences among the tests actually used.

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