Part 14: SPECT Imaging, PET Imaging

SPECT Imaging

1. The image resolution of current generation gamma cameras fitted with a high-resolution low-energy collimator for SPECT imaging of Tc-99m at a radius of rotation of 20 cm is ____ mm FWHM.

a) 4
b) 8
c) 10
d) 12
e) 16

2. Mark true or false before each of the statements below regarding tomographic image reconstruction in SPECT.

___ a) The filtered back-projection technique for reconstructing tomographic images also reduces the overall image noise in the reconstructed images.
___ b) Theory prescribes that the Butterworth filter be used for removing artifacts introduced during back-projection.
___ c) Lowering the cutoff frequency of a filter window decreases the amount of smoothing in a tomographic image set.
___ d) Sagittal and coronal images are reconstructed independently of transverse image set.

3. Mark true or false before each statement regarding spatial resolution in SPECT imaging.

___ a) To maintain equivalent spatial resolution, large objects need projection images to be acquired through a larger arc than for small objects.
___ b) Body contouring improves overall spatial resolution by maintaining minimum distances between the patient and collimator during the camera orbit.
___ c) Compared to step-and-shoot, image acquisition by continuous gamma camera rotation gives improved sensitivity, but at the expense of spatial resolution.
___ d) SPECT imaging enhances the spatial resolution over that which can be achieved by planar gamma camera imaging.

4. The bullseye artifact appears in SPECT images as a result of gamma camera non-uniformities. The bullseye is best observed in the _____ image slices.

a) transaxial
b) sagittal
c) coronal
d) oblique short axis
e) sinogram

5. SPECT reconstruction algorithms assume that the gamma camera axis-of-rotation projected onto the computer matrix (referred to as the center-of-rotation) coincides with the matrix center. If misalignment of this axis is not corrected, the resultant SPECT images

a) show the same bullseye artifact as for gamma camera non-uniformities.
b) exhibit overall loss in image resolution.
c) become excessively noisy.
d) are split in half and mirrored.
e) show a hot rim artifact.

6. The sinogram of a selected slice in SPECT is used to

a) eliminate the bullseye artifact.
b) display significant non-uniformities in the gamma camera images.
c) assign the appropriate filter for image reconstruction.
d) determine the patient contour needed for applying photon attenuation corrections.
e) detect patient motion.

7. Correction for photon attenuation in SPECT is most problematic in the

a) head.
b) thorax.
c) abdomen.
d) equally problematic in all sections of the body.

8. A flood image used to correct gamma camera non-uniformities should have at least _____ counts per pixel so that the uniformity correction itself does not contribute to uniformity artifacts in the reconstructed SPECT images.

a) 100
b) 1,000
c) 10,000
d) 1,000,000
e) 30,000,000

PET Imaging

1. Mark true or false before each statement below regarding PET imaging.

___ a) Scintillation detectors are paired opposite one another in order to simultaneously detect the two opposing, collinear 511 keV photons emitted from the positron decay.
___ b) The average range of a positron is on the order of 5 cm.
___ c) The coincidence detection technique provides for electronic collimation of the 511 keV photons.
___ d) BGO is the scintillator of choice for PET scanner.
___ e) Image resolution is improved by increasing the number of detectors per unit area in a PET scanner detector ring.

2. The positron emitting radioisotopes C-11, N-13, O-15, and F-18 are commonly used in PET imaging. **In terms of increasing half-life**, these positron emitters should be ordered as follows:

a) C-11, O-15, N-13, F-18
b) O-15, N-13, C-11, F-18
c) N-13, O-15, C-11, F-18
d) O-15, C-11, N-13, F-18
e) C-11, N-13, O-15, F-18

3. A possible nuclear reaction for the production of O-15 is

a) N-14 (d,n) O-15
b) N-14 (p,n) O-15
c) N-14 (p,α) O-15
d) O-18 (p,n) O-15
e) C-13 (p,n) O-15