NONINVASIVE IMAGING OF CARDIAC METABOLISM
DEVELOPMENTS IN CARDIOVASCULAR MEDICINE

Recent volumes


NONINVASIVE IMAGING OF CARDIAC METABOLISM

Single Photon Scintigraphy, Positron Emission Tomography and Nuclear Magnetic Resonance

edited by

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To my father
For Barbara
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F.J.Th. WACKERS

Metabolic imaging: The future of cardiovascular nuclear imaging?

Since cardiovascular nuclear imaging emerged as a new subspeciality in the mid-1970s, the field has gone through an explosive growth. Radionuclide techniques became readily recognized as important new diagnostic aids in the armamentarium of the clinical cardiologist. Initially, cardiovascular nuclear imaging focused on static myocardial imaging using either thallium-201 or technetium-99m-pyrophosphate for diagnosing acute myocardial infarction. Shortly thereafter, multigated equilibrium radionuclide angiocardiology became the most widely used noninvasive method for assessing cardiac function. Furthermore, attention and clinical application shifted towards the use of radionuclide techniques in conjunction with exercise testing, either with thallium-201 myocardial perfusion imaging or technetium-99m left ventricular function studies. The future of cardiovascular nuclear imaging appeared exciting and promising. However, around 1980 pessimists predicted the premature demise of cardiovascular nuclear imaging with the introduction of digital subtraction angiography and nuclear magnetic resonance imaging. These doomsayers have been proven wrong: in 1985 cardiovascular nuclear imaging is thriving and, in many centers, even expanding. Although digital subtraction angiography and magnetic resonance imaging provided exquisite anatomic detail, for practical evaluation of patients with ischemic heart disease — in the Coronary Care Unit or exercise laboratory — nuclear techniques appeared to be more practical.

Presently, the clinical usefulness of equilibrium radionuclide angiocardiology in patients with acute myocardial infarction or chronic cardiac disease is well established. In addition, a number of studies have demonstrated that nuclear techniques have great value in providing functional and prognostic information in ischemic heart disease.

Rather than aiming at further improvement of image resolution for providing greater anatomic detail, radionuclide methods are to be used for which they are uniquely suited: detection of (rapid) changes in count densities. Rapid
assessment of left ventricular function during exercise and acute interventions by first-pass angiocardiography, or assessment of myocardial perfusion at exercise by planar or tomographic thallium-201 imaging are typical applications of radionuclide techniques that cannot be duplicated by other noninvasive methods.

Another most appropriate use of radioactive tracers, the subject of this monograph, appears to be labeling of natural substrates of myocardial metabolism. The fascinating promise of metabolic imaging is the possibility to explore the fundamental metabolic aspects of the various diseases. The important clinical issue of differentiating between reversible and irreversible myocardial ischemia probably can only be answered unequivocally by monitoring radiolabeled substrates of metabolism. Furthermore, it is conceivable that, in particular in cardiomyopathies metabolic imaging will provide important new insights. Initially, imaging of myocardial metabolism appeared to be the exclusive domain of positron emission tomography. However, more recently, investigators have been successful in developing radioiodine labeled substrates that can be imaged using conventional gamma cameras.

In the present volume Dr. van der Wall has succeeded in bringing together the authoritative expertise of several of the pioneers and leaders in the field of myocardial metabolic imaging. The emphasis of most work is on radiolabeled free fatty acids and radiolabeled glucose, but also nuclear magnetic spectrometry of metabolic processes is being discussed. Free fatty acids are a key substrate in myocardial metabolism for production of adenosine triphosphate. Although myocardial accumulation of various iodine-labeled compounds of free fatty acids can be imaged with the conventional gamma camera, it is evident that substantial work still needs to be done in evaluating the relationship between uptake and clearance of labeled free fatty acid and whether they accurately reflect myocardial free fatty acid metabolism. The present volume provides a particularly useful and timely overview for those working in the field of nuclear cardiology, interested in myocardial metabolic imaging. Nuclear techniques are indeed uniquely suited to explore the pathophysiology of myocardial metabolism in a variety of myocardial diseases. As such, metabolic imaging is one of the most promising and exciting new directions in cardiovascular nuclear imaging.
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