

Neurology Clerkship Rotation Objectives

The following clerkship objectives are based on the Medical Council of Canada Medical Expert examination objectives and the American Academy of Neurology Clerkship objectives. This is not an exhaustive list of neurologic conditions or examination techniques but meeting these objectives will provide a good base of fundamental neurologic knowledge and exam skills for a general practitioner or emergency medicine provider.

These objectives were last updated in July 2018.

Neurologic History and Examination:

Students will be able to:

- 1) Perform a complete screening neurologic examination in less than 40 minutes including
 - a. Mental status exam including level of consciousness and when appropriate
 - i. informal bedside testing of attention/memory and/or
 - ii. Mini mental status exam (MMSE) and/or
 - iii. Montreal Cognitive Assessment (MoCA).
 - b. Language exam when appropriate (fluency, naming, comprehension, repetition, reading and writing).
 - c. Cranial nerves II through XII.
 - i. Visual acuity when appropriate
 - ii. Pupillary responses
 - iii. Extra ocular movements
 - iv. Facial Sensation, masseter/temporalis tone
 - v. Facial symmetry/strength
 - vi. Hearing
 - vii. Palate elevation and uvular deviation
 - viii. Examination for dysarthria
 - ix. Sternocleidomastoid and trapezius strength
 - x. Tongue bulk and power
 - d. Motor exam including bulk, tone, power and reflexes.
 - e. Sensory exam including pinprick, vibration and proprioception.
 - f. Cerebellar exam including finger to nose testing, rapid alternating movements and heel to shin testing.
 - g. Gait exam including tandem gait and checking for Romberg sign.
- 2) Perform a neurologic examination on a comatose or encephalopathic patient including
 - a. GCS score
 - b. Respiratory pattern
 - c. Pupillary function, vestibuloocular or oculocephalic reflex, assessment of spontaneous eye movements or gaze deviation, corneal response and gag reflex
 - d. Motor responses, limb reflexes, tone assessment, spontaneous limb movements
 - e. Sensory responses

- 3) Obtain a complete history from a patient specific to a neurologic complaint within 45 minutes.
- 4) Present the history and examination including pertinent positive exam findings to their preceptor or supervising resident including a differential diagnosis and plan
- 5) Interpret examination findings and propose a localization for the neurologic problem from one of the following areas:
 - a. Cortical or subcortical
 - b. Brainstem
 - c. Cerebellum
 - d. Spinal cord
 - e. Nerve root or motor neuron
 - f. Peripheral nerve
 - g. Muscle
 - h. Neuromuscular junction

Imaging Investigations

Students will be able to

- 1) Describe the difference between MR and CT imaging including indications for each and risks specific to each modality.
- 2) Describe indications for using IV contrast in brain and spinal cord imaging and risks/contraindications for IV contrast.
- 3) Describe indications for obtaining a CT angiogram and how this is different than an enhanced CT head
- 4) Identify the following structures on a CT or MRI scan
 - a. Frontal lobes
 - b. Parietal lobes
 - c. Occipital lobes
 - d. Temporal lobes
 - e. Lateral ventricles
 - f. Third ventricle
 - g. Fourth Ventricle
 - h. Optic nerves
 - i. Basal ganglia
 - j. Midbrain
 - k. Pons
 - l. Medulla
 - m. Cerebellum
- 5) Identify the following structures on a CT angiogram
 - a. Carotid arteries
 - b. Vertebral arteries
 - c. Basilar artery
 - d. Middle cerebral arteries

e. Posterior cerebral artery

Lumbar Puncture (LP)

Students will be able to:

- 1) List indications for a LP
- 2) List contraindications for LPs including identification of when imaging is required before the LP is done
- 3) Describe the technique for performing a LP under sterile conditions
- 4) Identify potential complications of LPs and their management including:
 - a. Infection
 - b. Headache and risk of cerebrospinal fluid leak
 - c. Epidural/spinal hematoma
 - d. Herniation in setting of raised intracranial pressure from cerebral mass lesion
- 5) Correctly identify possible causes of cerebrospinal fluid (CSF) abnormalities and recognize and differentiate the following diseases based on CSF findings:
 - a. Bacterial meningitis
 - b. Viral meningitis
 - c. Cytoalbuminergic dissociation as seen in Guillian Barre Syndrome

Neurologic Emergencies

The student will be able to identify the following neurologic emergencies and describe initial management and investigations:

- 1) Status epilepticus
- 2) Acute stroke
- 3) Coma
- 4) Raised intracranial pressure
- 5) Meningitis/Encephalitis
- 6) Spinal cord trauma/cauda equina syndrome
- 7) Respiratory distress due to neuromuscular disease

Common Neurologic Presentations (based on MCC Exam Objectives)

1) Ataxia/Gait Disturbance

Given a patient complaining of gait ataxia or imbalance the student will be able to

- a. Take a history specific to ataxia including possible drug/toxic etiologies
- b. Examine for and describe examination findings seen in ataxia
- c. Recognize different potential etiologies for the ataxia – cerebellar vs vestibular vs sensory ataxia vs other causes of gait disturbance
- d. List potential investigations appropriate to the presenting complaint

2) Stroke/Transient Ischemic Attack (TIA)

Given a patient with suspected TIA or stroke, the student will be able to:

- a. Provide definitions for stroke and TIA and how they are different
- b. Differentiate hemorrhagic and ischemic stroke

- c. List potential etiologies for ischemic stroke based on the Trial of Acute Stroke Treatment (TOAST) criteria
 - i. Cardioembolic
 - ii. Large artery disease
 - iii. Small vessel disease aka Lacunar stroke
 - iv. Other (venous sinus thrombosis, vasculitis)
 - v. Cryptogenic
- d. Suggest investigations to confirm presence of a stroke and describe when each is appropriate including
 - i. CT Head
 - ii. CT angiogram
 - iii. MRI
- e. Correctly identify potential acute treatments for ischemic stroke including tissue plasminogen activator (TPA) and intra-arterial (IA) therapy and recognize importance of early treatment and treatment time windows
- f. Identify potential complications of hemorrhagic stroke
- g. Suggest investigations for the cause of stroke based on the potential etiology
- h. Suggest secondary prevention strategies based on identified ischemic stroke etiology as per TOAST criteria

3) Diplopia

Given a patient complaining of diplopia the student will be able to:

- a. Correctly identify if the diplopia is monocular or binocular
- b. Provide possible localizations for binocular diplopia including
 - i. Ocular muscles
 - ii. Cranial nerves
 - iii. Brainstem
- c. Provide a differential diagnosis for diplopia including neurologic and non-neurologic conditions

4) Dizziness/Vertigo

Given a patient complaining of dizziness or vertigo the student will be able to:

- a. Take a history to differentiate true vertigo from lightheadedness or pre-syncope
- b. Describe a differential diagnosis for true vertigo including
 - i. Vestibular neuritis
 - ii. Benign paroxysmal positional vertigo
 - iii. Meniere's disease
 - iv. Drug toxicity
 - v. Central causes
- c. List some non neurologic/vestibular causes of dizziness including
 - i. Vasovagal syncope
 - ii. Orthostatic hypotension
 - iii. Cardiogenic syncope
 - iv. Anxiety/Panic attacks

- d. Perform a Dix-Hallpike maneuver
- e. Suggest appropriate investigations for a vertiginous/dizzy patient based on history and exam findings

5) Dysphagia

Given a patient complaining of swallowing difficulty the student will be able to:

- a. Take a history to determine whether the dysphagia is mechanical or may be due to neuromuscular weakness or neurologic disease
- b. List potential neurologic causes of dysphagia
- c. Identify patients at potential risk of aspiration

6) Headache

Given a patient complaining of headache, the student will be able to:

- a. Take a headache history with identification of red flags including
 - i. History of worst headache of life or change in usual headache
 - ii. Sudden (thunderclap) onset
 - iii. Age greater than 50 years
 - iv. Abnormal neurologic examination
 - v. Immunocompromised state
 - vi. Systemic features (fever, neck stiffness)
 - vii. Features of raised ICP
- b. Correctly identify features suggestive of migraine headache
- c. Suggest appropriate investigations based on the presence or absence of red flags

7) Speech/Language Disturbance

Given a patient with speech/language disturbance the student will be able to

- a. Perform a language examination including fluency, comprehension, repetition, naming, reading and writing
- b. Differentiate dysarthria from aphasia
- c. Characterize the patient's aphasia into one of the following categories
 - i. Expressive (Broca's)
 - ii. Receptive (Wernicke's)
 - iii. Global
- d. Provide a differential diagnosis and localization for the speech defect

8) Coma

Given a comatose patient, the student will be able to:

- a. Recognize that coma is a medical emergency and describe initial management and investigations of a comatose patient
- b. Obtain collateral history to determine the cause of coma
- c. Perform a coma examination (see above for details)
- d. Describe the possible localizations for decreased level of consciousness including
 - i. Diffuse cerebral disfunction
 - ii. Bilateral thalamic lesions

- iii. Brainstem/reticular activating system
- e. Provide a differential diagnosis for a comatose patient including neurologic and non-neurologic conditions

9) Delirium

Given a delirious patient, the student will be able to:

- a. Define delirium and differentiate it from aphasia and/or dementia
- b. Take a history from and perform a neurologic exam on a delirious patient including obtaining collateral history from family and/or caregivers
- c. Provide a differential diagnosis for delirium including potential neurologic causes
- d. List common medications and medication withdrawals which can cause delirium
- e. Suggest appropriate investigations for delirium
- f. Suggest a management plan including medical and non-medical interventions
- g. List some delirium prevention strategies

10) Major/Minor Neurocognitive Disorder (Dementia/Cognitive Impairment)

Given a patient with suspected cognitive impairment, the student will be able to:

- a. Define Major/Minor Neurocognitive Disorder
- b. Take a history and perform a physical exam on a cognitively impaired patient including collateral history from family and/or caregivers
- c. Perform standardized cognitive testing such as the MMSE or MoCA
- d. List potential reversible causes of cognitive impairment including
 - i. Secondary effects of medical conditions
 - ii. Vitamin B12 deficiency
 - iii. Hypothyroidism
 - iv. Sleep Apnea
 - v. Infections (HIV, syphilis)
 - vi. Normal Pressure Hydrocephalus
 - vii. Structural lesions (Subdural hematoma, mass lesion)
 - viii. Drug toxicity
 - ix. Depression
- e. List the most common neurologic causes of Neurocognitive Disorder including
 - i. Vascular disease
 - ii. Alzheimer's
 - iii. Frontal Temporal Degeneration
 - iv. Lewy Body Disease
- f. List appropriate investigations to determine the cause of the cognitive impairment and to rule out reversible causes

11) Numbness/Tingling

Given a patient presenting with numbness and tingling, the student will be able to:

- a. Perform a history and physical examination and provide a localization for the sensory complaints

- b. Provide a differential diagnosis for the sensory complaints and correctly identify potential neurologic emergencies which can present with acute sensory changes including
 - i. Guillan Barre Syndrome aka Acute Inflammatory Demyelinating Polyneuropathy
 - ii. Cauda Equina syndrome/Spinal Cord Compression
 - iii. Peripheral nerve vasculitis
 - iv. Ischemic/Hemorrhagic Stroke
- c. Correctly identify which investigations are appropriate depending on the proposed localization including
 - i. MRI imaging of the brain/spinal
 - ii. Nerve conduction studies
 - iii. Laboratory investigations
- d. List common reversible or treatable medical causes of peripheral neuropathy including
 - i. Diabetes
 - ii. B12 deficiency
 - iii. Hypothyroidism
 - iv. Liver disease
 - v. Renal disease
 - vi. Monoclonal gammopathy

12) Abnormal/Involuntary Movements

Given a patient with abnormal or involuntary movements, the student will be able to

- a. Characterize the movement as hyperkinetic or hypokinetic and if hyperkinetic, classify it under one of the following subtypes
 - i. Myoclonus
 - ii. Tics
 - iii. Stereotypies
 - iv. Chorea/Hemi-ballismus/Athetosis
 - v. Tremor
 - vi. Dystonia
- b. Describe the difference between essential tremor and a Parkinsonian tremor
- c. Describe the typical findings seen in Parkinson's disease including
 - i. Tremor
 - ii. Rigidity
 - iii. Bradykinesia
 - iv. Postural instability
- d. Identify potentially reversible or treatable causes of movement disorders including
 - i. Drug reactions
 - ii. Wilson's disease
- e. Order appropriate investigations to rule out treatable causes of movement disorders

13) Neuropathic Pain

Given a patient with acute or chronic neuropathic pain, the student will be able to

- a. Perform a history and physical examination in a patient with neuropathic pain including documentation of previous treatment strategies
- b. Propose appropriate investigations to determine the etiology of the pain
- c. Suggest a management plan including medications specific to neuropathic pain and psychosocial/non-medical interventions
- d. Be familiar with the dosing of Gabapentin and/or TCAs for treatment of neuropathic pain

14) Seizures/ Epilepsy

Given a patient with suspected seizure or epilepsy, the student will be able to

- a. Define epilepsy
- b. Provide a differential diagnosis for episodic loss of consciousness including medical causes such as syncope and cardiogenic syncope
- c. Take a focused history and attempt to differentiate between seizure and seizure mimic based on the historical features of the event
- d. Classify seizures as focal onset, focal onset with impaired awareness or generalized onset as per the 2017 International League Against Epilepsy Classification (<https://www.epilepsy.com/article/2016/12/2017-revised-classification-seizures>)
- e. Differentiate between primary and secondary seizures and list potential secondary causes of a seizure including but not limited to
 - i. Reversible metabolic/toxic causes in a medical patient
 - ii. Drug withdrawal
 - iii. Structural lesions
 - iv. Medication non-adherence
 - v. Infection
- f. Identify appropriate investigations including laboratory studies and imaging studies in a patient with a first time seizure
- g. Discuss safety concerns in patients with epilepsy including driving restrictions
- h. Define status epilepticus and describe initial management of a patient in status

15) Acute/Chronic Visual Disturbance

Given a patient complaining of visual disturbance, the student will be able to

- a. Perform bedside testing of visual acuity, pupillary function and visual fields
- b. Attempt a fundoscopic examination using an ophthalmoscope
- c. Describe and localize the following visual field abnormalities
 - i. Homonymous hemianopsia
 - ii. Bitemporal field loss
 - iii. Monocular vision loss
- d. Localize the cause of the loss based on exam findings into one of the following areas

- i. Ocular cause
- ii. Optic nerve/tract
- iii. Optic radiations/Meyer's loop
- iv. Occipital lobe
- e. Provide a differential diagnosis for causes of central vision loss including correct identification of a possible ischemic cause based on symptom acuity and exam findings

16) Weakness

Given a patient complaining of weakness the student will be able to

- a. Perform a history and neurologic examination on a weak patient and provide a localization for the source of the weakness
- b. Correctly grade muscle strength based on the Medical Research Council (MRC) scale
- c. Correctly grade reflex responses as below
 - i. 0 - Absent
 - ii. 1+ - Present with reinforcement
 - iii. 2+ - Present
 - iv. 3+ - Present with spread to adjacent muscle groups
 - v. 4+ - Present with triggering of clonus on reflex testing
- d. Suggest an etiology and appropriate investigations based on the localization of the weakness
- e. Correctly identify potential neurologic emergencies which can result in acute weakness including
 - i. Ischemic or hemorrhagic stroke
 - ii. Acute Inflammatory Demyelinating Polyneuropathy (Guillan Barre Syndrome)
 - iii. Myasthenia Gravis crisis
 - iv. Cauda Equina Syndrome/Spinal Cord Compression
 - v. Head Trauma

17) Meningitis/Encephalitis

Given a patient with suspected central nervous system infection, the student will be able to

- a. Differentiate meningitis from encephalitis
- b. Perform a history and physical examination including maneuvers to test for meningismus
- c. Discuss common microbial and viral etiologies for meningitis and encephalitis
- d. Propose appropriate initial antibiotic and antiviral therapy
- e. Order appropriate investigations including blood cultures and CSF studies

Common Neurologic Conditions

In addition to the diseases listed above, students should also be able to discuss the clinical features, exam and imaging findings in the follow common neurologic conditions

- 1) Multiple Sclerosis
- 2) Acute Inflammatory Demyelinating Polyneuropathy (Guillan Barre Syndrome)
- 3) Diabetic Polyneuropathy
- 4) Myasthenia Gravis
- 5) Alzheimer's Disease
- 6) Frontal Temporal Degeneration
- 7) Parkinson's Disease
- 8) Essential Tremor
- 9) Bell's Palsy
- 10) Inflammatory Myositis
- 11) Migraine Headache
- 12) Carpal Tunnel Syndrome
- 13) Subarachnoid Hemorrhage
- 14) Subdural Hematoma
- 15) Normal Pressure Hydrocephalus