Myocardial Perfusion Scintigraphy Report Writing

JERRY M. OBALDO, MD MHA
What is it that we do?
STRESS MYOCARDIAL PERFUSION SCINTIGRAPHY

Clinical information: Patient was referred for evaluation of chest pain; r/o CAD. Presenting with elevated cholesterol and triglycerides; smoker for 20 pack-years.

Exercise ECG findings
Resting 12-lead ECG showed normal sinus rhythm. The patient underwent treadmill exercise for 9 min 30 secs using the modified Bruce protocol. Peak heart rate was 144 bpm (90% of predicted maximum) while peak blood pressure was 170/100 mmHg. No significant ST segment changes nor arrhythmias were seen. The exercise test was stopped because of fatigue and shortness of breath. The ECG portion of the test was negative for exercise-induced ischemia.

SPECT findings
Images taken 45 minutes after a rest injection of 8 mCi of Tc-99m sestamibi showed uniform tracer distribution in the myocardial segments. Repeat imaging 15 minutes after a separate injection of 22 mCi of Tc-99m sestamibi at peak exercise showed large, moderate to severe labeling defects in the anterior segments. Gated SPECT revealed adequate wall motion and thickening post-exercise. Left ventricular parameters were as follows: EDV - 90 ml; ESV - 30 ml; EF - 67%.

INTERPRETATION:
Large, moderate to severe, stress-induced myocardial perfusion abnormality in the anterior segments (distribution of the LAD coronary artery). Preserved LV wall function.

(Signed)
JERRY M. OBALDO, MD MHA DFM FPSNM
Scintigraphy report

Our primary responsibility

Responsibility primarily ours
Importance of written report

- Usually the only interaction with clinicians
- Used for reimbursement, quality control, teaching
- Medico-legal document
Post-thyroidectomy
Content and Style
Technically acceptable

- Be aware of patient body habitus
- Review planar projections
- Check selection of LV long axis
- Normalize tomographic slices to maximal counts
- Assess images for artifacts
- Review polar maps and gated tomograms
Components of the MPS report

- Indications for the procedure
- Clinical information
- Procedure
- Findings
- Impression
Indications

- Diagnosis of coronary artery disease
- Delineation of extent and severity of disease
- Risk stratification
- Determination of myocardial viability
- Assessment of acute chest pain syndromes

ASNC Consensus Statement
Clinical information

- Demographics (age, sex, race)
- Body habitus (height, weight)
- Symptoms
- Medications
- Cardiac risk factors
- Prior cardiac events
- Prior diagnostic tests
- Therapeutic cardiac procedures

ASNC Consensus Statement
What should we include in report?

- Just enough to clarify indication / protocol
- Clinical information rarely provided by clinician
- Clinical condition often unknown by patient
- Requesting physician may be annoyed by inaccurate information or when judgement is questioned
Procedure

- Type and protocol of stress procedure
- Pharmacologic agents used, with total dose
- Adequacy of stress
- Symptoms during stress
- Hemodynamic response (heart rate, blood pressure)
- Electrocardiographic changes
- Radiopharmaceuticals used (with dose)
- Imaging protocol
- Functional data
- Use of attenuation/scatter correction

ASNC Consensus Statement
Findings

- Study quality
- Size of left and right ventricles at stress and rest
- Defect description (size, reversibility, severity, location)
- Extensiveness (transient cavity dilation/transient ischemic dilation, lung activity, right ventricular activity)
- Left ventricular function (global, regional)
- Extracardiac activity

ASNC Consensus Statement
Defect extent

- Large: >1/3 of LAD territory, or 1/2 of RCA or LCX territory
- Moderate: 1/6 to 1/3 of LAD territory, or 1/4 of RCA or LCX territory
- Small: <1/6 of LAD territory, or <1/4 of RCA or LCX territory
Defect severity

- Marked: <40% of maximal myocardial count density
- Moderate: 40% to 59% of maximal myocardial count density
- Mild: 60% to 80% of maximal myocardial count density
Defect reversibility

- Complete: >90% reversible
- Partial: 30% to 90% reversible
- Primarily fixed: 10% to 30% reversible
- Fixed: <10% reversible
QuickTime™ and a Microsoft Video 1 decompressor are needed to see this picture.
Impression

- Normal
- Probably normal
- Equivocal
- Probably abnormal
- Abnormal

ASNC Consensus Statement

<10%
Structured reporting

- Written report using standardized content and definitions in a coherent, clinically relevant, and predictable format

- Process of organizing and coding data: procedure, physical findings, images, waveforms, measurements and interpretations

ACCF/ACR/AHA/ASE/ASNC/HRS/NASCI/RSNA/SAIP/SCAI/SCCT/SCMR
2008 Health Policy Statement on Structured Reporting in Cardiovascular Imaging
1 = Basal anterior
2 = Basal anteroseptal
3 = Basal inferoseptal
4 = Basal inferior
5 = Basal inferolateral
6 = Basal anterolateral
7 = Mid anterior
8 = Mid anteroseptal
9 = Mid inferoseptal
10 = Mid inferior
11 = Mid inferolateral
12 = Mid anterolateral
13 = Apical anterior
14 = Apical septal
15 = Apical inferior
16 = Apical lateral
17 = Apex

Visual scoring
0 = No defect
1 = Mildly reduced
2 = Moderately reduced
3 = Severely reduced
4 = Absent activity

Summed stress score
Summed rest score
Summed difference score
Improved transfer of information

- Key report components will not be omitted if elements are listed systematically within a standard template.
- Common lexicons are used to standardize descriptors
- Data extraction easier if in an expected location and in standard defined terminology
- Comparison between studies would be facilitated
- Redundant testing may be reduced
Other administrative advantages

- Quality assurance activities (including auditing) are facilitated through imposed consistency of structured data collection and reporting
- Structured reporting and underlying structured data are critical to interoperability between electronic medical record systems
- Cost savings may be achieved by added efficiency
Structured data elements

- Site administrative data
- Study demographics
  - Patient demographics
  - Clinical information
- Stress testing data
- ECG data
  - Resting ECG data
  - Stress ECG data
- Imaging data
  - Imaging parameters
  - LV perfusion
  - LV perfusion quantitation
  - Stress LV function parameters
  - Rest LV function parameters
  - RV parameters
  - FPRNA/ERNA (Rest and Exercise) specific variables
  - Viability—qualitative analysis
  - Viability—quantitative analysis
- Overall impression

ACC/AHA Task Force on Clinical Data Standards
Competing principles in Structured Reporting

- Consistency ↔ Flexibility
- Completeness ↔ Conciseness
- Required Elements ↔ Optional Elements
- Universality ↔ Proprietary
STYLE
STYLE

- Given little attention in training programs
  - Coakley F et al. AJR 2003
  - Hall FM. AJR 2000

- Personal preferences
Institutional style guidelines

- Brevity
- Clarity
- Pertinence

Department of Radiology
Memorial Sloan Kettering Cancer Center
Interpretation

- What to call it?
  - Conclusion / Impression / Reading / Summary

- Format?
  - Numbered (Wilcon J. Applied Radiology 2006)
  - Do not number, separate lines (Hall FM. AJR 2000)

- Where to put it?
  - Beginning of report
  - End of report
Fraction of clinicians reading report

Interpretation only

Entire Report 38%

Clinger et al. Radiology 1988;169:825-6
Location of interpretation - Clinicians’ preference

- Beginning: 32%
- End: 29%
- No preference

Clinger et al. Radiology 1988;169:825-6
Inductive reasoning logic flow

Observations

Interpretation
Scintigraphic hierarchy of terms

- Describe and interpret to the highest level possible
  - “Be as helpful as you can . . .”
- Use terminology appropriate to the level
  - “. . . without putting yourself in jeopardy.”
Scintigraphic hierarchy of terms

1. Tracer kinetics
2. Physiological processes
3. Disease states

Observations

Interpretation
<table>
<thead>
<tr>
<th>Hierarchy level</th>
<th>Example phrases</th>
<th>Appropriate section</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Tracer kinetics</td>
<td>“Moderately decreased tracer activity in the inferior segments that improved at rest”</td>
<td>Observations</td>
</tr>
<tr>
<td>2. Physiological</td>
<td>“Reversible ischemia in the inferior segments”</td>
<td>Interpretation (maybe Observation)</td>
</tr>
<tr>
<td></td>
<td>processes</td>
<td></td>
</tr>
<tr>
<td>3. Disease states</td>
<td>“Significant stenosis of RCA”</td>
<td>Interpretation</td>
</tr>
</tbody>
</table>
Thyroid scan (unfortunately, an actual report)

- Thyroid scintigraphy was performed in multiple views after injection of 5 mCi of Tc-99m pertechnetate.

- Observation:
  - The thyroid gland was not visualized.

- Interpretation:
  - Non-visualized thyroid gland.
Bone scan (unfortunately an actual report)

- Whole body bone scans were performed 3 hours after injection of 20 mCi of Tc-99m HDP.

Observation:
- Follow up whole body bone scan using the Siemens Orbiter system and Quadra computer showed no change in the bone uptake in the sternum and 3rd anterior rib.

Interpretation:
- Stable tracer activity in the sternum and 3rd anterior rib.
## Scintigraphic hierarchy of terms

<table>
<thead>
<tr>
<th>Hierarchy level</th>
<th>Example phrases</th>
<th>Appropriate section</th>
</tr>
</thead>
</table>
| 1. Tracer kinetics / Scan findings    | “LVEDV = 200 ml
LVESV = 130 ml
LVEF = 35%”                                                                        | Observations        |
| 2. Physiological processes            | “Dilated left ventricle with wall dysfunction”                                   | Interpretation      |
| 3. Disease states                     | “Findings consistent with cardiomyopathy”                                        | Interpretation      |
Scintigraphic hierarchy of terms

- Description:
  - “There is mild hypoperfusion in the inferior segments that persisted in the rest images.

- Interpretation:
  - Soft tissue attenuation artifact in the inferior segments.
Inappropriate hierarchy

- Description:
  - “There is mild hypoperfusion in the inferior segments that persisted in the rest images.

- Interpretation:
  - Soft tissue attenuation artifact in the inferior segments.
Grammar

- Jargon
  - “photon-deficient”, “reverse redistribution”

- Colloquialism
  - “on the other hand”, “in contrast”

- Tautological phrases / redundancies
  - “small-sized”, “oval-shaped”, “close proximity”
Tense

- **Past tense**
  - “Stress gated SPECT was performed after injection of 3 mCi of thallium-201”
  - “The scan showed uniform tracer distribution”

- **Present tense**
  - “There is a severe defect in the inferior segments”
Type of study: MYOCARDIAL PERFUSION IMAGING WITH /SESTAMIBI/ TETROFOSMIN/ THALLIUM SPECT AT REST AND AFTER EXERCISE, AND GATED SPECT (AND RESTING FIRST PASS RADIONUCLIDE ANGIOGRAPHY).

History: (e.g. 65-yr woman with known coronary artery disease and recurrent chest pain).

Indication: (e.g. Evaluation for coronary insufficiency; risk stratification; evaluation of ischemia; evaluation of functional capacity; evaluation of myocardial viability).

Procedure: The patient exercised on treadmill (bicycle) for a total of ___ minutes, reaching stage ___ of the (Bruce; modified Bruce; etc) protocol, achieving an estimated workload of ___ METs. The heart rate was ___ bpm at baseline, and increased to ___ bpm at peak exercise, representing 85% (or ___%) of age-predicted maximal heart rate. The blood pressure response was (normal/ hypertensive/ hypotensive). Resting blood pressure was ___ mmHg, and peak/nadir blood pressure was ___ mmHg.
The patient (did/ did not) have chest pain/symptoms during the procedure. The electrocardiogram (did not show/ showed) ST-segment changes diagnostic for ischemia (describe appropriate changes).

The patient had myocardial perfusion imaging performed (using a same day/ two day, dual isotope imaging protocol), with the injection of ___ mCi of (radiopharmaceutical) at peak exercise, and the injection of ___ mCi of (radiopharmaceutical) at rest. Images were acquired by (gated) tomographic technique.

Findings: The left ventricle was normal in size (enlarged [degree of enlargement]; LVH was present etc. Describe presence of transient dilatation, if present. Describe increased post stress lung uptake, if present. Describe right ventricular abnormality, if present). There were no myocardial perfusion defects (if abnormal describe: e.g.: there was a large anteroseptal, anterolateral perfusion defect on stress images, that was partially reversible on the rest images). Mention whether artifacts were noted or suspected as well.
By gated SPECT (or by first pass angiography) resting (post exercise) global resting LVEF was normal/ abnormal. LVEF was calculated (or visually estimated) at ___%. Regional wall motion/thickening was normal, abnormal (describe). (If appropriate one can describe right ventricular function from the gated SPECT study).

IMPRESSION: Normal/or mildly abnormal, moderately abnormal, or markedly abnormal myocardial perfusion (sesstamibi/ tetrofosmin/ thallium-201) SPECT imaging after (excellent/ adequate/ fair/ submaximal) exercise, showing a (small/moderate/large) area of [anatomic location] infarction with or without (small/moderate/large) amount of [anatomic location] ischemia. (If considered pertinent add the following info.) The patients had (yes or no) symptoms. The stress ECG was abnormal (describe). The hemodynamic response was abnormal (describe). Resting RV and LV function was (normal/ abnormal).

[Add additional pertinent information that addresses the clinical reason for performing the study, such as low/high risk study. If appropriate mention suboptimal quality of study because of e.g. patient's obesity, etc.]

Wackers JFTh “Nuclear Cardiology: The Basics”
The patient did not have chest pain/symptoms during the procedure. The electrocardiogram did not show ST-segment changes diagnostic for ischemia (describe appropriate changes).

The patient had myocardial perfusion imaging performed (using a same day/two day, dual isotope imaging protocol), with the injection of ___mCi of (radiopharmaceutical) at peak exercise, and the injection of ___mCi of (radiopharmaceutical) at rest. Images were acquired by (gated) tomographic technique.

**Findings:**

The left ventricle was normal in size (enlarged [degree of enlargement]/LVH was present etc. Describe presence or transient dilation, if present. Describe increased post stress lung uptake, if present. Describe right ventricular abnormality, if present).

There were no myocardial perfusion defects (if abnormal describe; e.g., there was a large antero-apical, antero-lateral perfusion defect on stress images, that was partially reversible on the rest images). Mention whether artifacts were noted or suspected as well.

By gated SPECT (or by first pass angiography) resting (post exercise) global resting LVEF was normal/abnormal. LVEF was calculated (or visually estimated) at ___%. Regional wall motion/thickening was normal, abnormal (describe). (If appropriate one can describe right ventricular function from the gated SPECT study).

**IMPRESSION:**

Normal or mildly abnormal, moderately abnormal, or markedly abnormal myocardial perfusion (sestamibi/tetrofosmin/thallium-201) SPECT imaging after (excellent/adequate/fair/submaximal) exercise, showing a (small/moderate/large) area of [anatomic location] infarction with or without (small/moderate/large) amount of [anatomic location] ischemia. [If considered pertinent add the following info:] The patients had (yes or no) symptoms. The stress ECG was abnormal (describe). The hemodynamic response was abnormal (describe). Resting RV and LV function was (normal/abnormal).
Voice

Active
- “I see a ...”
- “The apex and anterior segments show ...”

Passive
- “Severely reduced tracer uptake is seen in the ...”
Observations by C. Edward Good

- From various authors:
  - “The active voice is preferred”
  - “The passive voice should be avoided”
Hedging

- <10% indefinite diagnosis
- “consistent with”
- “suggestive of”
- “possibly due to”
What do clinicians want?

- Accurate
- Prompt
- Clear terminology
- Unequivocal
- Clinical relevance
- Recommendations
Well-written scintigraphy report

- Maximize diagnostic and prognostic information
- Professional pride