BN 260 FINAL EXAMINATION May 19, 2000 (1.5 hours to complete) Pages 7: Points: 155

I. MULTIPLE CHOICE. Circle the letter next to every correct answer or completion. There may be one, more than one or no correct answers. (105 points)

1. Formation of clear, well-focused retinal images of external objects depends on

   a. adequate corneal dehydration
   b. the rise in refractive index as light passes from air to cornea
   c. a good match between the optical power and length of the eye
   d. regulation of tension in the zonule fibers suspending the lens in its capsule
   e. correct alignment of the visual axes of the two eyes.

2. Homonymous hemianopia

   a. is accompanied by loss of the direct and consensual pupillary light reflexes
   b. may result from occlusion of the posterior cerebral artery
   c. may result from occlusion of the middle cerebral artery
   d. accompanied by aphasia is probably due to pathology in the basilar artery
   e. may appear to spare the macula

3. The ability to consciously perceive (discriminate) two closely spaced points on the skin

   a. depends in part on the innervation density of the skin
   b. requires an intact medial lemniscus
   c. is better on the knee than on the hand
   d. normally depends on the anterolateral system
   e. requires an intact postcentral gyrus

4. Defective joint position sense may arise from damage to

   a. the medial lemniscus
   b. Group I (A-alpha) afferents
   c. the red nucleus
   d. the cerebellum
   e. the primary somatic sensory cortex

5. Transmission of pain signals from the skin to the cerebral cortex

   a. does not require a synaptic relay in the thalamus
   b. can be reduced in some cases by activation of large diameter cutaneous afferents
   c. can be reduced in some cases by electrical stimulation of the periaqueductal gray
   d. can be blocked by giving Naloxone
   e. is modulated in the dorsal horn by a projection from the medullary nucleus raphé magnus

6. The perception of slow pain following injury to the feet depends on normally functioning

   a. Group IV afferent fibers
   b. anterolateral systems
   c. free nerve endings
   d. dorsal columns
   e. spinothalamic tracts
7. The taste of food may change if there has been damage to the
   a. facial nerve
   b. glossopharyngeal nerve
   c. olfactory mucosa
   d. trigeminal nerve - spiciness will be lost
   e. tractus solitarius

8. A patient complains of deafness in her right ear. A tuning fork held against her forehead sounds louder on the left than on the right. This observation could indicate
   a. paralysis of the right stapedius muscle
   b. middle ear disease on the right
   c. damage to the right auditory nerve
   d. wax in the right external auditory canal
   e. damage to the left auditory cortex

9. A patient complains of abnormally loud sounds (hyperacusis) in his right ear. This could indicate damage to
   a. the cochlear nucleus on the right
   b. branches of the right trigeminal nerve
   c. the olivocochlear bundle on the right - loss of inhibition
   d. the organ of Corti on the right
   e. branches of the right facial nerve - stapedius

10. Horner's syndrome
    a. may result from a lesion in the hypothalamus
    b. may result from a lesion in the medulla
    c. includes ptosis, miosis, enophthalmos and facial anhydrosis
    d. cannot be distinguished from a lesion of cranial nerve III
    e. occurs only with a lesion of the cervical sympathetic chain

11. Hair cells of the utricular macula
    a. discharge a neurotransmitter at a rate proportional to their membrane potentials
    b. are depolarized when the stereocilia bend away from the kinocilium
    c. on one side respond only to tilt of the head toward that side
    d. synaptically activate the axons of cells located in Scarpas ganglion
    e. respond primarily during linear accelerations of the head

12. A normal subject lies face up with his head tilted forward 30 degrees (neck flexed). When the left external auditory canal is irrigated with WARM water, nystagmus occurs and
    a. the slow component is to the patient's right.
    b. the slow component adducts the right eye and abducts the left eye
    c. the quick component occurs only in the left eye.
    d. the slow component elevates the eyes.
    e. the quick component is to the right.
13. REM sleep
   a. occurs multiple times during the night, increasing in duration with each cycle
   b. may occur in unusually large amounts in people previously deprived of REM sleep
   c. normally first appears following an episode of slow-wave sleep
   d. is characterized by low voltage (amplitude), high frequency waves in the EEG
   e. is a period of poor thermoregulation

14. Sleep disorders observed in humans include
   a. sleep apnea
   b. narcolepsy
   c. epilepsy
   d. nocturnal myoclonus
   e. channel surfing

15. Which of the following oculomotor mechanisms [displace] images from one place on the retina to another (as distinct from rendering the images stationary on the retina)?
   a. the VOR
   b. optokinetic movements
   c. saccades
   d. physiological nystagmus
   e. smooth pursuit

16. Signs of damage to the long motor tracts may occur in a patient following occlusion of branches of the
   a. anterior spinal artery
   b. basilar artery
   c. middle cerebral artery
   d. anterior cerebral artery
   e. posterior cerebral artery

17. Loss of dopaminergic neurons in the substantia nigra, pars compacta leads to a clinical syndrome characterized by
   a. cogwheel rigidity
   b. hemiballismus
   c. tremor at rest
   d. bradykinesia
   e. dysdiadochokinesia

18. Neurons projecting directly (monosynaptically) to primary motor cortex (M1) reside in the
   a. premotor and supplementary motor areas (PMA and SMA)
   b. primary somatic sensory cortex
   c. vestibular nuclei
   d. ventral lateral nucleus of the thalamus
   e. dentate nucleus of the cerebellum
19. Neurons (or their axons) making monosynaptic contact with alpha motor neurons include:
   a. Ia axons of cells in the dorsal root ganglia
   b. gamma motor neurons
   c. certain neurons with cell bodies in the cerebral cortex
   d. cerebellar Purkinje cells
   e. Renshaw cells

20. A disease selectively affecting motor neurons of the spinal cord, such as poliomyelitis, may result in the following clinical signs in the affected muscles:
   a. flaccid paralysis
   b. fasciculation
   c. fibrillation
   d. spasticity
   e. athetosis

21. Occlusion of the posterior inferior cerebellar artery results in a syndrome that includes:
   a. chorea
   b. Horner’s syndrome
   c. hoarseness
   d. dissociated sensory loss
   e. spastic hemiplegia

II. In the space provided on the left, place the ONE letter BEST designating the location on the right where pathology (tumor, infarct, occlusion, infection, etc) might cause the clinical finding. A letter may be used once, more than once, or not at all. (15 points)

N. ataxia with Romberg’s sign
F. ataxia with pendular knee jerks
L. bilateral Babinski signs
P. incontinence, urinary retention, impotence
B. bitemporal hemianopia
S. Parinaud’s syndrome
M. hydrocephalus
C. non-fluent aphasia
H. hemiballismus
S. spontaneous otoacoustic emission
K. monocular blindness
J. dry eye (no tears)
E. mydriasis
D. sensory or receptive aphasia
A. superior quadrantanopia

A. Meyer’s loop
B. pituitary gland
C. Broca’s area
D. Wernicke’s area
E. Edinger-Westphal nucleus
F. inferior cerebellar peduncle
G. pineal gland
H. subthalamic nucleus
J. facial nerve
K. medial longitudinal fasciculus
L. falx cerebri
M. arachnoid granulations
N. medial lemniscus
O. mammillary bodies
P. cauda equina
R. ophthalmic artery
S. organ of Corti
III. Brain Section (15 points). In the space provided, place the ONE letter indicating the structure BEST fitting the description given. A letter may be used once, more that once, or not at all.

Damage in this region would produce the following signs:

- A/M impaired ability to locate source of sounds
- M paralysis of right face, left arm and leg
- P paralysis of right side of tongue, left arm and leg
- D ataxia, nystagmus and a tremor of intention
- G failure of adduction OD on left lateral gaze, convergence preserved
- E left homonymous hemianopia
- B mydriasis, failure of adduction and elevation OD; left hemiplegia including the face
- R hemineglect syndrome

Other
- H gyrus supplied by anterior cerebral artery
- Q uncinate fits originate here
- C secretes melatonin (in addition to being the center of the soul, says Descartes)
- L damaged in patient exhibiting alexia without agraphia
- N CSF enters third ventricle here
- K master circadian clock located here
- F axons bundled here arise from the right hippocampus

(" Insertion for Mirror Image label for Q-M-B-G")
IV. Clinical case 1. (5 points)
This 30 y/o woman’s husband reported that at breakfast one morning the right side of his wife’s face began to twitch and she became unable to speak. Shortly thereafter the movements spread to her arm and the rest of her body and she had a generalized convulsion. Following the episode she gradually regained consciousness, but for a short while there remained some facial weakness and labored speech. Physical examination the next day revealed no abnormal signs.

From the history:
This patient’s lesion is inside (outside) the CNS? (circle your answer)

What is the evidence for this? Focal seizure – starting with face and moving to arm, leg etc. (like Jacksonian march). Then become generalized

Where and on which side is the lesion? Cerebral cortex – primary motor cortex on left side. Facial areas represented laterally on M2.

How do you account for the patient’s speech difficulties?
Broca’s area is located very near to face and arm representations of the motor cortex. She probably sustained some damage to Broca’s area, resulting in a non-fluent aphasia.

V. Clinical case 2. (5 points)
This 45 y/o male states that he suddenly was unable to move his right leg. Examination revealed a spastic paralysis of the right leg, Babinski sign on the right, decreased appreciation of joint position and touch in the right leg, decreased appreciation of pin-prick and temperature in the left leg.

What neural pathways have been involved by a pathological process in this patient?
Babinski + spastic paralysis of right leg \(\Rightarrow\) long motor tracts on right (e.g. corticospinal)
loss of proprioception/touch right leg \(\Rightarrow\) DCML 5th (e.g. fasciculus gracilis)
loss of pain/temp left leg \(\Rightarrow\) anterolateral system (which crosses over soon after synapsing in the dorsal horn)

Where and on which side is this process located?
This lesion appears to be on the right side of the lumbar spinal cord. Symptoms are restricted to the legs and sensory problems resemble a Brown–Séguard syndrome. The lesion may look like this.
VI. Clinical case 3. (5 points)

This 64-year old, right-handed housewife was admitted to the hospital for evaluation of increasing deafness in the right ear and the gradual development of unsteadiness in walking. For one to two years prior to admission the patient had noted a progressive numbness on the right side of the face. Recently the muscles on the right side of the face had become “slack.” The patient had no nausea or vomiting but reported occasional recent diplopia and a bifrontal headache.

Abnormal neurological findings were:

- There was a decrease in pain and light touch sensibility over the right side of the face. The patient did not feel touch of the cornea on the right and no blinking occurred when this was done.
- The right corner of the mouth drooped, the right palpebral fissure was wider than the left, and there was an absence of normal blinking with the right eye.
- Hearing was markedly decreased in the right ear (both air and bone) compared to the left.
- Ice water caloric labyrinthine stimulation of the right ear evoked no response; there was a normal response to caloric stimulation of the left ear.
- There was a fine nystagmus on gaze to the left and to the right.
- Gait was slightly broad-based with some weaving to the right or left. She was unable to walk a tandem gait.

What neural structures appear to be involved by disease in this patient?

\[ \text{pain, touch - right face} \rightarrow \text{trigeminal nerve, right side} \]
\[ \text{paralysis (paresthesia - right face} \rightarrow \text{facial nerve (peripherally), right side} \]
\[ \text{hearing, caloric response} \rightarrow \text{cranial nerve VIII} \]
\[ \text{nystagmus} \rightarrow \text{difficult walking} \rightarrow \text{vestibular component of VIII (possibly cerebellar involvement) on the right side.} \]

Where and on which side would you place the lesion in this patient?

\[ \text{This looks like a lesion at the cerebellopontine angle (for instance an acoustic schwannoma). This knocks out II, III, VIII. The magic triad.} \]

VII. Clinical case 4. (5 points)

This 60 year old man suddenly complained of diplopia. The only abnormal findings pertained to eye movements. The left eye could be elevated and depressed but no movement occurred on attempted lateral gaze to left or right. The right eye could be elevated, depressed and abducted, but not adducted on lateral gaze. Both eyes adducted on convergence.

1. Where and on which side could a single lesion result in this clinical picture.

\[ \text{This lesion could occur in the dorsal pars on the left side} \]

2. What structures would have to be damaged by this lesion to account for these findings?

\[ \text{The left abducens nucleus is lost along with both MLFs. This results in a "one and a half" syndrome. See diagram.} \]