The Role of Clinical Data in Interpretation of Perfusion Images

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Myocardial perfusion imaging is frequently used in patients with suspected coronary artery disease (CAD) in order to establish a diagnosis, and, to better define prognosis and risk-stratify the patient with known coronary disease. In both circumstances, the requesting clinician formulates a treatment plan based on prior probability of disease (or ischemia in patients with known CAD) and the results of the test. A number of variables are taken into consideration, however, when analyzing results of an exercise stress test. These include exercise duration and the metabolic level of activity achieved, presence or absence of symptoms, changes in heart-rate and blood pressure, arrhythmias and ST-segment changes, in addition to perfusion imaging results. Indeed, all these parameters are included in the diagnostic report sent to the referring clinician in most nuclear medicine laboratories.

To the clinician, all parameters of the test ultimately contribute to the final interpretation of the result. Thus, a test demonstrating a moderately reversible defect in a small portion of the inferior wall at high level of exercise is likely to be interpreted and acted upon differently than a test demonstrating completely reversible ischemia of the entire anterior wall occurring early in exercise and accompanied by a fall in blood pressure. What is frequently missing from this picture, however, is acknowledgment of the fact that the same parameters clinicians use to assess results of the study in order to decide the next step in patient management are often used by nuclear physicians (nuclear medicine trained as well as nuclear cardiologists) to interpret perfusion images. Thus, an anterior wall defect in a young woman with atypical chest pain who has exercised for 15 min may well be attributed to tissue attenuation, whereas the same defect in a middle-aged man with early anginal symptoms during exercise may be interpreted as demonstrating true ischemia. Nuclear physicians (and radiologists in general) defend this practice by rightfully pointing out that a perfusion stress test (or, for example, a chest CT) includes a consultation with a specialist who should base the interpretation of the test on all available information.

This situation, however, has a number of implications that have not been critically examined in cardiological and nuclear medicine literature. First, how frequently are test readers swayed by clinical information in interpreting results of perfusion images? Second, do nuclear physicians and clinicians interpret the same clinical information similarly? After all, the referring clinician possesses much more information about the patient than is usually provided by a test request form; differences in training may also result in differences in interpretation. Finally, the same information is used twice—first by the nuclear physician to decide the result of the test and then by a clinician to decide on management given the result of the test; what impact does this have on ultimate decision making? Similar issues have been addressed with other imaging techniques (*1–6*), but there is no information available with regard to myocardial perfusion imaging.

With these questions in mind, we have looked at the performance of nuclear physicians at two academic nuclear cardiology laboratories. A scan reader was asked to read and record his impression of the scan without any clinical data and was then asked to read the same scan given clinical information available on the test-request form as well as data from the exercise part of the test. We found that the addition of clinical information frequently resulted in changes in interpretation. Furthermore, in a significant minority of cases, changes in interpretation were sufficiently major to completely reverse the final interpretation of the test (i.e., final reading would change from a probable negative to strongly positive or vice versa). There was no difference in the impact of clinical/exercise data whether perfusion scans were performed using planar or SPECT techniques or whether they were interpreted by readers trained in nuclear medicine or in cardiology. To address whether nuclear medicine physicians and clinicians used

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clinical information similarly, we compared the use of such data by the two groups. Overall, there was reasonable agreement between the two assessments. However, agreement was better when tests were ordered in patients with suspected coronary disease (diagnostic evaluation) than in patients with known coronary disease (prognostic evaluation). Thus, while nuclear physicians' interpretation of the signs and symptoms of suspected coronary disease were similar to that of clinicians, the two groups differed substantially in evaluating the clinical data in patients with known disease. It therefore appears that clinical information can significantly and frequently affect perception and interpretation of perfusion images, and nuclear physicians' analyses of clinical data may differ from that of clinicians.

A number of important questions remain:

1. Do these changes in interpretation improve or impair patient outcome?
2. Which interpretation of the scan is more accurate? Does *quantitative* analysis of scans make interpretation more objective and thus less prone to change when a reader is presented with clinical data?
3. Should the scan readers incorporate all available clinical information in their report?
4. Should a quantitative analysis without interpretation be provided to the referring physician, or should some intermediate form of interpretation and communication to the clinician be used?

Answering these important questions should be the subject of further research. Until such data are available, we believe that, at the very least, referring clinicians should be made aware that the test results they receive were arrived at with the knowledge of clinical data and the exercise part of the study, and that their use of the same data in arriving at a clinical plan of management does not constitute an independent use of these data.

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REFERENCES

1. Doubilet P, Herman PG. Interpretation of radiographs: effects of clinical history. *Am J Roentgenol* 1981;137:1055–1058.
2. Good BC, Cooperstein LA, DeMarino GB, et al. Does knowledge of the clinical history affect the accuracy of chest radiograph interpretation? *Am J Roentgenol* 1990;154:709–712.
3. Eldevik OP, Dugstad G, Orrison WW, Haughton VM. The effect of clinical bias on the interpretation of myelography and spinal computed tomography. *Radiology* 1982;145:85–89.
4. McNeil BJ, Hanley JA, Funkenstein HH, Wallman J. Paired receiver operating characteristic curves and the effect of history on radiographic interpretation. *Radiology* 1983;149:75–77.
5. Berbaum KS, El-Khoury G, Franklen EA Jr, Kathol M, Montgomery WJ, Hesson W. Impact of clinical history on fracture detection with radiography. *Radiology* 1988;168:507–511.
6. Berbaum KS, Franken KA, Dorfman DD, Barloon TJ. Influence of clinical history upon detection of nodules and other lesions. *Invest Radiol* 1988;23:48–55.