

Neuroimaging Changes Everything: How Do You Know Unless You Look?

Lesson 7 Guided Notes

Single Photon Emission Computed Tomography (SPECT)

Looks at blood flow patterns in the brain vs. MRI and CT, which look at brain anatomy and structure. SPECT identifies 3 important things:

- Good activity (normal blood flow)
- Low activity (abnormally low blood flow in specific areas)
- Too much activity (abnormally high blood flow in specific areas)

Psychiatry

The only medical specialty that does not typically utilize imaging as part of the diagnostic process. The cost and pain of ineffective assessment and treatment of brain-based disorders can lead to underachievement, failure in multiple important domains of life, permanent disability, and even suicide.

THROUGH
IMAGING,
AMEN CLINICS
LEARNED THAT

ADHD

ANXIETY

DEPRESSION

AND

ADDICTION

ARE NOT SINGLE OR SIMPLE
DISORDERS - THEY ALL HAVE
MULTIPLE TYPES; THUS,
IMAGING HELPS TARGET
EACH PATIENT'S TREATMENT.

SPECT Brain Imaging in a Nutshell

To obtain SPECT brain images, the radioisotope Technetium-99 (Tc99) is bound to a ligand (HMPAO or ECD), which transports the isotope through the blood-brain barrier. The radiopharmaceutical is injected into the patient's arm and taken up by brain cells within 2 minutes of injection. At the moment of uptake, a "snapshot" is taken of the patient's brain's activity and stays "fixed" in the cells for several hours afterward.

Depending on age and weight, patients are given 20-25 millicuries (mCi) of Tc99. The radiation exposure of 20 mCi is 0.7 rems, comparable to the radiation exposure of a bone or head CT scan.

Once a scan is completed, the raw data is checked for motion or artifact. It is then filtered, and attenuation correction is performed to make the brain's deeper structures appear as bright as the surface structures.

Masking of the images is done to eliminate extra isotope uptake from the parotid glands and tear ducts (which could otherwise interfere with accurate images of the brain's blood flow patterns)



As the Tc99 decays, release millions of photons (gamma rays) collected by the sodium iodide crystals in the SPECT (gamma) camera detectors. The camera rotates 360 degrees around a patient's head. Patients must remain still during the image acquisition period. The images will not be readable Amen Clinics uses 3-headed cameras, which allow for a scan to be completed in 15 minutes, thus reducing the amount of artifact in the images. The 10 million photons collected by the detectors are sent to the camera's computer, enabling the doctor to reconstruct images of how a patient's brain is functioning.

The processing software presents the images in slices of 3 views:

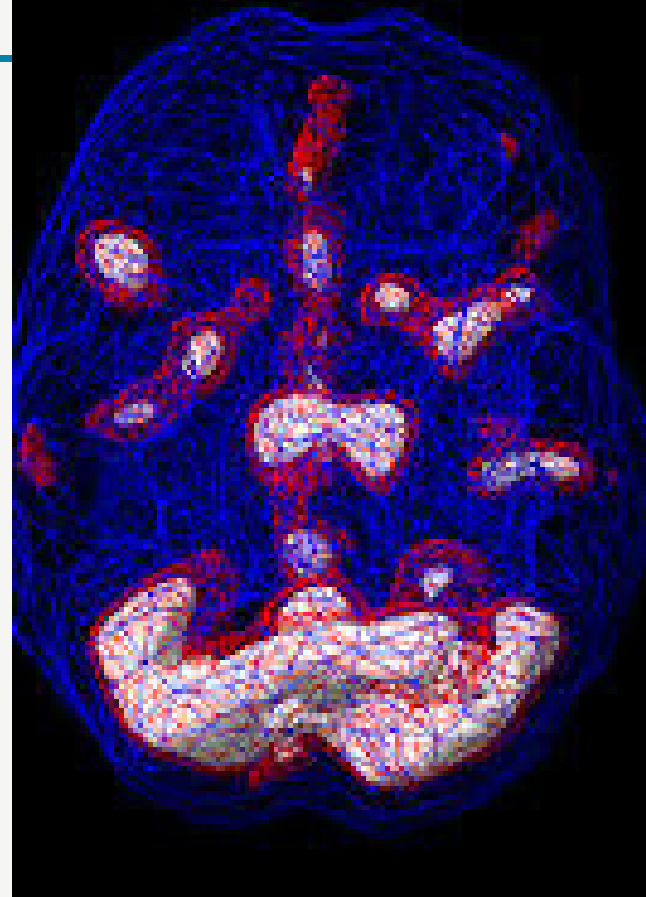
- Coronal (front to back)
- Sagittal (side to side)
- Transverse (top to bottom)

The 3-D images (surface and active views) are created from these “slices.”

The reading physician evaluates the slices for symmetry, “hot” spots (overactivity), “cold” spots (interactivity), and blood flow patterns and rates 100 areas of the brain using a color scale.

For the 3-D images, the threshold is set at 55%, meaning the reader is evaluating the top 45% of activity. Anything below that appears like a hole or dent in the surface of the brain.

For the active view, with the threshold set at 55%, blue is normal blood flow, red is 85% and reveals the top 15% of activity, and white is 92%, thus looks at the top 8% of activity.



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