Thursday, 13 October 2016; Time: 14:20-14:40
Session: Fundamentals III: Safety and quality

Appropriate use Criteria

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BWH - BRIGHAM AND WOMEN’S HOSPITAL

ASNC

SNM MI
SOCIETY OF NUCLEAR MEDICINE
AND MOLECULAR IMAGING
Disclosures

Grants:
• Astellas
• American Heart Association
• National Institutes of Health
Overview: Appropriate Use Criteria

• Why?
• Methodology
• Literature review
• Tools
Institute of Medicine: Core Needs for Health Care

- Safe
- Effective
- Patient-centered
- Timely
- Efficient
- Equitable
AUC: Why?
Increasing radiation burden from imaging

A six fold increase in medical radiation
A 2.5 fold increase in MPI volume

Einstein AE. J Am Coll Cardiol. 2012;59:553-65.PMC3272627
Rising health care costs related to imaging

Figure 1: Total Medicare Expenditures for Imaging Services Paid under the Physician Fee Schedule, 2000 through 2006

Methods to manage utilization of imaging

- Insurance providers: Prior authorization, radiology benefit managers, denial
- Medical societies: Appropriate use criteria
  - Radionuclide AUC 2005, was one of the first AUC documents in the series
- Centers for Medicare & Medicaid Services (CMS) requires incorporation of AUC into a clinical decision support system starting in 2018
Guidelines vs. Performance Measures vs. AUC

• Guidelines
  • Exhaustive review of literature
  • Virtually all-inclusive
  • Best practice
  • “Should do, should not do”
    Class I, Class III, Class IIa, IIb

• Performance measures
  • Selective
  • Largely guideline based
  • “Must do”
  • Tools for quality measurement

• Appropriate Use Criteria - AUC
  • Selective indications
  • Largely guideline based
  • Clinical scenarios/frequency
  • “Reasonable to do”
ACCF Proposed Method for Evaluating the Appropriateness of Cardiovascular Imaging

1. Literature review and synthesis of the evidence
2. List of indications and definitions
3. Expert panel rates the indications in two rounds:
   - 1st Round – No interaction
   - 2nd Round – Panel interaction

Appropriateness Score:
- (7-9) Appropriate
- (4-6) Uncertain
- (1-3) Inappropriate

Validation:
- Retrospective comparison with clinical records
  
  % Use that is Appropriate, Uncertain, Inappropriate

- Prospective clinical decision aids
  
  Increase appropriateness
AUC: Definition

• “An appropriate imaging study is one in which the expected incremental information, combined with clinical judgment, exceeds the expected negative consequences by a sufficiently wide margin for a specific indication that the procedure is generally considered acceptable care and a reasonable approach for the indication.”
### AUC methodology & terminology

<table>
<thead>
<tr>
<th>Median score</th>
<th>RNI AUC 2005 (Indications=52)</th>
<th>RNI AUC 2009 (Indications = 67)</th>
</tr>
</thead>
<tbody>
<tr>
<td>7-9</td>
<td>Appropriate (27)</td>
<td>Appropriate (33)</td>
</tr>
<tr>
<td>4-6</td>
<td>Uncertain (12)</td>
<td>May be appropriate (9)</td>
</tr>
<tr>
<td>1-3</td>
<td>Inappropriate (13)</td>
<td>Rarely appropriate (25)</td>
</tr>
</tbody>
</table>

*Dorbala et al. J Nuc Med. 2015;63:380-406*
Appropriate use criteria: PET and SPECT equivalent
Multimodality AUC for Detection of CAD/Risk assessment

I. Detection of CAD/Risk assessment
II. Prior testing or procedure
III. Preoperative evaluation for non cardiac surgery
IV. Determine exercise level prior to initiation of exercise prescription or cardiac rehabilitation

<table>
<thead>
<tr>
<th>Indication Text</th>
<th>Exercise ECG</th>
<th>Stress RNI</th>
<th>Stress Echo</th>
<th>Stress CMR</th>
<th>Calcium Scoring</th>
<th>CCTA</th>
<th>Invasive Coronary Angiography</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Low pre-test probability of CAD</td>
<td>A</td>
<td>R</td>
<td>M</td>
<td>R</td>
<td>R</td>
<td>R</td>
<td>R</td>
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<tr>
<td>ECG interpretable AND able to exercise</td>
<td></td>
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<tr>
<td>2. Low pre-test probability of CAD</td>
<td></td>
<td>A</td>
<td>A</td>
<td>M</td>
<td>R</td>
<td>M</td>
<td>R</td>
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<tr>
<td>ECG uninterpretable OR unable to exercise</td>
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<tr>
<td>3. Intermediate pre-test probability of CAD</td>
<td>A</td>
<td>A</td>
<td>A</td>
<td>M</td>
<td>R</td>
<td>M</td>
<td>R</td>
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<tr>
<td>ECG interpretable AND able to exercise</td>
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</tr>
<tr>
<td>4. Intermediate pre-test probability of CAD</td>
<td>A</td>
<td>A</td>
<td>A</td>
<td>A</td>
<td>R</td>
<td>A</td>
<td>M</td>
</tr>
<tr>
<td>ECG uninterpretable OR unable to exercise</td>
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</tr>
<tr>
<td>5. High pre-test probability of CAD</td>
<td>M</td>
<td>A</td>
<td>A</td>
<td>A</td>
<td>R</td>
<td>M</td>
<td>A</td>
</tr>
<tr>
<td>ECG interpretable AND able to exercise</td>
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<tr>
<td>6. High pre-test probability of CAD</td>
<td></td>
<td>A</td>
<td>A</td>
<td>A</td>
<td>R</td>
<td>M</td>
<td>A</td>
</tr>
<tr>
<td>ECG uninterpretable OR unable to exercise</td>
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</tr>
</tbody>
</table>

Frequency of appropriate indications for SPECT MPI: Variable

Data From: Hendel RC. J Nucl Cardiol. 2015;22:16-21
Appropriate MPI:
Abnormal scans and events highest

Data From: Hendel RC. J Nucl Cardiol. 2015;22:16-21
Rates of coronary angiography and revascularization: Ischemia driven & high regardless of appropriateness

Appropriate/Uncertain N=823, 54.5%
Inappropriate, N=688, 45.5%

Rates of events low with inappropriate MPI irrespective of scan results
Results of AUC: Optimize appropriateness of testing

Desai et al. JAMA. 2015;314:2045-53
Top 5 most frequent inappropriate indications: A multicenter study

<table>
<thead>
<tr>
<th>Indication</th>
<th>Inappropriate Studies, %</th>
<th>% of Total Studies</th>
</tr>
</thead>
<tbody>
<tr>
<td>Detection of CAD</td>
<td>44.5</td>
<td>6.4</td>
</tr>
<tr>
<td>Asymptomatic, low CHD risk*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Asymptomatic, post-revascularization</td>
<td>23.8</td>
<td>3.4</td>
</tr>
<tr>
<td>&lt;2 yrs after PCI, symptoms before PCI</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Evaluation of chest pain, low probability</td>
<td>16.1</td>
<td>2.3</td>
</tr>
<tr>
<td>Interpretable ECG and able to exercise</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Asymptomatic/stable symptoms, known CAD &lt;1 yr after catheterization or abnormal prior SPECT</td>
<td>3.9</td>
<td>0.6</td>
</tr>
<tr>
<td>Pre-operative assessment</td>
<td>3.7</td>
<td>0.5</td>
</tr>
<tr>
<td>Low-risk surgery</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total†</td>
<td>92.0</td>
<td>13.2</td>
</tr>
</tbody>
</table>

ABIM Choosing Wisely

<table>
<thead>
<tr>
<th>Source</th>
<th>Point</th>
</tr>
</thead>
<tbody>
<tr>
<td>SNMMI</td>
<td>Do not perform routine annual stress testing after coronary artery revascularization.</td>
</tr>
<tr>
<td>ASNC</td>
<td>Do not perform stress cardiac imaging or coronary angiography in patients without cardiac symptoms unless high-risk markers are present.</td>
</tr>
<tr>
<td></td>
<td>Do not perform cardiac imaging in patients who are at low risk.</td>
</tr>
<tr>
<td></td>
<td>Do not perform radionuclide imaging as part of routine follow-up in asymptomatic patients.</td>
</tr>
<tr>
<td></td>
<td>Do not perform cardiac imaging as preoperative assessment in patients scheduled to undergo low- or intermediate-risk noncardiac surgery.</td>
</tr>
<tr>
<td></td>
<td>Use methods to reduce radiation exposure in cardiac imaging whenever possible, including not performing such tests when the benefits will likely be limited.</td>
</tr>
</tbody>
</table>
AUC: Unresolved questions

• Time of order
• Time of test
• Whose responsibility
  • Referring MD
  • Imaging MD
  • Patient
• Reimbursement
• Which societal AUC?
AUC decision support tool at time of order: Reduced inappropriate tests, changed medical Rx

100 physicians, 472 patients over 8 months

# Discordance Between AUC for Nuclear MPI From Different Specialty Societies: A Potential Concern for Health Policy

<table>
<thead>
<tr>
<th></th>
<th>ACCF No./Total (%) Inappropriate</th>
<th>ACR No./Total (%) Usually not appropriate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ischemia SDS &gt; 3</td>
<td>1/39 (2.6)</td>
<td>14/80 (17.5%)</td>
</tr>
<tr>
<td>Abnormal MPI</td>
<td>3/41 (7.3)</td>
<td>29/82 (35.4%)</td>
</tr>
</tbody>
</table>

**A** ACCF indications

- Not Matched
- Agree on Appropriateness
- Disagree on Appropriateness
AUC: Conclusions

• Nuclear cardiology technology has advanced tremendously
• AUC developed to
  • Use medical resources efficiently
  • Improve quality of medical care
  • Evaluate under or over utilization
• Online apps are available and tools at point of order are evolving
• Unresolved issues
  • AUC may soon be linked to payment for services
  • Agreement between AUC from different societies
AUC: Take home points

• Do not perform
  • Routine annual testing after coronary artery revascularization
  • Stress cardiac imaging or coronary angiography in patients without cardiac symptoms unless high-risk markers are present
  • Cardiac imaging in patients who are low risk
  • Radionuclide imaging as a part of routine follow-up of asymptomatic patients
  • Preoperative assessment in patients scheduled to undergo low or intermediate risk non cardiac surgery

• Use methods to reduce radiation exposure in cardiac imaging whenever feasible, including not performing the tests when the benefits will likely be limited
Thank you

BWH Cardiovascular imaging

Marcelo Di Carli, MD
Ron Blankstein, MD
Hicham Skali, MD
Viviany Taqueti, MD
Faculty
Fellows
Staff

Funding Sources

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American Society of Nuclear Cardiology
Tangley Lloyd Foundation
Burt Glazov Foundation
DeMoulas Foundation
National Institutes of Health
American Heart Association
SAVE THE DATE 7-9 May 2017, Vienna AUSTRIA

Call for abstracts & clinical cases
15 Sept – 21 Nov 2016

Early registration fee deadline
27 February 2017

#ICNC2017 www.icnc2017.org
Differences between Radionuclide AUC 2009 and Multimodality AUC 2013

Table 1. Differences between the appropriateness categorization based on the 2009 radionuclide imaging (RNI) AUC and the 2013 multimodality (MM) AUC

<table>
<thead>
<tr>
<th>Indication</th>
<th>2009 RNI²</th>
<th>2013 MM³</th>
</tr>
</thead>
<tbody>
<tr>
<td>High CHD risk asymptomatic</td>
<td>A</td>
<td>M</td>
</tr>
<tr>
<td>Low CHD risk syncope</td>
<td>I</td>
<td>M</td>
</tr>
<tr>
<td>Worsening symptoms, normal prior study</td>
<td>U</td>
<td>A</td>
</tr>
<tr>
<td>High CHD risk, Agaston score 100-400</td>
<td>A</td>
<td>M</td>
</tr>
<tr>
<td>Agaston score &gt; 400</td>
<td>A</td>
<td>M</td>
</tr>
<tr>
<td>Preop assessment, intermediate risk surgery, ≥1 risk factor with poor functional capacity</td>
<td>A</td>
<td>M</td>
</tr>
<tr>
<td>s/p CABG, asymptomatic, &lt;5 years</td>
<td>U</td>
<td>R</td>
</tr>
<tr>
<td>s/p CABG, asymptomatic, ≥5 years</td>
<td>A</td>
<td>M</td>
</tr>
</tbody>
</table>

A, Appropriate; M, may be appropriate; R, rarely appropriate; U, uncertain; I, inappropriate; Agaston score refers to CT-derived calcium scoring.