HIGHLIGHTS FROM THE FIRST WORLD CHINESE
CONFERENCE OF NUCLEAR MEDICINE, WUXI, CHINA

Meeting reveals Chinese progress in PET, SPECT, monoclonal antibodies, and nuclear cardiology and oncology

The First World Chinese Conference of Nuclear Medicine (WCCNM) brought more than 150 physicians and scientists to the Jiangsu Institute of Nuclear Medicine in Wuxi, China in August 1993. It was the first time that Chinese nuclear medicine specialists from all over the world, including Taiwan, met for a joint scientific meeting in mainland China. Conference participants represented China, Taiwan, Hong Kong, Singapore, The Netherlands, and the U.S. The Chinese Society of Nuclear Medicine (CSNM) and the Chinese-American Society of Nuclear Medicine (CASNM) co-sponsored the conference, and it was organized by CASNM immediate past-president Koon Yan Pak, PhD, CSNM immediate past-vice-president Man-Da Zhang, MD, CASNM president Wei-Jen Shih, MD, and CSNM immediate past-president Xiang-Tong Lin, MD.

CASNM and CSNM had previously sponsored the First Sino-American Nuclear Medicine Conference, held in Wuxi, China in 1986 and the Second Sino-American Nuclear Medicine Conference, held in Beijing, China in 1991.

In an awards ceremony, Peter Shin-Hwa Yeh, MD, president of the Chinese Society of Nuclear Medicine (Taipei) from Taipei Veterans General Hospital and National Yang-Ming Medical College (Taipei, Taiwan), was named "Outstanding Nuclear Medicine Physician." An equivalent award was given to Xiujie Liu, MD, CSNM president from the Cardiovascular Institute and Fu Wai Hospital of the Chinese Academy of Medical Sciences (Beijing, China).

Jiangsu Institute of Nuclear Medicine, founded in 1959, is one of the research centers specializing in nuclear medicine in China. It has a staff of over 170, including 120 scientific and 20 senior investigators. The institute has a department of scientific research, a pharmaceutical factory, an information department, and an affiliated hospital. Under the auspices of the Ministry of Public Health, the pharmaceutical factory at the Jiangsu Institute produces radio-pharmaceuticals and radioimmunoassay kits which supply hospitals in China. The institute's Department of Information publishes the Chinese Journal of Nuclear Medicine. The affiliated hospital, at the center of Wuxi, has modern nuclear medicine facilities and 25 beds for radionuclide therapy.

Since Henry N. Wagner, Jr., MD, introduced the first 99mTc generator to China in 1979, nuclear medicine in China has made progress. Technetium generators and kits for technetium-labeling are now produced inside China for domestic use and for export. Whereas the availability of some cyclotron products like 123I and 131I in China is rather limited, kits for labeling with 99mTc like sestamibi and ECD are readily available. Other radio-pharmaceuticals distributed throughout China are 32P-sodium phosphate, 35S-collodial chromium phosphate, 51Cr-sodium chromate, 123I- and 131I-sodium iodide, 131I-ortho-iodopropionate, and 186Au-collodial gold. (See box, "Current Nuclear Medicine Status in China."

Invited Lectures
The first highlight at the WCCNM was the main invited lecture, presented by Dr. Wagner, who depicted the vital role of intercellular communication for the maintenance of higher life forms and the importance of receptor interaction in this integration. Nuclear medicine, he said, has "a unique potential to study specific intercellular interactions characteristic of the organism. Because disease starts at the molecular level, nuclear medicine will be able to trace disease at the earliest stage and directly monitor response to treatment."

Richard C. Reba, MD, SNM president,
made another major contribution in the keynote address on immunoscintigraphy for detecting malignant and infectious diseases. He presented the results of a multicenter trial on the first FDA-approved monoclonal antibody for immunoscintigraphy in humans (B72.1, OncoScint). For pelvic localizations and extra-abdominal metastases of colorectal carcinoma, immunoscintigraphy results were better than the outcome of CT. Significantly, Dr. Reba noted that in almost 88% of the patients, immunoscintigraphy appears to influence patient treatment decisions by modifying the planned surgical approach and by identifying who will need adjunctive pre-operative chemotherapy and who will not benefit by surgery.

Dr. Peter Yeh presented the preliminary results of a PET study with 18F-fluoro misonidazole in patients with nasopharyngeal carcinoma. PET sensitivity was 94%, superior to CT. The national PET and cyclotron center of Taiwan, inaugurated on November 23, 1992, consists of a 17 MeV cyclotron and a Scanditronix whole-body PET camera.

Dr. Liu discussed the evaluation of myocardial viability using isosorbide dinitrate infusion and 99mTc-sestamibi SPECT. In rest, 99mTc-sestamibi perfusion imaging cannot discriminate between viable and infarcted myocardium. But after isosorbide dinitrate infusion, 54% of abnormal perfusion segments in rest showed improved uptake of 99mTc-sestamibi, suggesting these segments' viability. This study was conducted in over 3,000 patients. Results of 99mTc-sestamibi SPECT were compared with the outcome of coronary angiography. A sensitivity for detection of myocardial ischemia of 96% and a specificity of 85% was found.

Ban An Khaw, PhD, from Northeastern University (Boston, MA) presented a lecture on the use of an IgM monoclonal antibody, Z2D3, directed against proliferating smooth muscle cells to visualize atherosclerotic lesions. Rabbit experiments with the native antibody gave disappointing results. But class-switched IgG variants and murine/human chimeric anti-bodies appeared better for in vivo targeting. For 'In-labeled Z2D3 Fab containing target-to-background ratios as high as six were found. The protein dose required for such a result in a rabbit was 1 mg. By loading the antibody fragment with polylsine, the non-specific uptake was diminished, enabling the reduction of the required antibody dose to 15 µg. Chimeric indium-labeled Z2D3 Fab seems very promising for imaging atherosclerotic lesions in patients.

Benjamin M.W. Tsui, PhD, from the University of North Carolina at Chapel Hill discussed recent advances in SPECT instrumentation and image reconstruction. Newly developed multi-headed SPECT systems provide better resolution and higher detection efficiency and thus reduce imaging time. Faster computers allow more sophisticated image processing with better correction for image degrading factors like attenuation, scatter, and noise.

Chin-Tu Chen, PhD, from the University of Chicago and the Institute of High Energy Physics (IHEP, Beijing, China), described the development of PET scanners in China. A prototype PET scanner was built in 1986 and then used primarily for animal and phantom studies. Since 1992, a PET scanner, developed at IHEP, has been in operation for clinical studies. This PET system has two rings, each with 304 BGO detector elements, and has an in-plane spatial resolution better than 6 mm at the center of the scanner. Design of the third system with improved performance characteristics is currently in progress at IHEP.

Hong-Yoe Oei, MD, from the University Hospital, University of Rotterdam (The Netherlands), presented an overview of the use of 111In-octreotide in more than 1,000 patients. Various tumors contain high numbers of somatostatin receptors, which enable in vivo localization of the primary tumor and its metastases by scintigraphy with the radiolabeled somatostatin analogue octreotide. Scintigraphy with octreotide can be used for localization of the tumor site for surgical treatment and to predict the effect of treatment with 'cold' octreotide. Planar and SPECT studies are preferably performed at 24 h.p.i. When bowel contents are visible, planar imaging should be repeated at 48 h.p.i. In cases of Grave's disease, increased thyroid uptake is seen, possibly due to receptor binding on activated lymphocytes.

Image Processing, Cardiology, Oncology, and Radionuclide Therapy

Several contributions dealt with optimizing reconstruction of SPECT images. Dr. Tsui presented a paper on attenuation and detector response compensation in cardiac SPECT imaging using iterative reconstruction algorithms. Quantitative cardiac SPECT reconstruction with compensation for attenuation due to patient anatomy provides improved imaging of the right ventricular wall and the posterior wall of the left ventricle. Results of the simulation study were supported by data from more than 20 201TI patient studies. Jerome Z. Liang, MD, from the State University of New York, Stony Brook, discussed a similar approach using a cone-beam projector/back projector he developed and an iterative figured back projection algorithm to reconstruct the images. A chest phantom was computer-generated to test the reconstruction. Quantitative reconstruction with less than 5% error was obtained within half an hour using a desktop computer. James J. Zhang, PhD, from Thomas Jefferson University Hospital (Pittsburg, PA), presented a contribution on co-registration of SPECT and MRI/CT images, for which there is a steadily increasing clinical need. For now, the main clinical application of this technique is brain imaging; because of the high anatomic resolution, it is well-suited for imaging of small brain tumors.

Reinjection of 201TI has been proposed as a means to improve the differentiation between infarcted and ischemic but viable myocardium. According to Z.X. He, MD, from Sun Yat-Sen Cardiovascular Hospital (Shenzhen, China), the extent of ischemic but viable myocardium is still
underestimated. He proposed to administer isosorbide nitrate immediately after exercise SPECT imaging in combination with reinjection thallium imaging at rest to further improve the detection of viable myocardium.

201Tl is a potassium analog widely used for myocardial scintigraphy, which has recently been proposed for tumor imaging. 99mTc-MIBI, which has the potential to replace thallium for cardiac imaging, may also be useful for scintigraphy of malignant diseases. Two WCCNM papers described tumor imaging with either 201Tl or 99mTc-MIBI. Chang-ying Jiang, MD, from the Cancer Hospital, Shanghai Medical University (Shanghai, China), reported on 201Tl SPECT imaging in 10 patients (nine malignancies, one hemangioma). All tumor localizations were positive on 201Tl imaging. Once more, 201Tl scintigraphy seems useful for detecting recurrent disease after treatment. It appeared to differentiate recurrence from inflammation and necrosis. Jia-Xiu Li, MD, from the Oncological Hospital of the Chinese Academy of Medical Sciences (Beijing, China) presented a paper on three-phase imaging with 99mTc-MIBI in 60 patients (38 lung cancers, 12 benign masses).

The majority of patients with central-type lung cancer do not have operative disease. Quan-Shi Wang, MD, from Norman Bethune University of Medical Sciences (Changchun, China), reported a new approach to local therapy of this type of lung cancer. By means of a fiberoptic bronchoscope and a laser beam, the tumor was holed and injected with an 111In Au colloid dose of approximately 40 MBq/cm² of tumor. Lung cancer patients, including stages III and IV, underwent treatment. Only slight damage was observed in surrounding tissues. Complete tumor disappearance was obtained in 4 out of 24 patients with stage IIIa lung carcinoma.

Roland A. Claessens, PhD, MD
University Hospital,
University of Nijmegen
Nijmegen, The Netherlands

Current Status of Nuclear Medicine in China

The status of nuclear medicine practice and research in China were summarized in the reports which CSNM President Dr. Liu Xiu-Jie gave at the Fourth National Nuclear Medicine Conference in Wuhan from April 11-13, 1993, and by the president of the Jiangsu Institute of Nuclear Medicine, Dr. Zhang Man-da. At present, 1,846 Ci of molybdenum-technetium as generators are used annually in China. About one-third is used in Beijing, Shanghai, and Tianjin. The amount of 131I used is 512 Ci; 125I is 77 Ci; 153Sm (probably in the form of EDTMP for bony metastases) is 73 Ci; and 113Sn-113mIn generator is 58 Ci. Small amounts of 198Au and 32P were used for therapy. More than 800 hospitals have nuclear medicine facilities with approximately 4,000 nuclear medicine worker. There are 75 gamma cameras, 102 SPECT and one triple-head SPECT camera in the country, compared to 1,074 SPECT and 23 PET in Japan. Twenty percent of the SPECT and one-third of the gamma cameras are in Beijing and Shanghai. Five of the thirty Chinese provinces do not have gamma cameras or SPECT, and there is no nuclear medicine facility in Tibet.

Throughout China, nuclear medicine is an independent department separate from radiology. There are three major nuclear medicine centers (Jiangsu Institute; Capitol Nuclear Medicine Facility in Beijing, and the Nuclear Medicine Center at the First Shanghai Medical University). There are three centers for PhDs and 58 for master training; presently there are 533 graduate students, but there is apparently no resident or fellowship training programs comparable to U.S. or European systems. Nuclear medicine is taught in the medical schools. About one-third of the Chinese provinces do not have teaching facilities in nuclear medicine. Notably, only 89 of 2,036 nuclear medicine papers from 1989-1992 were published outside China. Scientific nuclear medicine achievements is proportionately higher in military-affiliated institutions than in non-military institutions of military (data from Dr. Zhang). At the Fourth National Nuclear Medicine Conference, 934 papers were submitted. There were 297 oral presentations and 193 posters; 249 papers were on organ imaging or organ-related studies; and more than half of these related to liver, kidney, heart, and brain. Most of myocardium and brain perfusion studies were done in 99mTc-based SPECT. Despite approximately one million new cancer cases per year in China, there were only a few papers on oncology. Currently, 99mTc-sestamibi appears to be the radiopharmaceutical under investigation for localizing tumors in the lungs and head and neck areas. There were only a small percentage (about 10%) of papers on basic research, instrumentation, and radiopharmaceuticals. Competitive assay for hormones or drugs with 125I homemade kits occupied a large proportion of the papers presented. Judging from the case material presented by the Chinese investigators, there is plenty of clinical material available for various types of investigations. For example, in three papers on RBC, studies for hepatic hemangioma, the numbers of cases studied at three different institutions were 150, 104, and 76 respectively. Chinese colleagues currently are also measuring the mineral content of spine and forearm in various age groups, in minority tribes, in different geographic zones, and in health and disease. Chinese nuclear physicians have renewed their interest in therapy. 32P or 198Au colloid as well as 131I lipiodal were used intra-arterially or in intra-tumoral treatments for inoperable liver tumors.

Samuel D. Yeh, MD, ScD
Memorial Sloan-Kettering Cancer Center
New York, NY