Critical Review Form
Meta-analysis

Ioannidis JPA, et al. Accuracy of Imaging Technologies in the Diagnosis of Acute Cardiac Ischemia in the ED: A Meta-Analysis, Annals EM 2001; 37: 471-477

Guide	Question	Comments
I	***Are the results valid?***	
1.	Did the review explicitly address a sensible question?	Yes, *"to quantitatively evaluate the evidence on the diagnostic performance of imaging technologies (including rest and stress echocardiography and technetium-99m sestamibi scanning" for the diagnosis of acute cardiac ischemia and AMI in the ED"* (p. 471)
2.	Was the search for relevant studies details and exhaustive?	You need to review the separate "methods" paper (Annals EM 2001; 37: 453-460) to fully answer this question. The authors report a systematic review and meta-analysis of English-language medical literature from 1966-1998 (p. 471) using the following search terms: technetium sestamibi myocardial perfusion imaging, echocardiography, acute cardiac ischemia, acute myocardial infarction, unstable angina pectoris (p. 454). "Literature was retrieved from MEDLINE searches, references cited in the 1997 report, review of references from retrieved articles, and assistance from domain experts." **<u>Comments:</u>** a) <u>Detailed</u> – probably additional search terms applicable (myocardial perfusion imaging, chest pain, angina, ED, EM, etc.) b) <u>Exhaustive</u> – hardly. Did not search a number of databases (EMBASE, Cochraine), nor did they review research symposiums (American College of Cardiology, ACEP Scientific Assembly, etc.). Finally, they limited their search to English language. How many studies did they exclude by this less than 100% search? Maybe none, but the reader cannot be certain without doing the review themselves (or awaiting a future, more inclusive review). For interested readers, two excellent review articles detail the features that define a high quality EM systematic review: *Zed PJ, et al. Can J EM 2003; 5: 406-411* AND *Kelly KD, et al. Annals EM 2001; 38: 518-526.*

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<tr><td>3.</td><td>Were the primary studies of high methodological quality?</td><td>Each study was assessed on four dimension: study size (weight of evidence), methodological quality (internal validity), diagnostic performance or the magnitude of the clinical effect, or both, and applicability (generalizability) (p. 455). The authors defined 3 grades of methodological quality:

Grade A (least bias) - clear description of study setting and population as well as reference standard and diagnostic criteria. Very important that all or most of patients with negative results had verification (gold standard performed).
Grade B (susceptible to some bias)
Grade C (likely to have significant bias)

<u>Note:</u> this scale has been neither derived nor validated in a systematic fashion (see discussion of Jadad scale for randomized controlled trials in July 2004 Journal Club). Nonetheless, it makes intuitive sense.</td></tr>
<tr><td>4.</td><td>Were the assessments of the included studies reproducible?</td><td>It is <u>unknown</u> whether the search results or the quality assessment of the literature selected is reproducible because a kappa analysis is not provided.</td></tr>
<tr><td>II.</td><td>What are the results?</td><td></td></tr>
<tr><td>1.</td><td>What are the overall results of the study?</td><td><table><tr><th></th><th>Sensitivity*</th><th>Specificity*</th></tr><tr><td>Rest Echo</td><td>93% (81-97)</td><td>66% (43-83)</td></tr><tr><td>Sestamibi - ACI</td><td>89% (73-96)</td><td>77% (63-87)</td></tr><tr><td>Sestamibi - AMI</td><td>92-100%</td><td>49-84%</td></tr></table>* Parentheses represent 95% confidence intervals.

<u>Rest Echo</u> results based upon 3 studies (2 B, 1 C) totaling 397 patients with AMI prevalence ranging 3-30%.
<u>Sestamibi</u> results based upon 5 studies (3A, 2 B) totaling 1571 patients with AMI prevalence 2-12%.</td></tr>
<tr><td>2.</td><td>How precise are the results?</td><td>See the confidence intervals above. In general, sensitivities are fairly precise, but specificity is widely variable.</td></tr>
<tr><td>3.</td><td>Were the results similar from study to study?</td><td>a) Echo – different disease prevalence should impact critical analysis of test’s sensitivity and specificity, but across the various studies, the results seem consistent. Note, however the variable inclusion criteria, test criteria, and blinding in the various studies included in this meta-analysis (reflected in the author’s methodological grade, but should also impact critical reader’s interpretation of the applicability of this study to their patients).</td></tr>
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		b) Sestamibi – disease prevalence & test sensivity/specificity reasonably reproducible.

III.	***Will the results help me in caring for my patients?***	
1.	How can I best interpret the results to apply them to the care of my patients?	Based upon relatively few ED-specific studies, both resting Echocardiography and tech-99m sestamibi imaging of low risk chest pain patients appear to be sensitive and reasonably specific to identify either ACI or AMI. Based upon the random-effects model, overall sensitivity and specificity (translated into Likelihood Ratios) would change your post-test probability of an acute coronary syndrome on a patient with 15% pre-test probability in the following manner: 32% + Echo - 2% 41% + Sestamibi - 2%
2.	Were all patient important outcomes considered?	Outcomes of each individual trial not discussed in detail in this systematic review. One needs to pull the original articles to be certain, but outcomes presumeably included subsequent MI, cardiac mortality, and disability.
3.	Are the benefits worth the costs and potential risks?	Cost-benefit analysis not formally performed here, but given the current medical-legal malpractice climate, any test which reliably improves diagnostic accuracy and appropriate disposition of patients is beneficial to the emergency clinician.

Bottom Line: Relatively little ED-specific research exists for Echocardiography (resting or Dobutamine) or Sestamibi myocardial perfusion imaging to evaluate for underlying coronary artery disease. Based upon the current meta-analysis with several limitations, both imaging modalities appear to be sensitive to identify low risk chest pain patients with coronary disease. More research is required on different populations such as rural, elderly, female, and diabetic patients, as well as those with known (i.e. not low risk) CAD patients.