The Prognostic Value of Normal Stress gated-SPECT Myocardial Perfusion Imaging

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Concepts traditionally related to stress-only protocols

- Patients must be assessed at the time of their arrival to the laboratory to choose the most appropriate imaging protocol.
- Staff must be able to manage the everchanging patients flow.
- Physician should be called to interpret stress images as “normal” before the scheduling of a rest imaging.
- Lack of clinical evidence about safety and prognostic value of stress-only protocols.
Prognostic value

L. Shaw et al; JNC 2004
Diagnostic accuracy

![Bar chart showing diagnostic accuracy for Normalcy, Sensitivity, and Specificity across different stress conditions.](chart.png)

- **Normalcy**
  - Rest/stress: 94%
  - Full time stress only: 100%
  - Half time stress only: 78%

- **Sensitivity**
  - Rest/stress: 77%
  - Full time stress only: 83%
  - Half time stress only: 88%

- **Specificity**
  - Rest/stress: 67%
  - Full time stress only: 71%
  - Half time stress only: 56%

*Bateman et al.; J Nucl Cardiol 2009*
Aim of the present study is to validate the prognostic value of $^{99m}$Tc gated-SPECT stress only imaging in a large cohort of patients with low-to-intermediate pre-test likelihood of coronary artery disease.
Out of 16,729 patients DB undergoing a Tc-99m gated MPI and over a 41±7 months period, we analyzed a cohort of 5,830 pts with a low-to-intermediate pre-test likelihood of CAD and normal Tc-99m gated-SPECT imaging.

“Stress only” (1,977 pts) group was compared to “two days stress/rest” (3,853) group.
Methods

Only patients with normal perfusion, normal LVEF, wout known CAD and/or pre-organ transplantation were included. Mortality for all causes and cardiac causes were determined and survival was analyzed using Kaplan-Meier stat in a FUP of 41± 7 mo).

Perfusion and function gating quantitation were automatically calculated with the use of Autoquant® software package in all pts. No attenuation correction was used.

1° day

Tc-99m tetrofosmin (12.2±2 mCi)*

STRESS gated-SPECT

2° day (13.1±2.6 mCi)

REST gated-SPECT

10-15’ 30’

Totale dose stress + rest imaging (25.6±3.1 mCi)*
Methods

**Definition of “Normal stress gSPECT images”**

- LV perfusion which appears visually homogeneous
- Cavity size “normal”; L/H ratio < 0.42; absent TID (<1.22)
- Early post-stress LVEF ≥ 50%
- Early post-stress “normal” regional wall motion and wall thickening
- Quantitative analysis with no perfusion defect (0%) at 2.5 SD / SSS < 3 (LV 17 segments model)
## Baseline demographic data

<table>
<thead>
<tr>
<th>Clinical Characteristics</th>
<th>Total (5,830 pts)</th>
<th>Stress only (1,977 pts)</th>
<th>Stress/Rest (3,853 pts)</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Age</strong></td>
<td>58±12</td>
<td>55±12</td>
<td>63±11</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td><strong>Female sex</strong></td>
<td>3,635 (62.3%)</td>
<td>1,285 (65%)</td>
<td>2,350 (61%)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td><strong>Mean number of risk factor</strong></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td><em>Hypertension</em></td>
<td>3,323 (56.9%)</td>
<td>1,077 (54.5%)</td>
<td>1,365 (58.1%)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td><em>Hyperlipidemia</em></td>
<td>2,373 (40.7%)</td>
<td>769 (38.9%)</td>
<td>1,622 (42.1%)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td><em>Diabetes Mellitus</em></td>
<td>1,807 (30.9%)</td>
<td>561 (28.4%)</td>
<td>1,213 (31.5%)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td><em>Smoking</em></td>
<td>612 (10.4%)</td>
<td>195 (9.9%)</td>
<td>447 (11.6%)</td>
<td>&lt;0.001</td>
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<tr>
<td><strong>Indication for SPECT</strong></td>
<td></td>
<td></td>
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<tr>
<td><em>Chest pain</em></td>
<td>4,443 (76.2%)</td>
<td>1,451 (73.4%)</td>
<td>3,047 (79.1%)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td><em>Exertional Dyspnea</em></td>
<td>241 (4.1%)</td>
<td>97 (4.9%)</td>
<td>154 (4.0%)</td>
<td>&lt;0.01</td>
</tr>
<tr>
<td><em>Ischemic stress ECG</em></td>
<td>711 (12.1%)</td>
<td>272 (13.8%)</td>
<td>420 (10.9%)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td><strong>Stressor used</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Exercise</em></td>
<td>3,475 (59.7%)</td>
<td>2,477 (64.3%)</td>
<td>1,081 (54.7%)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td><em>Pharmacologic</em></td>
<td>2,355 (40.3%)</td>
<td>705 (35.7%)</td>
<td>1,679 (43.6%)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td><strong>Mean Duke Treadmill score</strong></td>
<td></td>
<td></td>
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</tr>
<tr>
<td><em>Low risk</em></td>
<td>3,807 (65.3%)</td>
<td>1,237 (62.6%)</td>
<td>2,616 (67.9%)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td><em>Intermediate risk</em></td>
<td>2,023 (34.7%)</td>
<td>733 (37.1%)</td>
<td>1,202 (31.2%)</td>
<td>&lt;0.001</td>
</tr>
</tbody>
</table>
RESULTS

Survival for the entire cohort according to gSPECT Protocol

- Stress + Rest
- Stress only

% survival

0.5 0.6 0.7 0.8 0.9 1.0

Years

0 1 2 3 4

All cause mortality

Log-rank p=0.90 (adjusted)

0.989 / 0.987

55 total deaths (2.8%)
127 total deaths (3.3%)
RESULTS

Survival on the basis of sex for each gSPECT Protocol

FEMALE

Log-rank p=0.69 (adjusted)

MALE

Log-rank p=0.98 (adjusted)
RESULTS

Survival on the basis of Stressor Modality according to gSPECT Protocol

**Treadmill**

- Stress + Rest
- Stress only

Log-rank p=0.56 (adjusted)

**Pharmacologic**

- Stress + Rest
- Stress only

Log-rank p=0.68 (adjusted)
RESULTS

Survival on the basis of Duke Treadmill Score according to gSPECT Protocol

Low Risk

Intermediate risk

Log-rank p=0.18 (adjusted)

Log-rank p=0.98 (adjusted)

% survival

Years

Stress + Rest
Stress only

Stress + Rest
Stress only
RESULTS

Survival on the basis of DM according to gSPECT Protocol

Diabetics

Log-rank p=0.30 (adjusted)

% survival

Years

Non Diabetics

Log-rank p=0.32 (adjusted)

% survival

Years

Stress + Rest
Stress only

Stress + Rest
Stress only
RESULTS

Survival for the entire cohort according to gSPECT Protocol

- 10 cardiac deaths (0.5%)
- 23 cardiac deaths (0.6%)

Log-rank p=0.95 (adjusted)
The prognosis of a normal stress-only Tc-99m Myocardial perfusion imaging study

Patients (4910 pts -> 1673 to only stress) at lower pre-test risk for CAD

% survival

6 18 30 48 60 months

p=0.29

96,7 %

95,2 %

W. Lane Duvall et al. JNC; 2010, 17: 370
Conclusions

• This study is limited for its retrospective, non randomized nature but represent current clinical practice

• Stress only GMPI is feasible and has similar prognostic value at distance when compared to stress/rest protocol.

• Stress only protocol have the ability to provide robust prognostic informations with shorter test time (1-day in approx 60 min) and less radiation exposure (8-15 mCi TC-99m agent).
“Stress only” GMPI should be encouraged in patients with normal stress perfusion, normal EF, w/o known CAD.

Test time radiation dose and imaging costs will be decreased.”