

BOOK REVIEWS

PROGRESS IN NUCLEAR MEDICINE VOL. 6.—CARDIOVASCULAR NUCLEAR MEDICINE. A. Righetti, A. Donath, Eds. Basel, S. Karger A.G., 1980, 225 pp, \$88.75

By comparison with other subspecialties, such as endocrinology or even the broader topic of cardiovascular diseases in general, the practice and literature of nuclear cardiology suffers from two persistent deficiencies—the lack of strong physiologic orientation and the lack of sophisticated statistical analysis. When present, these two characteristics lend a certain scientific “hardness” to the field; when absent, vagueness or scientific “softness” taints the topic. Certainly, there are outstanding examples in nuclear cardiology of investigators whose papers demonstrate the scientific “hardness” so necessary for survival of the field as a circumscribed subspecialty. However, in the face of the statistical, probabilistic nature of the basic data in nuclear cardiology, even more self-discipline is demanded than in many other specialties, and there is a tendency to slide toward the “soft,” the “art” of medicine, toward a “shrug of the shoulders” and daily conclusions made because “I think so” rather than “the probabilities are . . .,” or “there is no answer,” or “this approach doesn’t work well enough.” This lack of intellectual discipline detracts from the science of nuclear cardiology to an extent that in literature the investigators sometimes make their points by persuasion and consensus rather than by proof based on tightly reasoned logic, hard data, and merciless statistics. In essence, persuasion and concensus are political processes, not scientific ones. Although all science is in part political and results must be accepted by a group of peers, nuclear cardiology particularly demonstrates this problem, as does this book.

This text, however, is important and useful in that it makes an attempt to present nuclear cardiology in the context of cardiovascular physiology. The choice of authors and of the material presented give evidence of this attempt. Virtually every author has been trained as a cardiovascular scientist first, his expertise has evolved with the methodology of nuclear instrumentation, and he or his group has made significant original contributions to the field of nuclear cardiology. In every chapter the attempt has been made to couch the message within the framework of cardiovascular physiology, although with varying success. It is a good approach! For example, the opening chapter is a summary of cardiovascular physiology by Kirk Peterson. The strength of the chapter, and of the book, lies within the effort made to integrate physiology with diagnostic nuclear instrumentation. The only defects in this excellent review chapter are a surprising, skimpy discussion of the ejection fraction, the sole crucial hard measurement in nuclear cardiology, and no discussion of the physiology of exercise. The specific effects on ejection fraction of heart rate, RR interval, and atrial fibrillation, the effects of acute and chronic changes in afterload and preload are not discussed. It is essential to know that ejection fraction may be depressed in aortic stenosis but returns to normal after valve replacement when afterload is relieved. It is also essential to know that a depressed ejection fraction in the presence of mitral regurgitation with chronic ventricular unloading into the left atrium and pulmonary circulation is an ominous sign; that valve replacement in that circumstance with restoration of normal afterload may make the ejection fraction even worse. The effects of hypertension, hypotension, inotropic agents, and various drugs or exercise, etc., are all a crucial part of the physiologic

background necessary for interpreting ejection fraction; however, there are no details on this important topic. Similarly, there is simply no discussion of the physiology of exercise, especially supine versus upright exercise so important to thallium treadmill testing or supine gated blood-pool analysis. Germane to these studies, the concepts of coronary flow reserve and ventricular function reserve are not addressed either.

The following chapter by Melvin Marcus on the clinical application of technetium pyrophosphate infarct imaging is a paradigm of writing in nuclear cardiology. It is a scholarly presentation beginning with a brief history acknowledging other appropriate investigators, followed by a concise, heavily referenced and documented discussion of the experimental basis, technical problems, clinical applications, sensitivity, and specificity. There are well-considered tables listing specific indications, interpretations, and diseases where the technique is most useful. The section on unique applications and new concepts is interesting; future problems and promise are also mentioned. The chapter does not “sell” the technique but objectively lays out the topic in some of the clearest, best organized, and thoughtful writing that I have read.

The three chapters on thallium imaging were frustrating to this reviewer, since the topic was divided into separate chapters on the use of thallium in infarction-ischemia, exercise, and finally, acute resting chest pain syndromes. As a consequence, there was no cohesive organized presentation of thallium in the same elegant way that the pyrophosphate topic was presented in the previous chapter. George Beller reviewed the kinetics of thallium in a thorough and readable review of the literature. His analysis of thallium redistribution, based primarily on his own investigations, is particularly important and useful. On the other hand, the uptake and subsequent washout of thallium can be analyzed in terms of the classical indicator-dilution theory that utilizes residence time and residue curves reported in an extensive literature on the topic, thereby integrating this interesting information into an established body of knowledge. The description of changes in regional thallium activity with time in patients helps us understand the kinetics of thallium in clinical circumstances. For the diagnosis of coronary artery disease after thallium treadmill testing, this approach is not a strong contribution to the book because of the absence of a sufficiently large data base to produce valid estimates of sensitivity and specificity. The mix of topics, i.e., exercise testing, myocardial infarct imaging, and applications of thallium in noncoronary disease, is a reflection of the difficult organization that the editors apparently imposed upon the topic of thallium imaging.

The assessment of ischemic heart disease with thallium exercise imaging by Gene Trobaugh very nicely outlined the problems of limited sensitivity and specificity as well as the very important concept of Bayes’ theorem to explain the limitations of an imperfect test applied to populations with low prevalence of coronary disease. This important concept was not dealt with elsewhere in the book and, given its importance, could have been expanded considerably. There were some nice examples of abnormal exercise thallium studies with very high quality images characterizing the Seattle work; however, the chapter was somewhat unsatisfactory to this reviewer because it omitted any physiologic studies describing the kinetics and mechanism of thallium defects. For example, there is no discussion on the severity of regional perfusion

necessary to produce a thallium defect. There is no explanation for the well-recognized fall in myocardial thallium activity during exercise as opposed to myocardial activity after resting injection. This question is, of course, related to the fact that thallium uptake in the myocardium is dependent on the relative percent of the cardiac output going to the myocardium at the time of thallium injection, again understandable if presented against the background of classical indicator-dilution theory. Similarly, there is good evidence documenting the fact that defects on thallium images are due primarily to flow disparities rather than ischemia *per se*. To achieve maximum sensitivity and specificity the concept of coronary flow reserve and the necessity for maximum exercise stress are ignored. It is also important for the reader to be informed about the lack of specificity for identifying either the number of arteries involved or specific arteries involved, and about the low sensitivity for detecting circumflex lesions due to attenuation of overlying tissues. Although the chapter is primarily clinically oriented, there is no specific list of indications or review of the sensitivity and specificity for diagnosing coronary artery disease by thallium testing in asymptomatic patients with positive electrocardiographic treadmill results. As it stands, the chapter is clearly written, concise, and certainly accurate; however, it lacks the thoughtful completeness and elegance of detail that characterize other parts of the book.

The final chapter on thallium by Parodi and Maseri is a discussion of thallium scintigraphy at rest. It reviews the pathophysiology of coronary spasm and outlines the kinetics of thallium as it relates to cardiac output in a clear and appropriate way. This limited subject did not give the author sufficient leeway in describing the usefulness or kinetics of thallium in somewhat broader terms. The examples of resting angina with EKG changes were interesting but the images illustrating these cases were not of good quality. These three chapters on thallium imaging do present most of the essentials of the topic but are lacking in some important details, and there is no cohesive integrated approach.

The chapter by Paul Cannon on the measurement of regional myocardial perfusion by the intracoronary xenon technique is presented in sophisticated detail from basic physiology and mathematical models through clinical application and drug interventions. There is an extensive literature on the limitations of inert gas washout techniques because of heterogeneous flow in diseased myocardium. The author does address this problem but not in sufficient detail, and I was unable to resolve the two different points of view from this discussion. This chapter then is an excellent description of a technique developed by Dr. Cannon but which suffers from limited applicability due to the necessity for intracoronary injection during cardiac catheterization. In a book on nuclear cardiology, this reviewer would like to have seen a broader discussion of basic theory and various other techniques for measuring coronary blood flow by this recognized expert in the field.

The chapter on assessment of ventricular function by radionuclide techniques by Heinrich Shelbert is excellent. It is scholarly, detailed, and physiologically oriented and describes the technique precisely with appropriate equations and limitations. The images presented are of a very high quality and documentation by independent angiographic techniques is presented. Dr. Shelbert is critical to a fault and outlines the limitations of both the first-pass and the gated blood-pool studies. He explicitly states the problems and failure of current techniques for measuring regional ventricular function on gated blood-pool images.

The next chapter by Jeffrey Borer extends the topic to clinical application, particularly to exercise-induced changes in ejection fraction for assessing the severity of various forms of heart disease. The author has been in the forefront of assessing ventricular function reserve, which has major implications in diagnostic nuclear cardiology. Certainly, in coronary artery disease as well as

in valvular heart disease, the response of the ventricle to stress is a crucial measure of subtle impairment of ventricular function. However, in view of his significant contributions, the chapter fails to acknowledge the nonspecificity of a fall in ejection fraction during exercise. The quoted specificity of 100% and sensitivity of 93% are clearly due to the selection of patients studied. Subsequent studies have demonstrated that in nonselected groups of patients, the specificity of this test for diagnosing coronary artery disease at least is very much lower, and particularly lower than the specificity for thallium perfusion imaging. The significance of a fall in ejection fraction in the patients with aortic insufficiency is also unsatisfactory as a diagnostic end point. In the group of patients with aortic insufficiency presented as an example, both symptomatic and asymptomatic patients demonstrated a fall in ejection fraction that was not correlated with either surgical selection or survival. While the concepts presented are important, the factual details and statistical validation necessary for practical clinical application are not complete, and these limitations are not explicitly stated in the chapter.

The applications of nuclear medicine to congenital heart disease, particularly in children, has not been developed to the extent of its application in adults. The brief chapter by Gilday and Ashe outline the potential uses of radionuclide techniques and the standard diagnostic tests for this group of patients. The chapter is primarily an outline, and there are insufficient details for the reader to calculate the volume of shunts or to apply the technique to a variety of congenital defects. There are several examples, however, that are quite interesting. Given the necessity for dynamic viewing of radionuclide angiography in congenital heart disease, this chapter is an appropriate and timely description of the general topic.

The final two chapters are a description of the future and a summary of nuclear cardiology. Although not generally available, positron tomography for cardiac studies is the beginning of a new era for quantitative analysis of the metabolism, function, anatomy, and flow in the heart. Michael Phelps outlines the history and instrumentation of positron tomography and touches upon the mathematical modeling of some of the available radionuclides as an example of what can be accomplished. Given the enormous breadth of the topic, involving physics, biochemistry, physiology, and clinical imaging, Dr. Phelps has concisely presented a generous amount of material. The complexity of some of the illustrations reminded this reviewer of a complicated, three-dimensional road map changing in time. Perhaps that problem arises as a consequence of the presentation of high-quality images showing more anatomic detail than those of us in nuclear cardiology are accustomed to viewing. A more thoughtful pruning or selection of figures would have strengthened his case. The last chapter by Bertram Pitt is a summary of the role of myocardial imaging in cardiovascular disease. The summary chapter demonstrates both the strengths and the weaknesses of this book. The various applications of nuclear imaging to cardiovascular diseases is nicely outlined and the potential importance of such studies is made clear. For this reviewer's taste there is an overabundance of optimism about the specificity and sensitivity of these tests with a paucity of hard data documenting their usefulness. For example, I would take exception with the quoted sensitivity and specificity of 95% for exercise gated blood-pool studies in the diagnosis of coronary artery disease. In this same vein there was no chapter seriously addressing the problem of statistics in nuclear cardiology. Statistics of counting are important in individual images or regions of an image as well as for sophisticated receiver operating curves used for assessing sensitivity and specificity. This topic is so important to the field and is certainly complex enough that a separate chapter would have been very much in order.

Despite my critical comments I liked this book because it takes a physiologic approach to nuclear cardiology. It is easily read,

informative, and provides a good summary of the topic. My complaints are primarily ones of omission, which may have been imposed by the restrictions of book length. Given the enormous rate of change in this field and the complex interlacing between physiology, physics, instrumentation, chemistry, and clinical medicine, the authors and editors, Righetti and Donath, are to be congratulated on producing a book that belongs on the bookshelf of every cardiologist and nuclear physician.

LANCE GOULD
University of Texas
Health Science Center
Houston, Texas

IRRADIATION AND THYROID DISEASE: DOSIMETRIC, CLINICAL AND CARCINOGENIC ASPECTS. J. E. Dumont, J. F. Malone, A. J. Van Herle. Luxembourg, Commission of the European Communities, 1980, 254 pp, \$27.60

This volume was prepared, according to Dr. Dumont's introduction, for the clinically oriented reader. It consists of a clinical overview of pathological states of the human thyroid induced by radiation (Van Herle), followed by more detailed discussions of thyroid radiation dosimetry (Malone), thyroid physiology (Dumont), and radiation-induced thyroid damage (Dumont and Malone).

The clinical survey chapter includes an excellent review of studies of the effects of irradiation on the human thyroid, with special attention to the relative incidences of hypothyroidism, benign thyroid nodules, and thyroid cancer. The author discusses essentially all clinical and epidemiological studies that address this topic, and he succeeds in making logical sense out of a confusing assortment of studies. He also presents practical guidance to the clinician evaluating and treating patients whose thyroid glands have been irradiated.

The chapter on dosimetry was fascinating. Dr. Malone covers the practical aspects of human thyroidal dosimetry after commenting that he supposes that the paucity of quantitative literature about human thyroidal radiation effects relates somehow "to the feeling that thyroid dosimetry is technically difficult, if not impossible." He then proceeds to explain lucidly how dosimetry can be done, including a review of various methods to estimate thyroid gland size and a presentation of his own work with thermoluminescent disks for determining the integral under the time-activity curve. Unfortunately, he presents a theoretically plausible technique for measurement of the latter based on a constant dose extrapolated from experimental work not validated in man. It is probably useless in the human thyroid except when biologic radioiodide half-life is unusually short. There follows a section on the microdosimetry of the thyroid as affected by various forms of radiation and a discussion of thyroidal doses encountered in practice.

The chapter on the physiology of the nonirradiated thyroid gland starts with an excellent and comprehensive, yet succinct, review of current understanding of follicular cell physiology. When the author discusses control mechanisms, however, he introduces a degree of experimental detail that seemed, to this reviewer, to be excessive in detail and difficult to relate to the central theme of the book. The final chapter presents experimental work on the induction of thyroid cancers by irradiation. The introductory sections of this chapter—on the chemical effects of radiation in biologic systems and on the effects of radiation on the thyroid—are of general interest. The review of current understanding of tumorigenesis in the thyroid leaves this reader with the dissatisfaction produced by an erudite elucidation of a poorly understood subject.

The authors summarized this monograph succinctly in a three-page conclusion. The bibliography, 439 citations from world

literature, contains many items that may be new to the American reader interested in this field.

Finally, it must be noted that this volume appears to have been hastily prepared. The photo-offset format from typewriter script is not bothersome in itself, but the imprints of as many as three distinct typewriter keyboards can be seen on a single page. Editing has been done with minimal retyping, leaving one with the feeling of reviewing a second draft. In places, characters are left out—presumably because there was no appropriate key on the particular typewriter—and no one noticed the absence in proofreading. Some typographical errors are present and several tables are out of order. While such technical details do not mask this as a useful, timely document, they do tend to modulate its impact.

MARGUERITE T. HAYS
University of California at Davis
Veterans Administration
Medical Center
Martinez, California

PEARLS IN DIAGNOSTIC RADIOLOGY. H. D. Rosenbaum. New York/London/Melbourne, Churchill Livingstone, 1980, 238 pp, \$32.50

The true measure of the success of a book is the manner in which the author or authors attain the goal of imparting information or enjoyment to those who read it. In this case, Dr. Rosenbaum has succeeded admirably.

This text, bound in looseleaf style so that additions may be easily added, consists of 60 examples of case-orientated teaching selected from those used as a weekly teaching experience at the University of Kentucky. Each case is presented in a method that allows the reader to test his or her knowledge before a review of the radiographic findings and clinical correlation, and the cases cover a spectrum of disease problems in both adult and pediatric chest, cardiovascular, gastrointestinal, genitourinary, and orthopedic radiologic disease states. By no means is the text meant to be a complete coverage of the field of diagnostic radiology; it is, rather, an example of the usefulness of the case-oriented format for teaching and learning by the individual. The only disappointing factor in the entire book is a minor one—a lack of consistency in the reproduction of the radiographs, with a few of the reproductions not reaching the generally high caliber found throughout the text.

I believe Dr. Rosenbaum should be congratulated for a very worthwhile attempt to add to our knowledge with this case-oriented approach. The explanation and discussion of the cases presented are brisk, short, and yet quite complete. The main value of this book may well be to those, such as radiology residents, who have had at least some basic radiologic training, but I believe the book holds great value for any physician who is even obliquely involved in evaluating diseased patients by any imaging modality.

ROBERT E. O'MARA
Univ. of Rochester
School of Medicine
and Dentistry
Rochester, New York

AMPLITUDE DISTRIBUTION SPECTROMETERS. Waldemar Scharf and Waldemar Lisieski. New York, Elsevier Scientific Publishing Company, 1979, 568 pp, \$90.25

This book is intended to be a reference source for users of amplitude distribution spectrometers. It was originally published in Polish in 1973, and the present edition is a revised and updated English version. It is divided into eight chapters covering the