《海外参加者との討議会》

(1) Progress in Nuclear Cardiology

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Nuclear methods are being applied more and more in clinical cardiology and cardiological research. Such studies fall into two major groups: those concerned with characterization of the heart as a pump, and those concerned with the heart as a muscle. To study right and left ventricular function, the patient's red blood cells are labeled with technetium-99m. The first transit of the tracer through the heart and great vessels is observed with either a scintillation camera or a smaller cardiac probe (nuclear stethoscope) directed at a specific region. During the first transit study with a camera, we look at the size and location of the various cardiac chambers and computer mean transit times through the right ventricle, lungs and left ventricle. From these, flow and regional volumes can be calculated. Both right-to-left and left-to-right shunts can be quantified. These procedures are well validated and in routine use. We are currently evaluating the use of first transit studies to evaluate right ventricular function.

After the labeled red blood cells equilibrated throughout the cardiovascular system, the images of the scintillation camera are synchronized with the patient's electrocardiogram to generate 16 images throughout the cardiac cycle. In viewing the images, we look at regional as well as overall function of both ventricles. We also look for the filling and emptying of the right atrium and motion of the great vessels to ensure that the gating mechanism is functioning properly. Following subjective viewing of the images, we identify or flag regions of interest, such as the right and left ventricle to generate ventricular time-activity curves. These tell us systolic and diastolic time intervals, rates of filling and emptying of the ventricles, stroke volume and ejection fraction.

We can assess valvular regurgitation by comparing the stroke volume of the two ventricles, detect aneurysms of the left ventricle, assess the overall and regional status of the muscle, and, by generating pressure-volume relationships, computer ventricular work, power and efficiency. Patients can be classified as to the degree of pressure, volume or muscle disease of the ventricle.

To look at the muscle directly, tracers such as thallium-201 are administered, although recent research involves the use of carbon-11 palmitate and fluorine-18 deoxyglucose to study regional metabolism. Thallium-201 studies, as well as ventricular function studies, are usually performed during the stress of exercise, isometric handgrip or cold pressor manuevers. Thallium stress tests are used in patients with an exceedingly high risk of coronary heart disease, determined by estimation of risk factors such as family history, hypertension, diabetes, smoking habits, and hypercholesterolemia, those who have sustained myocardial infarction, where the problem is to determine the size and location of the infarction, patients with suspected pulmonary hypertension to detect right ventricular hypertension, those patients who have equivocal exercise electrocardiograms and those patients with angina who have negative exercise electrocardiograms.

Recent research is concerned with evaluation of right ventricular function and with derivation of pressure changes within the ventricles by analysis of accurate ventricular function curves. New tracers include substitutes for thallium for measurement of blood flow and metabolic tracers, such as glucose and fatty acids.