

CNS Nuclear Medicine Examination

Name: _____

Date: _____

Enter the best answer to the left of each numbered question below:

_____ 1. Which of the following brain perfusion agents has the best blood-brain barrier permeability?

- a. [^{99m}Tc] HMPAO
- b. [^{15}O] H_2O
- c. [^{99m}Tc] ECD
- d. [^{11}C] butanol

_____ 2. True statements regarding [^{99m}Tc] ECD and [^{99m}Tc] HMPAO are:

- a. Both tracers are incompletely extracted from blood to brain at usual CBF rates, but completely retained for many hours after entering brain tissue
- b. Both tracers are completely extracted from blood to brain at usual CBF rates, but are lost due to incomplete trapping.
- c. Both tracers are incompletely extracted and incompletely retained in brain at usual CBF rates.
- d. Higher CBF regions will extract and retain a greater fraction of the tracers presented in arterial plasma than regions of lower CBF.
- e. Activity retained at long post-injection times (15 min and longer) represents untransformed tracer.

_____ 3. Imaging with which of the following provides the closest link to synaptic neuronal activity?

- a. [^{99m}Tc] ECD
- b. [^{15}O] H_2O
- c. [^{18}F] fluorodeoxyglucose
- d. [^{11}C] flumazenil

In the following section, match the pathological pattern of hypometabolism/hyperperfusion (in Column A) to the most likely corresponding diagnosis in Column B (diagnoses may be used more than once).

PATHOLOGICAL PATTERN (column A)

DIAGNOSIS (column B)

_____ 4. caudate nucleus and putamen

a. Alzheimer's disease

_____ 5. temporoparietal neocortex

b. Parkinson's disease

_____ 6. frontal neocortex

c. Pick's disease

_____ 7. temporoparietal & occipital neocortex

d. Huntington's disease

_____ 8. thalamus

e. dementia with Lewy bodies

f. none of these

_____ 9. Which of the following SPECT perfusion patterns is least likely due to attenuation artifact?

_____ 10. Which of the following patterns is most likely an attenuation artifact?

- a. bifrontal increase
- b. left cerebral and left cerebellar decrease
- c. right cerebral and left cerebellar decrease
- d. bilateral cerebellar decrease

Which of the following brain regions may be abnormal in some interictal [^{18}F] FDG PET studies of patients with refractory, nonlesional temporal lobe epilepsy?

Label each region with either: "A" = abnormal or "N" = not abnormal.

Also label each region with "H" = histopathological abnormality is expected or "U" = pathological changes are unexpected:

- _____ 11. lateral temporal neocortex
- _____ 12. thalamus
- _____ 13. amygdalohippocampal formation
- _____ 14. cerebellum
- _____ 15. pons

Regarding the localization of non-lesional, medically-refractory seizure foci, which of the following diagnostic tests are localizing (label with "O") and which are lateralizing (label with "A")?

- _____ 16. scalp/sphenoidal (surface) ictal EEG
- _____ 17. proton MRI
- _____ 18. ictal/interictal subtraction SPECT perfusion
- _____ 19. interictal [^{18}F]FDG PET
- _____ 20. proton MR spectroscopy (MRS)
- _____ 21. interictal [^{11}C]flumazenil PET
- _____ 22. depth ictal EEG

_____ 23. Which of the above tests (16-22) are predictive of good surgical outcome after temporal lobectomy (may select more than one)?

_____ 24. Which imaging approach best contrasts normal brain with recurrent astrocytoma?

- a. [²⁰¹Tl] thallium chloride SPECT
- b. [¹⁸F] FDG PET
- c. [¹¹C] methionine PET
- d. both b and c
- e. both a and c
- f. no difference between a-c

_____ 25. Which of the above approaches best distinguishes cystic astrocytoma from abscess?

_____ 26. Which of the above best contrasts normal brain and radiation necrosis?

_____ 27. **True or False?** A patient in the ICU after a cardiopulmonary arrest is found to be comatose with decerebrate posturing in response to deep pain. The pupils are 5mm bilaterally, without response to light. There are no oculocephalic reflexes. Corneal reflexes are absent. The patient gags when the endotracheal tube is manipulated. Portable radionuclide angiography after injection of [^{99m}Tc]HMPAO reveals absent delayed tracer activity in the cerebral hemispheres and cerebellum, diagnosing the presence of brain death.

Which of the following are positive predictors (label with "P") or negative predictors (label with "N") for cognitive improvement after ventriculoperitoneal shunting. Some entries may not be of predictive value (label with "U"=uninformative).

_____ 28. onset of gait abnormality and urinary incontinence before cognitive abnormality

_____ 29. persistent ventricular tracer reflux on radionuclide cisternography

_____ 30. remote history of subarachnoid hemorrhage

- _____ 31. temporoparietal hypometabolism on [18F]FDG PET imaging
- _____ 32. recent abrupt discontinuation of corticosteroids
- _____ 33. status-post cranial radiotherapy for leukemia

Answer Key (Do not distribute)

1. d
2. c
3. c
4. d
5. a
6. c
7. e
8. f
9. c
10. b
11. au
12. au
13. ah
14. ah
15. nu
16. a
17. a
18. o
19. a
20. a
21. o
22. o
23. 19,20
24. e
25. c
26. f
27. f
28. p
29. p
30. p
31. n
32. u
33. p

Brain & Head Neck

1. An HMPAO diamox scan is used to evaluate:
 - a. cerebrovascular perfusion reserve
 - b. Parkinson's disease
 - c. Alzheimer's disease
 - d. cerebrovascular accident

2. Typical appearance on HMPAO SPECT in Alzheimer's disease is:
 - a. decreased uptake in the cerebellum
 - b. increased uptake in the temporal lobes
 - c. decreased uptake in parietal lobes
 - d. decreased uptake in the frontal lobes

3. Which of the following is true in Alzheimer's patients?
 - a. tangles and plaques on histology
 - b. lateral temporal lobe atrophy
 - c. increased FDG uptake in parietal lobe
 - d. decreased FDG uptake in lenticular nucleus

4. Which of the following can be used in distinguishing radiation necrosis from recurrent astrocytoma:
 - a. SPECT HMPAO
 - b. SPECT Thallium-201
 - c. $^{13}\text{NH}_3$ -PET
 - d. CECT

5. Which of the following is true regarding PET evaluation of seizures?
 - a. seizure focus is typically located at temporal and/or frontal lobes.
 - b. seizure focus is hypermetabolic.
 - c. increased uptake in one lobe over the other lobes indicates that the patient would benefit from surgical treatment.
 - d. hypometabolism in the temporal lobes and basal ganglia portends a poor prognosis / more difficult to treat operatively

6. Which of the fluorinated agent following is an angiogenesis_imaging agent?
 - a. fluciclatide
 - b. florbetapir
 - c. flutemetamol
 - d. florbetaben

7. Which of the following determines brain FDG uptake in a given voxel?
 - a. number of neurons
 - b. number of astrocytes

- c. number of microglia
- d. number of synapses

8. Which of the following is true about the brain arterial supply?

- a. paramedian brain is supplied by MCA
- b. thalamus is supplied by ACA
- c. basal ganglia is primarily supplied by ACA branches
- d. temporal lobe is supplied by both MCA and PCA

9. Which of the following is **not true** about 99mTc-DTPA brain death scan?

- a. normal symmetric DTPA uptake within brain confirms against brain death
- b. normal midline linear uptake is normal
- c. asymmetric transverse sinus activity is quite common
- d. HMPAO scan is better in the diagnosis of brain death

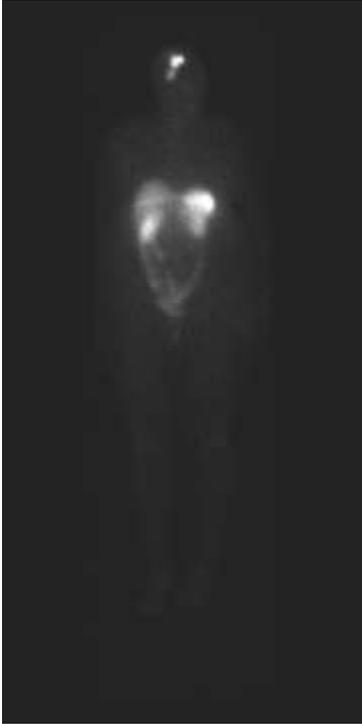
10. Which of the following parotid gland tumor demonstrates high 99-m-Tc-Per technatate uptake?.

- a. benign mixed tumor (pleomorphic adenoma)
- b. adenoid cystic adenoma
- c. warthin tumor
- d. mucoepidermoid carcinoma

11. A tumor between the branches of the common carotid artery demonstrated very high uptake of ¹¹¹In-Pentetreotide. What is the likely diagnosis of the tumor?

- a. carotid body tumor
- b. vascular ectasia
- c. vagal nerve schwannoma
- d. neuroenteric cyst

12. Forty-five year old woman with long history of headache presented to a Neurologist who ordered an Octreoscan which revealed a large intensely enhancing extra axial mass with enhancement of the adjacent dura. Following scan was obtained as to plan appropriate therapy. What is the diagnosis?



- a. meningioma
- b. glioblastoma
- c. medulloblastoma
- d. sinonasal undifferentiated cancer

13. Which of the following tracer is taken by hypoxic cells?

- a. FMISO
- b. fluciclatide
- c. annexin v
- d. FLT

14. Imaging vesicular monoamine transporter type II (VMAT2) system is primarily used to image

- a. Alzheimer disease
- b. Creutzfeldt-Jakob disease
- c. Parkinson disease
- d. Pick's disease

15. Cerebral Ischemia is characterized by

- a. high CBF, high cerebral metabolic rate of O₂ (CMRO₂), high oxygen extraction fraction (OEF)
- b. low CBF, high CMRO₂, high OEF

- c. low CBF, low CMRO₂, high OEF
- d. low CBF, low CMRO₂, low OEF

Brain & Head Neck Answers

1. A
2. C
3. A
4. B
5. A
6. A
7. D
8. D
9. A
10. C
11. A
12. A
13. A
14. C
15. C