Quality control of stress echocardiography

Stress echocardiography is being used with increasing frequency for the evaluation of patients with known or suspected coronary artery disease. The theory and principles behind stress echocardiography are well founded. It has been recognised for many years that with the onset of ischaemia regional myocardial function becomes impaired almost immediately. This regional dysfunction is both a reliable sign of ischaemia and represents the fundamental consequence of the ischaemic process. Echocardiography offers an excellent means of accessing regional function by providing multiple tomographic views of the left ventricle. The examination is real time and non-invasive. Resolution for evaluating regional wall motion and thickening is good and the examination can be done on almost all patients. Thus it is reasonable to use two dimensional echocardiography to detect ischaemia and this has been one of the major uses of this diagnostic tool.

The main technological and logistical challenge was whether two dimensional echocardiography could be used to detect stress-induced ischaemia. Initially stress testing was done exclusively with exercise. There are technical difficulties in obtaining a satisfactory echocardiogram in an exercising patient. For example, no practical technique has been devised for obtaining an echocardiogram during treadmill exercise because the chest is constantly moving. On the other hand, one can obtain echocardiograms during bicycle exercise because the chest is not moving as vigorously. A major advance in stress echocardiography occurred when it was noted that stress-induced wall motion abnormalities did not disappear rapidly. A form of stunned myocardium was produced. Regional dysfunction persisted for one to two minutes or more after a treadmill exercise test. Thus it could be detected on a post treadmill echocardiogram.

It has been known for at least 15 years that exercise echocardiography was feasible. However, there were still many technical difficulties in the analysis of exercise echocardiograms. The echocardiograms were recorded on videotape. One needed to compare mentally the resting and exercise images. When changes were obvious such mental comparisons were not difficult. However, it was tedious to identify subtle wall motion changes especially in a recording with excessive respiratory artefact. The technological advance that overcame most of these difficulties was digital recording of the echocardiogram. It was now possible to place digitised, cine loop, resting and exercising echocardiograms side-by-side for direct comparison. The next major development in the evolution of stress echocardiography was the introduction of pharmacological stress testing. Either potent vasodilators, such as dipyridamole, or catecholamines, such as dobutamine, will induce ischaemia which can be detected on the echocardiogram. This development had many advantages. First of all, the technical aspects of obtaining and interpreting the echocardiogram were simplified because the patient was not exercising. In addition, some applications such as the detection of stunned or hibernating myocardium were now feasible.

Numerous investigators throughout the world showed that stress echocardiography provided reasonable data that were comparable to other forms of stress imaging. Physicians also began to recognise other advantages of stress echocardiography over stress nuclear testing. Patients did not have to return four hours later for reperfusion examinations. The appropriate isotope did not have to be available. In the case of exercise echocardiography even an intravenous injection was not necessary. Lastly the cost of the ultrasonic examination was usually about half that of a nuclear examination. With all of these medical and pragmatic factors it is not surprising that worldwide interest in stress echocardiography has been increasing dramatically. The problem now arises as to how can we maintain quality control with the rapidly expanding use of this technique.

It must be emphasised that, despite its many advantages, stress echocardiography is probably one of the most difficult techniques in echocardiography. Although it is not as difficult as one might think to obtain adequate stress echocardiograms, there are still many patients in whom the images are less than ideal. Patients with known or suspected coronary artery disease are frequently overweight and have smoking related lung problems which interfere with obtaining high quality echocardiograms. Furthermore, the evaluation of regional wall motion can be subtle and requires an experienced and trained observer. To complicate matters, stress testing is frequently done as an outpatient or in physicians’ offices. No one may be available to monitor the quality of these tests. Physicians merely need to combine some form of stress testing, which they probably already have, with an echocardiogram to proceed with stress echocardiography. The patient, of course, has no way of knowing whether or not the stress echocardiogram is properly performed or interpreted. Thus the potential for abuse and misuse of stress echocardiography is great.

One approach to the problem of quality control has been an ongoing preceptorship at our own institution at Indiana University to assist
in the interpretation of stress echocardiograms. We have been carrying on this programme for several years and I am happy to say that the level of skill of the people taking this course has been improving dramatically. In recent sessions most of the participants have been skilled at evaluating regional wall motion and their ability to interpret stress echocardiograms has been high. Thus among those individuals who have the incentive to take a course to enhance their skills there is good reason to believe that quality control is improving. Unfortunately, this experience does not tell us about the large number of physicians who do not make any effort to become trained in this technology.

There are several other possible solutions to the problem of quality control. In a hospital setting one can set rules for eligibility to interpret stress echocardiograms. Some demonstrated effort at training and or competence should be required.

Because stress echocardiograms are frequently recorded digitally, these images are easily reviewed by other physicians. This review could even be done by referring clinicians. Significant wall motion abnormalities should be apparent even to physicians who do not regularly look at echocardiograms. If the clinicians cannot appreciate any of the changes that have been reported, they should question the accuracy of the interpretations.

The American Society of Echocardiography has begun giving competency examinations in echocardiography. Reading stress echocardiograms is a part of this examination. More tests of this type will be used to permit physicians to demonstrate their competence in echocardiography in general and stress echocardiography in particular. In the meantime, clinicians must be aware that quality control of stress echocardiography continues to be a problem. Unfortunately, quality control of almost all medical technology probably is not much better. However, the fact that echocardiograms can be performed in offices and are difficult to monitor makes the problem more troublesome. I am pleased that progress is being made. I am convinced that the quality of stress echocardiography is improving dramatically. Eventually the problem of quality control, although never eliminated, will be much less than it is today.

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STAMPS IN CARDIOLOGY

René Henri Marie Leriche (1879–1955)

This stamp was the highest value in a set of four stamps issued by France on 25 January 1958 to commemorate famous French doctors. Recess printed, it was designed and engraved by Decaris. The other doctors featured in the set are Philippe Pinel (psychiatry), Georges Fernand Isidore Widal (microbiologist and serologist), and Charles Nicolle (bacteriologist).

René Henri Marie Leriche was an outstanding vascular surgeon who was professor of surgery in Strasbourg and Lyon before attaining the high office of Professor of the Collège de France in Paris in 1936. He is best known for his description in 1923 of the syndrome caused by incomplete obstruction of the bifurcation of the aorta which is named after him. He was an early advocate of sympathectomy for arterial disease and anticipated in the 1920s that the ideal treatment for an obliterated segment would be replacement with a vascular graft. He did in fact do several vein bypass grafts of occluded iliac arteries though without success. As this was the pre-heparin era he advised that venous allografts should not be longer than 6 cm because of the risk of thrombosis.

Leriche had a deep interest in the mechanism of pain and he pioneered the use of sympathectomy for pain relief. In 1940 he wrote a classic monograph, La Chirurgie de la Douleur. He was deeply admired by the British neurologist, Dr Macdonald Critchley, who said he was "a perceptive and humane doctor . . . the compassionate philosopher whom the world was acclaiming in 1934 as the pain surgeon par excellence".1

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