*ASNC CONSENSUS STATEMENT*

# REPORTING OF RADIONUCLIDE MYOCARDIAL PERFUSION IMAGING STUDIES

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## PREAMBLE

Although clear and effective guidelines have been published regarding the optimal practice for nuclear cardiology procedures, including reporting, the Writing Group felt that it was important to specifically identify the critical factors involved in effective reporting and provide this information so it may serve as a standard for all nuclear cardiology laboratories. Information regarding reporting has been collated from a number of sources, some of which provide extensive and comprehensive guidelines for many aspects of nuclear cardiology procedures. It is the intent of this Consensus Statement to specifically focus on reporting and provide a consolidation of recommendations with regards to this critically important task.

## INTRODUCTION

The final task in performing a myocardial perfusion imaging study and often the only portion that is directly examined by the referring physician is the written report. The purpose of these reports is to communicate the findings and clinical implications of the myocardial perfusion imaging procedure. The report should also document the technical aspects of the procedure for purposes of accountability and reimbursement. Additionally, the written report provides appropriate documentation necessary for certification of physicians and accreditation of the nuclear cardiology laboratory. The report also functions as part of ongoing quality assurance measures and allows comparison with other modalities, such as coronary angiography. Templates for exercise (Figure 1) and pharmacologic stress imaging (Figure 2) are included in this position paper.

## COMPONENTS OF THE REPORT

The individual components of the report include the indications for the procedure, clinical history, procedure, findings and impression. While individual laboratory and practitioner variability may be present with regards to how these fields are constructed, each of the specific areas contains vital information that should be part of the final report. Each section of the report will be examined individually.

### Indication

The specific purpose for which the test is being performed should be clearly identified. This provides the required documentation for the medical necessity of the study and focuses the report on the question asked by the referring physician. While many indications are possible, they may be broken down into 5 general fields: 1) Diagnosis of coronary artery disease, 2) Delineation of extent and severity of disease, 3) Risk stratification, 4) Determination of myocardial viability, and 5) Assessment of acute chest pain syndromes.

## Clinical History

Selective clinical information should be included within the report so as to clarify the image findings (Table 1). These may include patient demographics such as age and gender. Body habitus, height, weight, chest circumference, and bra size (optional) may also be included, but should definitely be collected for assistance in the interpretation of the perfusion study. The type of symptoms for which the study is being performed should be identified as well as the current medications that the patient is receiving, and whether the patient is under the influence of specific cardioactive medications at the time of stress testing. The latter may have dramatic impact on the overall interpretation of the study. A reasonably detailed cardiac history should also be included including all past procedures and the major cardiovascular risk factors. Finally, previous diagnostic tests or therapeutic procedures may also be included so as to add to the clinical relevance of the report.

## Procedure

All aspects of the stress and imaging procedures should be well documented within the report (Table 2). The type of stress test (i.e. exercise or pharmacologic) should be identified. For a pharmacologic stress examination, the total doses of the stress agent and timing of administration should be noted, as well as whether adjunctive exercise was performed. If an exercise test is performed, the type of protocol (Bruce, modified Bruce, Naughton) should be noted as well as the adequacy of the stress results [peak heart rate, percent of the maximum predicted heart rate and duration of exercise, estimated METS (optional)]. The presence of symptoms during the test should be noted and whether they provided an indication for termination. Angina should be classified as typical or atypical and the location of chest pain may be described. Hemodynamic information, such as the heart rate and blood pressure response should be noted. The baseline and peak heart rate and blood pressure may also be included. Finally, the presence or absence of significant ECG changes should be mentioned for both exercise and pharmacologic stress, including the amount of ST-segment deviation and whether or not resting abnormalities were present. The imaging procedure should also be delineated including the protocol utilized, the radiopharmaceutical and its dose, the timing of injection (optional) and the time between injection and imaging (optional). The use of gating or attenuation correction should be noted.

## Findings

The first portion of the “Results” section (Table 3) should comment about image quality, if it is technically inadequate, as this has important ramifications regarding the accuracy and interpretation of the result. This assessment of study quality should be based on the degree of patient motion, subdiaphragmatic/hepatic activity interfering with interpretation, insufficient myocardial activity and other technical features.

Perfusion defect(s) should be well described in terms of their size (small, medium, and large), their type (reversible, persistent, or mixed) and severity (mild, moderate or severe). Summed stress, rest and differences scores may be reported, providing a

more quantitative assessment of defect size and severity and the true quantitative measures, such as percent of left ventricle, may also be used (optional). The location should be noted and described in concordance with the position paper on standardized myocardial segmentation (Figure 3).

Evidence of extensive abnormalities should be mentioned, including abnormal radiopharmaceutical lung activity and the presence of cavity enlargement, either as stress-only cavity enlargement or as persistent cavity dilation should be mentioned. The transient cavity dilation (TCD, alternatively known as “TID”) ratio should also be described. Finally, abnormal right ventricular activity and size should also be noted.

Assessment of left ventricular function should be performed with stress and/or rest gated techniques. The report should describe regional wall motion abnormalities both in terms of severity (hypokinesis, akinesis, dyskinesis) as well as in location. Differentiation between global and focal abnormalities should be noted. A comment regarding the overall left ventricular function should be made such as normal or moderately depressed left ventricular systolic function. Finally, the quantitative left ventricular ejection fraction should be included within the report. For ejection fractions >60%, the actual calculated number should be included in the report and mention made of overestimation in patients with small hearts. Ventricular volumes may also be reported (optional).

The vascular location may be commented upon by the interpreter. Each report should attempt to differentiate between the presence of single or multi-vessel coronary artery disease and markedly abnormal studies should be clearly identified. The specific assignment of vascular territories, especially to the inferolateral regions and the apex may be difficult. Significant extra cardiac activity (e.g. abnormal focal tracer uptake which may represent malignancy) should be described.

**Impression**

The most critical portion of the report is the impression. The final interpretation must possess clarity and must state whether or not the study is “normal” or “abnormal”.

The reader is encouraged to use those categories that provide the greatest clarity for the report. The categories of probably normal, probably abnormal, and equivocal should be used as infrequently as possible, but may allow for communication of interpretive uncertainty. The cause of the uncertainty, whether it is technical or related to specific patient issues, should be stated. A small percentage of patients may fall into an “equivocal” category but this should be used in less than 10% of all studies interpreted.

Of special importance is the finding of normal perfusion in the setting of other abnormal findings, such as left ventricular dysfunction. Such studies should be described as “abnormal”, with clarification that the perfusion data is homogeneous or normal but other aspects of the imaging study lead to this conclusion. If the patient is unable to achieve an adequate level of stress or the images are of inadequate quality, the term “nondiagnostic” should be used to describe the overall impression of the study.

In the former circumstance, repeat testing with pharmacologic stress should be recommended.

Following the final impression, which is stated in the first sentence, the presence of apparent perfusion abnormalities may be noted and coordinated with the final impression by acknowledging that artifacts such as those due to soft tissue attenuation, patient motion, or left bundle branch block may result in apparent perfusion abnormalities in the presence of CAD or infarction. A report may still be interpreted as normal even if it possesses an artifactually produced perfusion abnormality. The functional information should be included in the final section by describing the presence or absence of regional and/or global abnormalities. Correlation with clinical stress testing and angiographic data should also be included in the impression section as well as any comparisons to prior studies. Finally, the report should address the clinical question that was posed as the indication for the procedure.

## STRUCTURED REPORTING

ASNC supports the development of structured reporting for myocardial perfusion imaging. It is anticipated that many of the components of a final report as outlined in this Position Paper will be included as part of the data elements for structured reporting.

A preliminary recommendation of elements to be included in a structured report is included in the Appendix. A DICOM subcommittee specifically dealing with this issue is presently delineating the critical fields. All key organizations and societies are working with instrumentation manufacturers in the development of structured reporting.

## CONCLUSIONS

In summary, ASNC is strongly in favor of the standardization of myocardial perfusion imaging reports. Furthermore, we encourage clarity and clinically relevant conclusions. Finally, the report should contain adequate information to support the medical necessity of the procedure

**TABLE 1**

**Clinical Information**

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

**TABLE 2**

**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)
- ECG changes
- Radiopharmaceuticals utilized (with dose)
- Imaging protocol
- Functional data
- Use of attenuation/scatter correction

**TABLE 3**

**Results**

- Study quality
- Size of left and right ventricle at stress and rest
- Defect description (size, reversibility, severity, location)
- Extensiveness (TCD/TID, lung activity, RV activity)
- Left ventricular function (global, regional)
- Extra cardiac activity

## REFERENCES


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**FIGURE 1. Template For Exercise Myocardial Perfusion Imaging**

STRESS/REST (*OR* REST/STRESS) SINGLE/DUAL ISOTOPE SPECT IMAGING WITH EXERCISE STRESS AND GATED SPECT IMAGING

**Indication:** Diagnosis of coronary disease

(select one) Evaluation of extent and severity of coronary artery disease

Evaluation of myocardial viability

Risk stratification-post-MI/preoperative/general

Assessment of acute chest pain

**Clinical History:**

____ year old man/woman with (no) known coronary artery disease

Cardiac risk factors include: ____

Previous cardiac procedures include: ____

Current symptomatology includes: ____

**Procedure:**

The patient performed treadmill exercise/bicycle exercise using a modified Bruce/Bruce/Naughton/ ____ protocol, completing ____ minutes and completing an estimated workload of ____ METS. The heart rate was ____ beats per minute at baseline and increased to ____ beats at peak exercise, which was ____% of the maximum predicted heart rate. The blood pressure response to exercise was normal/hypotensive/hypertensive. The patient did/did not develop any symptoms other than fatigue during the procedure; specific symptoms include ____. The resting electrocardiogram demonstrated _____ and did/did not show ST-segment changes consistent with myocardial ischemia.

Myocardial perfusion imaging was performed at rest (___ minutes following the injection of ____ mCi of ____). At peak exercise, the patient was injected with ____ mCi of ____ and exercise was continued for ____ minute(s). Gating post-stress tomographic imaging was performed ____ minutes after stress (and rest).

**Findings:**

The overall quality of the study is poor/fair/good/excellent.

Left ventricular cavity is noted to be normal/enlarged on the rest (and/or stress) studies. There is evidence of abnormal lung activity. Additionally, the right ventricle is normal/abnormal (specify: ____ ).

SPECT images demonstrate homogeneous tracer distribution throughout the myocardium *OR* a small/moderate/large perfusion abnormality of mild/moderate/severe intensity is present in the ____ (location) region on the stress images. The rest images reveal ____. Gated SPECT imaging reveals normal myocardial thickening and wall motion. *OR* Gated SPECT imaging demonstrates hypokinesis/dyskinesis/akinesis of the ____ (location). The left ventricular ejection fraction was calculated to be ____% *OR* The left ventricular ejection fraction was normal (>60%).

**Impression:**

Myocardial perfusion imaging is normal/abnormal. There is a small/moderate/large area of ischemia/infarction in the ____ location. Overall left ventricular systolic function was normal/abnormal with/without regional wall motion abnormalities (as noted above). Compared to the prior study from ____ (date), the current study reveals ____.

**FIGURE 2. Template For Pharmacologic Myocardial Perfusion Imaging**

STRESS/REST (*OR* REST/STRESS) SINGLE/DUAL ISOTOPE SPECT IMAGING WITH PHARMACOLOGIC STRESS AND GATED SPECT IMAGING

**Indication:**

(select one) Diagnosis of coronary disease

Evaluation of extent and severity of coronary artery disease

Evaluation of myocardial viability

Risk stratification-post-MI/preoperative/general

Assessment of acute chest pain

**Clinical History:**

____ year old man/woman with (no) known coronary artery disease

Cardiac risk factors include: ____

Previous cardiac procedures include: ____

Current symptomatology includes: ____

**Procedure:**

Pharmacologic stress testing was performed with adenosine/dipyridamole/dobutamine with a dose ____. Additionally, low level exercise was performed along with the vasodilator infusion (specify: ____). The heart rate was ____ at baseline and rose to ____ beats per minute during the adenosine/dipyridamole/dobutamine infusion. This corresponds with ____% of the maximum predicted heart rate. Blood pressure response was normal/hypertensive/hypotensive during the stress procedure. The patient developed significant symptoms which included ____. The resting electrocardiogram demonstrated _____ and did/did not show ST-segment changes consistent with myocardial ischemia. Myocardial perfusion imaging was performed at rest (___ minutes following the injection of ____ mCi of ____). At peak pharmacologic effect, the patient was injected with ____ mCi of ____. Gating post-stress tomographic imaging was performed ___ minutes after stress (and rest).

**Findings:**

The overall quality of the study is poor/fair/good/excellent.

Left ventricular cavity is noted to be normal/enlarged on the rest (and/or stress) studies. There is evidence of abnormal lung activity. Additionally, the right ventricle is normal/abnormal (specify: ____ ).

SPECT images demonstrate homogeneous tracer distribution throughout the myocardium *OR* a small/moderate/large perfusion abnormality of mild/moderate/severe intensity is present in the ____ (location) region on the stress images. The rest images reveal ____. Gated SPECT imaging reveals normal myocardial thickening and wall motion. *OR* Gated SPECT imaging demonstrates hypokinesis/dyskinesis/akinesis of the ____ (location). The left ventricular ejection fraction was calculated to be ____% *OR* The left ventricular ejection fraction was normal (>60%).

**Impression:**

Myocardial perfusion imaging is normal/abnormal. There is a small/moderate/large area of ischemia/infarction in the ____ location. Overall left ventricular systolic function was normal/abnormal with/without regional wall motion abnormalities (as noted above). Compared to the prior study from ____ (date), the current study reveals ____.