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HOW SPECT (SINGLE PHOTON EMISSION COMPUTED TOMOGRAPHY) WORKS

Ergashev Askar Zong'oboyevich
Samarkand State Medical University Trainee-researcher of the Department of Physics, Biophysics and Medical Physics

Abduvaitova Sevinch
109 students of Samarkand State Medical University,
Faculty of Medicine No. 1.

Abdukarimov Sanjar
Student of group 136 of Samarkand State Medical University,
Faculty of Medicine No. 1

Annotation: *Single-photon emission computed tomography (SPECT) is a diagnostic imaging technique in which radionuclide distribution tomograms are obtained using gamma photons detected at multiple label distribution sites. Emission computed tomography (ECT) allows obtaining a layer-by-layer distribution of functional properties from the upper and lower layers of the studied organ in biological tissues that do not take into account the contribution of radioactivity, and ECT images describing physiological and metabolic processes in the body and physiological and metabolic processes in the body are approximately 15 in SPECT systems With a spatial resolution of -20mm this is worse than TKT systems (1mm).*

Keywords: *SPECT, Single photon emission computed tomography, radioisotopes, Gantry motion, CT, TKT, Emission computed tomography.*

The goal: The principle of single-photon emission computed tomography is to obtain a series of scintigrams by software-controlled rotation of one or more tomograph directors along the longitudinal axis of the body of patients receiving radiopharmaceuticals necessary for research. A chest X-ray is an example of a planar transmission image. An abdominal computed tomography (CT) is an example of a transmission tomography (TT). Single Photon Emission Computed Tomography (SPECT) is similar to PET and uses radioisotopes and gamma radiation emitted by a gamma camera, SPECT is a rapid so It requires injection of a traceable U-radioactive marker, but is not redistributed by the brain. Its consumption is approximately 100%

within 30-60 seconds, which reflects the blood supply of the brain at the time of injection. These properties of SPECT make it particularly suitable for epilepsy, which is usually difficult due to patient movements and various types of seizures. The image projections obtained during the full rotation of the detector system are processed on a computer and special algorithms are used to reconstruct the axial, coronal, sagittal and oblique sections. The detector head includes: a collimator, a 3/8" (9.3 cm) thick NaI (Tl) scintillation detector, a light guide, a photomultiplier unit, and a coordinate and energy signal generation circuit. The detector head includes : a lead shield protecting against the impact of the gamma-ray detector, excluding the collimator apertures. In modern tomographs, signals are digitized at the level of preamplifiers of photomultipliers, and all subsequent data processing is carried out on a digital scale (fully). Digital one-photon emission computed tomography - in such tomographs, the number of analog-to-digital converters is equal to the number of photomultipliers. SPECTRUM forms. Planar. A planar image shows only one projection of the distribution of a radiotracer in the patient's body. Tomographic. A tomographic image is a slice or volume representation of the radiotracer distribution calculated from multiple images taken at different camera positions. There are two types of images in SPECT: emission images (they show the distribution of the radiotracer in the body) and transmission images (they show the distribution of the extinction coefficient) . In SPECT, transmission tomography can be used to more accurately reconstruct emission tomograms. This could be by building more accurate models of the emission data collection process and providing the data needed for more accurate inversion software. Examining bones using SPECT is an example of emission tomography (ET). Planar transmission emission images are projections of the scanned object. Through the interior of the gray object at each point, the information transmits the sum of the information received from all points along a single path. The goal of image reconstruction is to interpret this mixed information to determine the features of the object at each individual point of the body. A major advantage of SPECT is ET imaging—images of a radiotracer inside the body are used to evaluate the attenuation effects of gamma rays within the patient, and TT imaging is performed to correct the ET images. These non-attenuation-corrected images are non-quantitative and are only suitable for qualitative assessment of the marker distribution.

Single photon emission computed tomography systems. The advantage of acquiring data in SPEKT is that it is enough projection data to reconstruct the tomographic image. To do this, gamma cameras rotate around the object, and data is collected for several sections at the same time. Standard protocols take 64 or 128 measurements (using 64 or 128 detector elements) of the object at each angle during camera rotation. That is, at each stop in the data corner, a 64x64 or 128x128 image or projection is created according to the scanning protocol.

System configurations. SPEKT systems differ in the number of gamma cameras. (Jaszczak, Chang, Stein, et al., 1979; Lim et al., 1980, 1985; Chang et al., 1992; Rowe et al., 1993; Milster et al., 1990). In principle, as the number of cameras increases, the sensitivity of the system increases, because gamma-ray photons that do not propagate perpendicular to the surface of any camera head are simply not counted.

Gantry movement. There are two common forms of data collection, which are reflected in the way the portal operates. In continuous scanning, data is collected by continuously rotating the Gntry ring with the camera around the patient. The data obtained for each scanning angle form an equivalent array. In step scanning, the rotating gantry ring stops at various positions until data collection is complete and then moves on to the next position.

Summary: Because SPECT images have relatively low spatial resolution, doctors often compare them to X-ray CT images. This allows to better determine the exact position of the anomaly in relation to the surrounding anatomical structures.
For this purpose, imaging support systems have been developed that perform SPECT and CT using the same cameras on a rotating gantry. These imaging devices, called SPECTT systems, produce well-aligned SPECT and CT images with precise anatomic localization of pathology. In addition, CT images can be used to correct for attenuation in SPECT images.

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