Rev Esp Cardiol. 2013;66(3):161–162

Editorial

Clinical Need for Evaluation of Ischemia

Necesidad clínica de evaluación de la isquemia

Frank E. Rademakers*

Department of Cardiology, University Hospitals Leuven, Leuven, Belgium

Article history:
Available online 28 September 2012

In the setting of patients with known ischemic heart disease, clinical management depends on ruling out active disease, i.e. ischemia, or on the correct decision for appropriate therapy.[1] The former requires a test with high negative predictive value on a per patient basis while the latter involves a quantitative test with high positive predictive value on a per segment basis (as tested in a high prevalence population).

Therapy (either with medication, percutaneous coronary intervention or surgery) is warranted to: *a)* treat symptoms, or *b)* improve prognosis, i.e. to reduce the risk of coronary events and sudden death.[2]

The identification of unstable coronary plaques could become more important in the future, when targeted therapy of such plaques becomes available and treatment can be shown to improve prognosis. Until such treatment and evidence become available, plaque imaging is a very important and challenging research tool, but has no immediate role to play in clinical practice.

Prognosis is related to the presence and extent of ischemia, including silent ischemia, and the specific substrate for arrhythmic events. The latter could be related to ongoing ischemia and/or the co-existence of scar and normal myocardium in the border zone of a previous myocardial infarction.

The extent of ischemia is important since the choice of revascularisation vs medication depends on the presence of more or less than 15% of ischemic myocardium[3]: quantification of ischemia is thus required to make correct therapeutic choices.

The extent of ischemia and its quantification is also relevant in view of the very poor prognosis of left main and 3-vessel disease, which influences this negative prognosis through the presence of extensive ischemia.

Ischemia imaging is thus warranted in the setting of patients with an intermediate pre-test probability on the basis of non-invasive risk stratification with history, clinical examination, resting function and electrocardiogram exercise testing. In these patients, various imaging modalities (echocardiography, nuclear, cardiovascular magnetic resonance, computed tomography) and stressors (exercise, dobutamine, vasodilatation) can be used.[4]

More recently it has become evident that acute coronary syndromes are at least in part (and probably in the majority of cases) related to ischemia causing lesions,[5,6] rather than to less than 50% lesions as was previously presumed.[7,8] Treating ischemic lesions could, therefore, also prevent acute coronary syndromes, but this remains to be proven.

In the present setting of economic constraints, stakeholders i.e. the citizens paying directly or indirectly for these imaging examinations, request evidence showing a benefit when using these technologies and we need to ask whether such use of an imaging test changes patient management and possibly outcome. In contrast to what is required for medication to enter the "market", medical technology has far fewer regulatory steps and, apart from limited evidence on safety, no additional proof of efficacy is needed, let alone the requirement to show an added value over other existing techniques. In the "hierarchy" of diagnostic efficacy described by Fryback and Thornbury,[9] most medical imaging technologies only reach level 2 or 3:

- Level 1: Technical quality of the images.
- Level 2: Diagnostic accuracy, sensitivity and specificity of the images.
- Level 3: Degree to which the results influence physicians' diagnostic thinking: prognosis.
- Level 4: Degree to which imaging results affect patient management.
- Level 5: Efficacy studies that measure the degree of effect on patient management.
- Level 6: Analyses of societal costs and benefits of a diagnostic imaging technology.

Both clinicians and industry should work together to provide evidence reaching at least level 4 or 5 and preferably 6. Only then can we avoid a blind limitation in the use of imaging in ischemic heart disease and in cardiology in general.

The choice of one imaging technology over another, i.e. echocardiography vs nuclear vs cardiovascular magnetic resonance or computed tomography to substantiate and quantify ischemia, mainly depends on the experience of the center involved[3]: there is no definite evidence to prefer one over the other but one should use what one knows best, where one has experience and knows one's limitations.[10]

In contrast, there is ample evidence that the information which emerges from imaging studies is not always translated into appropriate patient management,[11] i.e. the presence or absence of significant ischemia should be converted in either a revascularization strategy or conversely in an abstinence of further invasive procedures, let alone revascularization. In real practice, some patients with ischemia are not appropriately treated by

* Corresponding author: Department of Cardiology, University Hospitals Leuven, Herestraat 49, 3000 Leuven, Belgium.
E-mail address: frank.rademakers@uzleuven.be

1885-5857/$ – see front matter
http://dx.doi.org/10.1016/j.rec.2012.07.002

percutaneous coronary intervention or coronary artery bypass graft, while patients without evidence of ischemia are routinely catheterized and sometimes revascularized (without substantiation of a decreased fractional flow reserve).

CONFLICTS OF INTEREST

None declared.

REFERENCES

1. Cheng VY, Berman DS, Rozanski A, Dunning AM, Achenbach S, Al-Mallah M, et al. Performance of the traditional age, sex, and angina typicality-based approach for estimating pretest probability of angiographically significant coronary artery disease in patients undergoing coronary computed tomographic angiography: results from the multinational coronary CT angiography evaluation for clinical outcomes: an international multicenter registry (CONFIRM). Circulation. 2011; 124:2423–8.
2. Nabel EG, Braunwald E. A tale of coronary artery disease and myocardial infarction. N Engl J Med. 2012;366:54–63.
3. Berman DS, Hachamovitch R, Shaw LJ, Friedman JD, Hayes SW, Thomson LE, et al. Roles of nuclear cardiology, cardiac computed tomography, and cardiac magnetic resonance: Noninvasive risk stratification and a conceptual framework for the selection of noninvasive imaging tests in patients with known or suspected coronary artery disease. J Nucl Med. 2006;47:1107–18.
4. Villines TC, Hulten EA, Shaw LJ, Goyal M, Dunning A, Achenbach S, et al. Prevalence and severity of coronary artery disease and adverse events among symptomatic patients with coronary artery calcification scores of zero undergoing coronary computed tomography angiography: results from the CONFIRM (Coronary CT Angiography Evaluation for Clinical Outcomes: An International Multicenter) registry. J Am Coll Cardiol. 2011;58:2533–40.
5. Virmani R, Kolodgie FD, Burke AP, Farb A, Schwartz SM. Lessons from sudden coronary death: a comprehensive morphological classification scheme for atherosclerotic lesions. Arterioscler Thromb Vasc Biol. 2000;20:1262–75.
6. Ozaki Y, Okumura M, Ismail TF, Motoyama S, Naruse H, Hattori K, et al. Coronary CT angiographic characteristics of culprit lesions in acute coronary syndromes not related to plaque rupture as defined by optical coherence tomography and angioscopy. Eur Heart J. 2011;32:2814–23.
7. Falk E, Shah PK, Fuster V. Coronary plaque disruption. Circulation. 1995; 92:657–71.
8. Finn AV, Nakano M, Narula J, Kolodgie FD, Virmani R. Concept of vulnerable/unstable plaque. Arterioscler Thromb Vasc Biol. 2010;30:1282–92.
9. Fryback DG, Thornbury JR. The efficacy of diagnostic imaging. Med Decis Making. 1991;11:88–94.
10. Heijenbrok-Kal MH, Fleischmann KE, Hunink MG. Stress echocardiography, stress single-photon-emission computed tomography and electron beam computed tomography for the assessment of coronary artery disease: a meta-analysis of diagnostic performance. Am Heart J. 2007;154:415–23.
11. Hachamovitch R, Nutter B, Hlatky MA, Shaw LJ, Ridner ML, Dorbala S, et al. Patient management after noninvasive cardiac imaging results from SPARC (Study of myocardial perfusion and coronary anatomy imaging roles in coronary artery disease). J Am Coll Cardiol. 2012;59:462–74.