About Alzheimer's disease

Alzheimer's disease is the most common form of dementia—a general term that describes memory loss or other mental impairments serious enough to interfere with daily life. More than 5 million people are currently living with Alzheimer's—and experts predict this number could triple by 2050. Alzheimer’s usually sets in after age 60 and involves a progression of symptoms, beginning with impairments in learning and memory and later extending to every aspect of thinking, judgment and behavior. New developments in molecular imaging technologies are contributing to our understanding of Alzheimer's disease and improving the ways in which Alzheimer's disease (AD) is diagnosed. Early detection of AD through molecular imaging techniques will assist the development and evaluation of medications to slow the progression of the disease and optimize patient care.

What are molecular imaging procedures, and how can they help Alzheimer’s patients?

Molecular imaging (MI) procedures are highly effective, safe and painless diagnostic imaging and treatment tools that present physicians with a detailed view of what's going on inside an individual's body at the cellular level. Most nuclear medicine procedures are molecular imaging procedures using radioactive substances.

The most commonly used molecular imaging procedure for diagnosing or guiding treatment of Alzheimer's disease is positron emission tomography (PET) scanning. Conventionally, the confirmation of Alzheimer's is a long process of elimination that may take two to three years of diagnostic and cognitive testing. However, MI technologies are now available that help physicians safely and painlessly identify abnormalities in the brain that indicate the presence of Alzheimer's disease. [For more information on PET/CT scanning, please read SNM’s fact sheet “PET/CT Scans: Get the Facts” on SNM’s Web site at http://interactive.snm.org/index.cfm?PageID=7988.]

What MI technologies currently are available for Alzheimer’s patients?

The MI technology most commonly used in diagnosing and guiding treatment of Alzheimer’s patients is PET scanning. [See also “PET/CT scanning: Get The Facts.”]

PET Scanning

How can PET scanning help Alzheimer’s patients?

Specifically, PET scanning is a powerful tool for:

- Diagnosing Alzheimer's earlier;
- Differentiating Alzheimer's disease from other types of dementia; and
- Monitoring the progression of the disease and the effectiveness of new therapies in clinical trials.

How does PET scanning work?

PET scanning is a molecular imaging procedure that allows physicians to obtain three-dimensional images of what is happening in a patient's body at the molecular and cellular level. For a PET scan, a patient is injected with a very small amount of a radiotracer such as fluorodeoxyglucose (FDG), which contains a sugar with a radioactive tag attached. The radiotracer is absorbed by the brain and will show the amount of sugar consumption in different regions of the brain. The brains of people with dementia consume less energy and therefore less sugar, and in patterns specific to the different types of dementia. In addition, radiotracers for amyloid plaques have been developed recently that show the presence and extent of plaques in the brain. This allows for early detection of Alzheimer's disease. Though still in clinical trial, new PET tracers for amyloid plaque are expected to be available for patient care within a few years.
After the radiotracer is injected, the patient lies down on a table, and his or her head is moved to the center of a PET or PET/CT scanner. The PET scanner is composed of an array of detectors that receive signals emitted by the radiotracer. Using these signals, the PET scanner detects the amount of metabolic activity while a computer reassembles the signals into images. (For more information on PET/CT scans and how they work, visit “PET/CT Scanning: Get the Facts.”)

How accurate are PET scans in detecting Alzheimer's disease?
Studies indicate that PET is very accurate at diagnosing Alzheimer's disease and differentiating it from other types of dementia. In one recent study that included seven centers in the United States and Europe, investigators at the New York University (NYU) School of Medicine used optimized FDG-PET analysis techniques to measure glucose metabolism in different regions of the brain. More than 90 percent of the time, researchers were successfully able to distinguish patients with Alzheimer’s disease from healthy subjects and patients with other dementias such as frontotemporal dementia—an umbrella term for a diverse group of rare disorders that primarily affect the frontal and temporal lobes of the brain—the areas generally associated with personality and behavior.

How can PET scanning help in the long-term management of Alzheimer's disease?
PET scanning can help physicians gain a clear understanding of the existence, progression and aggressiveness of the disease. Researchers are experimenting with several new treatments for Alzheimer's disease. Molecular imaging tools such as PET can help determine whether treatments are working as intended. Molecular imaging may also help researchers learn more about the causes of Alzheimer’s and how the disease progresses.

How long does it take to get PET scan results?
A trained radiologist or nuclear medicine physician will interpret the results and write a report for the physician who ordered the tests. A verbal report is available the day of the PET scan, and the written report is usually delivered to the physician within two or three days.

Does PET show promise for identifying those at risk for developing Alzheimer’s disease?
Postmortem studies suggest that the amyloid plaques of Alzheimer’s are present for as long as a decade before dementia sets in. The results of several clinical trials indicate that PET imaging of amyloid plaques can identify patients destined to develop Alzheimer’s disease several years before the development of dementia. For example, researchers at the University of Pittsburgh conducted a study of PET scanning with a radiotracer for amyloid plaques known as Pittsburgh Compound-B (PiB) in patients who had mild cognitive impairment, a condition that often—but not always—precedes Alzheimer’s disease. Using PET with PiB, the researchers tracked patients with mild cognitive impairment for four years and found that only patients with brain plaques developed Alzheimer’s. Other tracers are also being tested for this purpose.

Where can I get more information about Alzheimer’s disease and molecular imaging?
To learn more about Alzheimer’s disease, visit www.snm.org/facts. To learn more about PET/CT scanning or other nuclear medicine procedures, visit the SNM Molecular Imaging Center of Excellence (www.molecularimagingcenter.org).

(Endnotes)