International Perspectives on Nuclear Cardiology

At the 2003 SNM annual meeting in New Orleans, LA, a session on recent international trends in nuclear cardiology was presented by the SNM Cardiovascular Council (CVC). Nagara Tamaki, MD, a member of the CVC board of directors, and Salvador Borges-Neto, MD, president of the CVC, planned and organized the session to focus on the ways in which growing numbers of nuclear cardiology techniques are implemented around the world. Although nuclear cardiology is well developed and rapidly growing in North America, this is not the case everywhere. Differences in educational systems, nuclear medicine regulations, and the prevalence of heart disease may have significant effects on the practice of nuclear cardiology.

In that session, 3 speakers representing Asia, Europe, and Latin America described the cost and number of performed procedures, the fraction of cardiac studies among the total of nuclear medicine procedures, the persons responsible for performing nuclear cardiology procedures and reporting of results, and clinical perspectives on the ways in which diagnostic tests are used for patient management. They also discussed ways to promote and integrate nuclear cardiology into clinical cardiology.

Results discussed in this seminar are presented here as background for some of the excellent scientific presentations on cardiovascular nuclear medicine scheduled for presentation by individuals from more than 40 countries at the 2004 SNM meeting in Philadelphia (June 21–24). In addition, the CVC and other organizers have prepared an outstanding categorical seminar for the meeting on advances in cardiovascular nuclear medicine, many of which are already making inroads into the practice settings outlined here (see page XXN).

Asia

Tamaki (Hokkaido University, Japan) surveyed the status of nuclear cardiology in Japan, Korea, and other Asian countries. He first discussed nuclear medicine practice in Japan, citing data from the report of the fifth nationwide survey, published in 2002. Although the number of nuclear medicine procedures had not changed significantly (1.6 million per year), the number of nuclear cardiology procedures was increasing slightly but significantly (at a rate of about 0.4 million per year). Myocardial imaging has been the second most commonly performed nuclear scan, with bone imaging in first place. Among myocardial imaging radiopharmaceuticals, 201Tl remains the most commonly used tracer for perfusion, but 99mTc-sestamibi (99mTc-MIBI) and -tetrofosmin have become increasingly popular. In addition, 123I-labeled radiopharmaceuticals, such as 123I-β-methyl-p-iodophenylpentadecanoic acid (123I-BMIPP) and 123I-metaiodobenzylguanidine (123I-MIBG), are in more common use in Japan than in North America. 123I-BMIPP is routinely used for detecting myocardial ischemia in patients with suspected or known coronary artery disease, whereas 123I-MIBG is mainly used in patients with varying types of depressed cardiac function.

Nuclear cardiology in Korea has recently been growing rapidly. Although the total number of nuclear medicine procedures has increased by only 10% in 2 years, the number of cardiac scans doubled in that period (28,960 in 2000; 59,929 in 2002). In particular, myocardial perfusion imaging has greatly increased, with about equal numbers of 201Tl- and 99mTc-labeled pharmaceutical applications.

Japan and Korea are the 2 countries in Asia in which nuclear cardiology is most well developed and in widest clinical use in many cardiology centers. This may be the result, in part, of the fact that the 2 countries are geographically close, with frequent and unrestricted communication that fosters the promotion of nuclear cardiology.

Nuclear cardiology in China has also been growing rapidly in the past 20 years. Since 1986, 5 national nuclear cardiology conferences have been held. The first International Symposium on Cardiovascular Nuclear Medicine, sponsored by China and the International Atomic Energy Agency, was held in Beijing in 2002, with more than 200 participants. The total number of nuclear cardiac procedures in China in 2002 was 85,000, 90% of which were myocardial perfusion imaging (which was the second most widely used nuclear diagnostic imaging procedure). Ninety percent of these MPI procedures used 99mTc-MIBI as the tracer. In some nuclear medicine departments, 18F-FDG is used for myocardial viability PET or SPECT studies with coincidence detectors.

Nuclear cardiology is not widely performed in other Asian countries. This is unfortunate, especially when the large population bases of the region are considered. Although nuclear cardiology is relatively well known in India, Pakistan, and Singapore, the numbers of cardiac scans performed annually are only 15,000, 12,000, and 10,000, respectively. For Pakistan and Singapore, however, these numbers represent a doubling in the past 4 to 5 years. India has only 42 nuclear cardiology centers, Pakistan 18, and Singapore 5. Most cardiologists in these countries prefer echocardiography as a screening test and coronary angiography as a final diagnostic test. Coronary angiography remains relatively inexpensive compared with radionuclide imaging. Nuclear medicine and specifically nuclear cardiology procedures are considered to be
special tests and are performed in only a few large centers. Similar situations are seen in a number of other countries in Asia.

Other problems facing nuclear cardiology in Asia are limited training opportunities and the fact that general cardiologists currently have a greater interest in intervention and echocardiography than in nuclear medicine techniques. To promote nuclear cardiology in these countries, important issues in training and health administration must be addressed. Nuclear cardiology training should be required as a part of a core curriculum for cardiologists and nuclear medicine fellows. Fortunately, nuclear cardiology satellite meetings have been held in conjunction with the Asia and Pacific Oceania Congresses of Cardiology during the past several years. In addition, one university in Pakistan offers an excellent nuclear medicine training program including nuclear cardiology. This extensive 2-year training and teaching program requires the preparation and submission of a research thesis at completion. Such efforts may serve to increase the number of nuclear cardiology scans performed.

**Europe**

Jeroen Bax, MD (Leiden University Medical Center, The Netherlands), addressed the use of nuclear cardiology in Europe. The status of nuclear cardiology in Europe was reviewed using reports provided by Mallinkrodt Medical, Amersham Health, and Bristol-Myers Squibb. Data (originally reported in 2000) from France, Germany, Italy, Spain, and the United Kingdom were compared. In a brief demographic review, Bax noted the respective populations of the countries (range, 39–82 million), percentages of individuals older than 65 years (range, 16%–18%), life expectancies (77–79 years), incidences of cardiovascular disease (expressed as percentage of total mortality; range, 1.6%–1.8%), incidences of ischemic heart disease (range, 4.0%–4.6%), and health care spending (expressed as share of gross domestic product; range 7.5%–10.6%).

Also compared for the 5 countries were total practicing physicians (range, 100,400–322,120), numbers of doctors per 100,000 persons (range, 170–578), cardiologists per 100,000 persons (range, 1.1–6.6), total hospital facilities (range, 800–3,700), hospital beds per 1,000 persons (range, 4.0–9.4), cardiac surgery facilities (range, 20–115), and cardiac catheterization laboratories (range, 115–340).

Based on this information, it was concluded that although the demographics of the 5 countries did not vary significantly, substantial differences existed in physician numbers and hospital facilities.

Next, equipment was reviewed, with data applicable for all of Europe but not for specific countries. A total of 4.8 MRI systems, 0.3 PET systems, and 13.2 CT systems were available for every million persons. A total of 86,761,200 procedures were performed in 2000, including 52,070,000 electrocardiographic examinations, 33,000,000 noninvasive procedures, and 1,691,200 invasive procedures. Of these noninvasive procedures, 3% were MRI studies, 9% CT, 18% nuclear cardiology, and 70% ultrasound.

More precise data were presented on the use of myocardial perfusion studies in Europe in 2002. A total of 765,342 studies were performed, compared with 5.9 million procedures in the United States. In Europe, the highest number of studies was performed in Germany (270,218) and the lowest in the United Kingdom (61,368). Comparative growth rates of these procedures were also reviewed. In Europe, the growth rate from 1998 to 2002 was 11.4%, compared with 11.0% in the United States. The highest European growth rate was observed in the United Kingdom (26.7%), and the lowest in France (5.1%).

Nuclear cardiology in Europe, for the most part, is performed by nuclear medicine physicians. In the majority of settings, close collaboration exists between these physicians and the cardiologist. This collaboration should be intensified to optimize the use of nuclear cardiology in Europe.

**Latin America**

Fernando Mut, MD (University of Uruguay, Montevideo), presented data from Latin America. The main characteristic of the Latin American region is diversity, not only in geography but also in cultural, socioeconomic, and epidemiologic features. Heart disease is the most common cause of death in some countries, such as Argentina, Uruguay, and Chile, as well as in most of Brazil, Colombia, and Costa Rica. Not surprisingly, these are among the most developed countries in the region. In other countries, the incidence of coronary artery disease is less prevalent, although increasing steadily.

The 20 countries that form Latin America and encompass the Caribbean and Central and South America have more than 700 nuclear medicine departments, performing at least half a million nuclear cardiology studies annually. The population served totals more than 400 million. Installed technology is diverse, although state-of-the-art instruments and procedures are commonly available. Nuclear cardiology has experienced a significant growth during the past few decades, representing less than 5% of all nuclear medicine procedures in the 1960s and 1970s to about 40% in the new millennium, according to a recent survey.

SPECT technology is the standard in most laboratories, although a few continue to perform planar studies. Myocardial perfusion scintigraphy is the most frequently used procedure, and gated SPECT, a technique that is rapidly growing, is offered at about 20% of facilities. The use of pharmacologic stress, especially with dipyridamole, is increasing to the point that, in many laboratories, it almost equals exercise as the stressing agent of choice. $^{99m}$Tc-sestamibi is the most widely employed radiopharmaceutical for myocardial perfusion.

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Nagara Tamaki

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