SNM Highlights as History: 1988

From the original 1988 SNM Highlights Lecture

The Future is Now

This year I have chosen the theme "The Future is Now" because what was anticipated in the past has become a reality. Today both positron emission tomography (PET) and single photon emission computed tomography (SPECT) are major forces in the field of nuclear medicine. Forty-two percent of all the presentations at this meeting involve tomography with equal numbers of PET and SPECT. Two organ systems, the brain and the heart, continue to dominate much of the field, accounting for nearly half of the papers presented. We have new brain tracers, new heart tracers, uniquely useful studies, studies that can be performed by no other modality, and cost-effective studies. Medicine in general has accepted the orientation of nuclear medicine toward function and chemistry. More and more radiologists are becoming increasingly interested in function and chemistry. The chemical orientation of nuclear magnetic resonance (NMR) spectroscopy has proven to be a major force in pointing out the advantages of positron emission tomography to the scientific and medical communities. In the four years between 1984 and 1988, the number of PET papers has doubled. In the last three years there has been a fourfold increase in the number of SPECT papers, and a tripling of cardiac PET papers since last year. We now have three major SPECT brain agents: iodine-123 iodoamphetamine with 21 presentations, technetium-99m hexamethylpropyleneamine oxime (HMPAO) with 27 papers, and technetium-99m ethyl cysteinate dimer (ECD) with 12 papers. We now have technetium-99m isonitrile compounds and boronated agents and indium-111 anti-myosin for heart studies.

Henry N. Wagner, Jr., MD

Advances made initially by PET chemistry are translated into compounds for SPECT. There were 67 clinical studies with PET, indicating that PET is moving steadily into clinical practice. It is easier to make a variety of compounds using cyclotron-produced carbon-11 than it is to prepare either iodine-123 or technetium-99m labeled compounds. One of the major forces in the advancement of nuclear medicine is the development of new compounds. Using principles established in universities, extensive research is now being conducted by the pharmaceutical industry, and the success is reflected in the results presented at this meeting. . . .

Recognition Sites

At this meeting, it becomes increasingly clear that iodine-123 and technetium-99m ligands can be developed that will bind to recognition sites, including transport processes, enzymes and neuroreceptors. A major principle in modern biomedicine is that communication among cells depends on such recognition sites. The question to be answered now is whether iodine-123 and technetium-99m ligands and SPECT can be used to quantify these receptors. We need to learn how quantitative such measurements can be, and how these recognition sites integrate and regulate biochemical processes in health and disease.

The usual sequence of developments in the field of nuclear medicine today is that the drug industry and basic science departments develop and evaluate tritiated or carbon-14 compounds. If useful, they

25 Years of Highlights

The Highlights Lectures, delivered by Henry N. Wagner, Jr., MD, at the annual meeting of the SNM every year since 1977, form a series of snapshots of the evolution of nuclear medicine. As we continue to celebrate the Society's 50th anniversary, Wagner has gone back to review the original texts of those presentations. Newsline presents serial excerpts as they appeared in the original published versions of the lectures. This month, passages from the 1988 lecture reflect interest in PET and SPECT, ^{99m}Tc as a neuroreceptor tracer, and Wagner's selection of the "image of the year." *The complete text of the 1988 presentation is available at www.snm.org/pdf/highlights_lecture_1988.pdf.*

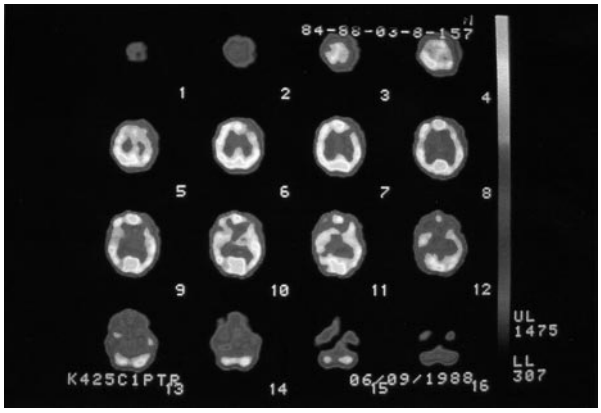

Figure 1. The 1988 Image of the Year, by Devous et al., was obtained with a three-detector SPECT scanner using technetium-99m ECD.

can subsequently be labeled with carbon-11, fluorine-18 or iodine-123. At times putting an iodine on a molecule not only does not inhibit the binding to the receptor, but may in fact increase its affinity. Often, the talented chemists in nuclear medicine can incorporate the iodine at a position where deiodination is no longer a problem.

What about technetium-99m? Results reported at this meeting give reasons for optimism that technetium 99m-labeled ligands can be developed that will bind to recognition sites. Some chemists had doubted whether a technetium-labeled compound could cross the blood-brain barrier and still react with specific recognition sites, such as enzymes or receptors. This has been accomplished with technetium-99m ECD. . . .The enzymatic reaction occurring in the brain has been characterized by kinetic analysis. These results offer great encouragement to chemists trying to develop technetium-99m compounds to bind the receptors.

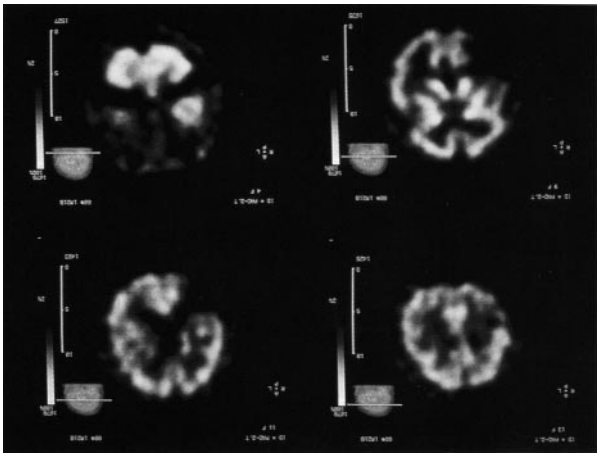

Figure 2. Another outstanding SPECT image from 1988, by Kimura of Osaka University Medical School, used technetium-99m HMPAO.

Image of the Year

Every year, I select what I believe is the most significant image presented at the meeting (Fig. 1). It is a SPECT study, reflecting the increasing role of SPECT not only in clinical practice, but also in nuclear medicine research. It is also a SPECT image performed with a new generation of SPECT instruments. These images were obtained by Devous et al. using a three-detector SPECT scanner. The tracer is technetium-99m ECD, which binds to a specific recognition site inside the brain, an esterase.

Figure 2 shows technetium-99m HMPAO images obtained with another advanced SPECT system. Looking at the spatial resolution of these SPECT images, we can't tell them from PET images. For the first time, in preparing for this talk, I have often had to look twice to see whether the images were obtained by SPECT or PET. This work with technetium-99m has been done by Kimura of Osaka University Medical School.

Using technetium-99m-labeled HMPAO, Momose and others at Tokyo University presented a new approach to SPECT imaging with technetium-99m HMPAO. An initial injection of technetium-99m HMPAO is made at rest and then ten minutes later, a second injection is made while the subject is performing a memory task. Because the initial tracer remains fixed, the initial residual activity can be subtracted from the activity obtained after the second injection. In a patient with Alzheimer's disease, the two sets of images are hardly different, while in a normal person, several areas, such as the frontal cortex, reflect increased blood flow. . . .

Nuclear medicine continues to be a vigorous area of medical research. This year's meeting has brought yesterday's promise of the future closer to everyday practice.

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