Contemporary Cardiology

Christopher P. Cannon, MD

Series Editor

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In the USA, the performance of nuclear cardiology studies increased dramatically over the past 5 to 10 years. In 2001, the number of patient visits for myocardial perfusion imaging was 7.9 million. In 2005, the number of patient visits increased to 9.3 million. Roughly 96% of these studies used ECG-gated single-photon emission computed tomography (SPECT) imaging. Roughly half (47%) of these studies were performed in nonhospital settings [1].

The growth of nuclear cardiology as an expanded outpatient laboratory enterprise is readily apparent. In the USA, as well as in other parts of the world, this growth has been linked to the recognition of the ability of cardiologists to perform these studies. Certification examination in nuclear cardiology is now an established cardiology phenomenon in the USA. Certification by one of several mechanisms is now generally required for hospital privileges in reading studies and is also often required to obtain reimbursement for study performance and interpretation.

Accreditation of laboratories is also well established. Indeed, at the time of this writing, we have learned that one large payor, responsible for 70 million lives, will require laboratory accreditation for reimbursement by March 2008.

Over the years, some of the most frequent questions asked of us by our former trainees after leaving the program relate to practical issues involved in the establishment of a nuclear cardiology laboratory. In view of the growth of the field, this is certainly not surprising.

There are a number of excellent texts on general nuclear cardiology available [2–5]. These books generally deal with the overall concepts of the field, its scientific basis, techniques, clinical applications, and clinical value. However, to our knowledge, there does not presently exist a volume designed to provide the nuclear cardiologist with a manual dedicated specifically to how to establish and run a well organized and state-of-the-art nuclear cardiology laboratory.

Consequently, the purpose of this book is to provide the outline for the “nuts and bolts” establishment and operation of a nuclear cardiology laboratory. In so doing, we have attempted to deal with the relevant issues that a laboratory director must address in either setting up the laboratory or maintaining its competitive edge and clinical
competence over time. We primarily attempt to identify issues related to outpatient imaging facilities. However, where appropriate, issues related to in-patients in hospital-based laboratories are also discussed.

This book is aimed at cardiology fellows, nuclear cardiology fellows, and nuclear medicine and radiology residents completing training as well as established cardiologists, radiologists, or nuclear physicians who want to establish a nuclear cardiology laboratory. The book should also be of value to nuclear cardiology technologists, laboratory managers, and health maintenance organizations. Attention has also been paid to those factors relevant for laboratory accreditation.

The book is organized in what we feel is a logical progression. In this new edition, we have kept the basic format established in the first edition. In addition to reviewing, modifying, and updating each chapter in the first edition, we have added entirely new chapters on positron emission tomography (PET) imaging, hybrid imaging, and the clinical appropriateness of nuclear cardiology procedures.

The initial chapter addresses what is required to establish the laboratory in terms of equipment, availability of radiopharmaceuticals, and staff qualifications. A chapter is devoted to the types of information patients should be provided with, prior to arriving in the laboratory. Chapters are devoted to laboratory logistics and appropriate clinical protocols for stress studies. Several chapters deal with the technical aspects of performance of studies, such as those acquisition parameters relevant for high-quality studies, processing parameters, and quantification and display options. Sections on attenuation correction have been expanded. Examples are given of commonly encountered artifacts. We deal with issues relating to networking, both within one laboratory and linking several laboratories. Issues relating to dictation and reporting, coding and reimbursement, and quality assurance are also separately addressed. Finally, we address key policy issues that are relevant to high-quality clinical performance and conclude with a chapter addressing issues relevant to laboratory accreditation. The new chapter on PET imaging and hybrid imaging reflects new clinical advances in the field since the first edition. It is likely that these technologies will have an increasing clinical utilization in the immediate and near future. The new chapter on appropriateness guidelines reflects the recent joint attempt of ACC/ASNC to establish clinical criteria for technology utilization. It is important for practitioners of nuclear cardiology to perform studies only when appropriate. It is not enough to run a highly capable technologic enterprise; it must be clinically relevant as well.
We are hopeful that this second edition will continue to fill an important clinical need within the cardiology and imaging communities. The book has been designed to be straightforward and to deal directly with the issues at hand and to build on the strengths established in the first edition. In many instances, we present several sides of a particular issue. The final decision on which approach to take will depend on local circumstances.

Finally, in conclusion, it is very important to acknowledge the multiple lessons we have learned from the many technologists and trainees, both in cardiology and nuclear medicine who have passed through our laboratory over the past two decades. Their input, as well as the opportunity to take part in their training, has helped us enormously in the conception and writing of this book. Some of the useful websites are http://www.asnc.org, http://www.cbnc.org, and http://www.icanl.org.

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Frans J. Th. Wackers, MD, PhD

Frans J. Th. Wackers, MD, is Professor of Diagnostic Radiology and Medicine and served as Director of the Cardiovascular Nuclear Imaging Laboratory at Yale University School of Medicine for 22 years.

Born in Echt, The Netherlands, Dr. Wackers received both his MD and PhD degrees from the University of Amsterdam School of Medicine in 1970. He completed training in Internal Medicine and Cardiology in the former Wilhelmina Gasthuis, Amsterdam in 1977. Dr. Wackers moved to the USA in 1977, where he was on the faculty of the Section of Cardiovascular Medicine at Yale University School of Medicine (1977–1981), the University of Vermont College of Medicine (1981–1984), and since 1984 at Yale University School of Medicine.

Dr. Wackers is a Fellow of the American College of Cardiology; a Fellow of the American Heart Association, Council on Clinical Cardiology; a member of the Society of Nuclear Medicine; and a member and Fellow of the American Society of Nuclear Cardiology. He is also a Diploma European Cardiologist of European Society of Cardiology. He is on the Editorial Board of the *Journal of the American College of Cardiology*, the *American Journal of Cardiology*, and the *Journal of Nuclear Cardiology*. He was President of the Cardiovascular Council of The Society of Nuclear Medicine (1992–1993), President of the American

Dr. Wackers is considered a pioneer in Nuclear Cardiology. He is the founder of the American Society of Nuclear Cardiology (1993), the Certification Board of Nuclear Cardiology (1996), and the Intersocietal Commission for Accreditation of Nuclear laboratories (1997). He was Co-Chair of the 6th and 7th International Conference of Nuclear Cardiology (2003 and 2005, repsectively).

Dr. Wackers has published more than 300 articles on nuclear cardiology and clinical cardiology.

Dr. Wackers is presently the Principal Investigator and Chairman of the multicenter Detection of Ischemia in Asymptomatic Diabetics (DIAD) study. The study began in September 2000, recruitment was completed in August 2002, and continued until September 2007.

Dr. Wackers is also the director of the Yale University Radionuclide Core laboratory. The laboratory has been involved in numerous multicenter clinical studies utilizing cardiac nuclear imaging since its inception in 1984.
Wendi Bruni, BS, CNMT

Wendy Bruni is manager of the Nuclear Cardiology and Nuclear Medicine laboratories of the Department of Diagnostic Radiology at Yale-New Haven Hospital, New Haven, CT. She served as chief technologist of the Cardiovascular Nuclear Imaging Laboratory for 10 years. Ms. Bruni received her BS in nuclear medicine from the Rochester Institute of Technology, Rochester, NY, in 1986. She worked in the nuclear medicine department at the Community General Hospital, Syracuse, NY, from 1986 to 1992. In 1992, she moved to Yale-New Haven Hospital. In 1995, she became Chief Technologist of the Yale Nuclear Cardiology Department. In 2004, she became the administrative manager of Yale-New Haven Hospital Nuclear Cardiology and Nuclear Medicine laboratories.

Ms. Bruni is an active member of the American Society of Nuclear Cardiology, participating in the technologist, newsletter, and program committees. She was secretary of the New England Chapter of the Society of Nuclear Medicine (1999) and Chair of the Nuclear Cardiology Council of the Society of Nuclear Medicine Technologist Section. Ms. Bruni was selected to be on the panel of nuclear cardiology technologists who helped the NMTCB evaluate the Nuclear Cardiology Specialty Exam for technologists. She was one of the first to obtain the specialty certification of Nuclear Cardiology (NCT) in June 2001.
Barry L. Zaret, MD

Barry L. Zaret, MD, is Robert W. Berliner Professor of Medicine (Cardiovascular Medicine) and Professor of Diagnosis Radiology. He served as Chief of Cardiovascular Medicine at Yale University for 26 years.

Dr. Zaret received his BS degree from Queens College, City University of New York, and MD degree from New York University School of Medicine.

He completed training in cardiology in 1971 at The Johns Hopkins University School of Medicine. He became Chief of Cardiology at Yale University School of Medicine in 1978.

He is a Fellow of the American College of Cardiology; Fellow of the American Heart Association; and a Founding member of the American Society of Nuclear Cardiology. He is founding Editor-in-Chief of the *Journal of Nuclear Cardiology* and is on the Editorial Board of the *Circulation*, the *Journal of the American College of Cardiology*, the *American Journal of Cardiology*, and the *Journal of Nuclear Cardiology*. He was president of the Association of Professors of Cardiology (1992–1993).

He has received numerous awards and recognitions, including the Herrman Blumgart Award of the Society of Nuclear Medicine, New England Chapter (1978), the Louis Sudler Lecturer and Medalist, Rush-Presbyterian Medial College (1993), the Award for Contribution and Leadership in Noninvasive Cardiology, 4th International Conference on Noninvasive Cardiology, Cyprus (1993), the 29th Nathan J. Kiven Orator award, Providence RI (1996), The Solomon A. Berson Medical Alumni Achievement Award in Clinical Science, New York University
School of Medicine (1998), Co-Chair of the 1st and 2nd International Conference of Nuclear Cardiology (1993 and 1995, respectively), Co-Director of the 2nd, 3rd, and 4th Wintergreen Conference on Nuclear Cardiology (1994, 1996, 1998, respectively), First Samuel and Patsy Paine Lecturer, University of Texas (2001), 2nd Annual Mario Verani Lecture, American Society of Nuclear Cardiology (2003), the Ellis Island Medal of Honor (2003), and the American Society of Nuclear Cardiology Distinguished Service Award (2006).

Dr. Zaret is considered one of the founders and present leaders of the subspecialty of Nuclear Cardiology. He has made numerous contributions to cardiology literature on myocardial perfusion imaging and assessment of cardiac function using radionuclide imaging methodology.
All illustrations and movies in this book can be found in digital format on the accompanying CD. The images are best viewed on a high-resolution (1280 \times 1280) color (24-bit or higher true color) computer monitor. The movies are best viewed at a display of 8–10 frames per second.