Stress Echo

Methods and Mechanisms

Tips and Tricks.

Theodora Zaglavara MD, PhD
Cardiologist

Department of Cardiac Imaging,
INTERBALKAN MEDICAL CENTER
Thessaloniki
Goals of Cardiac Imaging in Coronary Artery Disease: 

*The Ultimate Goal is to Improve Prognosis*

- ✔ Assessment of *Ischaemic Burden*
- ✔ Prognosis / risk stratification in patients with known or suspected CAD
- ✔ Myocardial Perfusion
- ✔ Ventricular dimensions and overall function
- ✔ Coexisting significant valve disease
- ✔ Detection of myocardial viability/myocardial scar
- ✔ Direct imaging of coronary arteries
- ✔ Vulnerable Coronary Plaque
- ✔ Coronary Flow Reserve
The Ischaemic Cascade

- Increasing Workload
- Dobutamine Stress CMR
- Contrast Echo/ Flow reserve
- Stress perfusion CMR
- Nuclear
- Stress echo
- Angina
- ECG changes
- Regional systolic dysfunction
- Diastolic dysfunction
- Flow heterogeneity = perfusion abnormality
- Decrease in coronary blood flow

Exercise treadmill time
Stress Methods and Imaging with Echo

- Steep-lateral decubitus position
- Raised left arm
- Cut-out mattress to permit visualization of the true apex while avoiding LV foreshortening
- Imaging at quiet respiration or end-expiration

INO = inotropic state  
HR = heart rate  
BP = systolic blood pressure
Know your Echo Machine - Optimize Contrast and Stress Echo Protocols
Tips for Obtaining Apical views

These views are performed in the interspace where the apex is felt, usually in the left 5th-6th interspace between the midclavicular and anterior axillary lines.

Medially/superiorly displaced position results in an enlarged RV and/or forshortened LV.
Tips for Optimising Apical views:

Moving the anterior or lateral wall to the middle of the sector can reduce wall-filling dropout.
Prognostic Stratification of a Negative Stress Echo Test

Lack of response is not normal, but not diagnostic of ischemia

Maximal Stress Achieved
Resting EF > 50%
Anti-ischaemic Therapy Off

Very Low Risk of Hard Cardiac Events (<0.5%/year)
Abnormal Response: Inducible Ischaemia at a Low Workload

Baseline

Peak Stress
Low Dose/Workload (Ischaemic Threshold)

Resting EF<40%
Anti – ischaemic Therapy On

LAD Coronary Territory

High Peak WMSI

Slow Recovery
Heterozonal Positivity or Baseline Dyssynergy

_The assessment and quantification of ischaemic burden rather than the pure detection of myocardial ischaemia, is the next important step towards optimizing therapy strategies in patients with CAD._
Selecting Suitable Patients

Pre-test probability

- Low
  - Stress echo
    - Unfeasible/ Equivocal
      - MSCT
        -
      -
  -+

- Intermediate
  -

- High
  - Coronary angiography
    -+
Tip: Know the Right Time to Stop

- Submaximal Stress has a Suboptimal Diagnostic Value
- Compared to Exercise complications are more common with pharmacologic stress and particularly dobutamine
LV Obliteration (Increased inotropic state & decreased loading) → Reduced wall stress → Potential cause of false negative results and/or hypotension
The gold Standard is not Always ‘Pure Gold’

Comparison of ‘Physiology’ (Ischaemia) to ‘Anatomy’ (% Stenosis)

- Limited reproducibility % stenosis
- % stenosis unrelated to CFR
- Underestimation of diffuse disease
- Infarct –producing plaques often noncritical
- Thrombus, spasm, inflammation, rupture, and emboization unrelated to plaque size
Impaired Flow Reserve /Perfusion Defect and Normal Wall Motion at Peak Stress (Proximal RCA plaque)
Factors Affecting Stress Echo Sensitivity

<table>
<thead>
<tr>
<th></th>
<th>Increases sensitivity</th>
<th>Decreases sensitivity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Previous myocardial infarction</td>
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<td>Absent</td>
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<tr>
<td>Antianginal therapy</td>
<td>Absent</td>
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<td>Stenosis severity</td>
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<td>Stenosis extent</td>
<td>Multivessel disease</td>
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<td>Stenosis morphology</td>
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<td>Stenosis location</td>
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<tr>
<td>Stress intensity</td>
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<td>Submaximal</td>
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<tr>
<td>Variant (vasospastic) angina</td>
<td>Yes</td>
<td>No</td>
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<tr>
<td>Echocardiography interpretation criteria</td>
<td>Lack of hyperkinesia</td>
<td>Marked hypokinesia</td>
</tr>
<tr>
<td>Echocardiography reader</td>
<td>Expert</td>
<td>Beginner</td>
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</tbody>
</table>
Lateral Wall Inducible Ischemia
Blocked Lcx Stent and SVG

Low Dose Dobutamine
Peak Dose Dobutamine
## Factors Affecting Stress Echo Specificity

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<tr>
<th></th>
<th>Increases sensitivity</th>
<th>Decreases sensitivity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Resting wall motion abnormalities</td>
<td>Absent</td>
<td>Present</td>
</tr>
<tr>
<td>Left ventricular hypertrophy, left bundle branch block</td>
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<td>Present</td>
</tr>
<tr>
<td>Stress intensity</td>
<td>Submaximal</td>
<td>Maximal</td>
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<tr>
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<td>No</td>
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<td>Marked hypokinesia</td>
<td>Lack of hyperkinesia</td>
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<tr>
<td>Interpreting the basal third of the inferior wall</td>
<td>No</td>
<td>Yes</td>
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Before you Start:
Tips on Setting Up a Stress Echo Service

1. Training is Essential: Avoid the “See 1- Do 1 -Teach 1” philosophy (100 is the number)
2. Know your Echo Machine – How it works
3. Liberal Use of Contrast
4. Regular Echo Lab Quality Control (compare stress echo results with angiography or cardiac CT)
5. Safety Starts with Verification of Test Indication
6. Do not underestimate ischemic risk, a fixed inflexible approach can be dangerous.