Introduction

Up to 10% of patients seen by family practitioners present with neurologic symptoms and pose neurologic questions to their physicians. Only 16% of the 45 million Americans who visit a physician for a chief complaint referable to the nervous system are ever evaluated by neurologists. Clearly, primary care physicians are routinely called upon to evaluate and manage patients with neurologic disease. Practicing physicians require a firm understanding of the general principles of clinical neurology.

The most suitable setting in which to lay the foundation for that understanding is in a neurology clerkship in the clinical phase of medical school. We view the third year medical school neurology clerkship teaching as a cumulative knowledge and continuum, beginning with the second year Neuroscience Course and fourth year neurology electives to build expected core knowledge and skills in neurology.

Overview

The Neurology Clerkship is a four-week introduction to Clinical Neurology taken during the third year of medical school. It has been designed to provide a broad experience in neurology, with ambulatory and outpatient rotations and diverse patient problems from typical complaints seen in primary care to tertiary-level, refractory neurologic diseases. Also emphasized are the basic tools of neurologic diagnosis; the neurologic history and examination. The clerkship rotation sites include; USA Neurology outpatient clinic, USA Medical Center, USA Pediatric-Neurology clinic, USA Neurosurgery outpatient clinic and affiliated private practice clinic staffed by adjunct USA faculties, although students will spend more time at USA adult neurology inpatient and outpatients facilities. Students develop their clinical skills by actively participating in patient evaluations and learn an organized and methodical approach. Students also learn to incorporate neurologic studies to help confirm their diagnoses, including neuroimaging (MRI, CT) and neurophysiologic studies (EEG, EMG and NCV).

GOALS AND OBJECTIVES COMPETENCY – BASED & CURRICULUM

Goals and Competency- Based Objectives

I. Goals

The goal of the neurology clerkship is to provide students with the fundamental skills required by all physicians to recognize, diagnose, and formulate an initial treatment plan for patients with common neurologic disorders. As such, a principal goal of the clerkship is to help students refine skills in taking a neurologic history and performing a thorough neurologic examination, and to demonstrate and apply national standard of the principles and skills underlying the recognition and management of the neurologic diseases a general medical practitioner is likely to encounter in practice.

II. Competency-Based Educational Objectives

1. (Compc1) PATIENT CARE; to achieve and demonstrate the following:

   a) obtain an accurate neurologic history, and elicit neurologic complaints
   b) perform detailed neurologic examination, and distinguish normal from abnormal findings
   c) localize the likely site or sites in the nervous system where a lesion could produce a patient’s symptoms and signs
   d) formulate a differential diagnosis based on lesion localization, time course, and relevant historical and demographic features
   e) make informed decision about appropriate diagnostic studies, explain and formulate required treatment based on scientific evidence, clinical judgment and patient preferences
   f) assess the outcome, and adverse effects of therapies based on patient feedback, validated outcome measurement tools and clinical judgment
   g) recognize situations in which it is appropriate to request neurologic consultation.

2. (Compc2) MEDICAL KNOWLEDGE (Cognitive); to impart and reinforce the following:
a) recognize symptoms that may signify neurologic disease (including disturbances of consciousness, cognition, language, vision, hearing, equilibrium, motor function, somatic sensation, and autonomic function)
b) demonstrate awareness of the use and interpretation of common tests used in diagnosing neurologic disease
c) apply the principles underlying a systematic approach to the management of common neurologic diseases (including the recognition and management of situations that are potential emergencies)
d) integrate basic science information (neurophysiology, neuroanatomy, neuropharmacology, and neuropathology) to clinical correlates.
e) describe key aspects of brain, spinal cord, peripheral nerves and muscle diseases clinical, pharmacologic, anatomical, pathology, causes, prognosis and management
f) identify normal and abnormal neuroimaging (CT, MRI), CSF and common diagnostic studies utilized in clinical neurology

3. (Compc3) INTERPERSONAL and COMMUNICATION SKILLS (Psychomotor); to build and reinforce the following:
   a) the ability to take a complete and reliable neurologic history [see Appendix 1]
   b) the ability to perform a focused and reliable neurologic examination [see Appendix 2]
   c) the ability to examine patients with altered level of consciousness or abnormal mental status [see Appendix 3]
   d) articulate a clear, concise, and thorough oral presentation of a patient’s history and examination
   e) prepare a clear, concise, and thorough written presentation of a patient’s history and examination
   f) [Ideally] the ability to perform a lumbar puncture
   g) the ability to communicate with consultants, primary care providers and other members of the team.
   h) the ability to communicate with the family caregivers of non-verbal patients

4. (Compc4) PROFESSIONALISM (Attitude); to demonstrate and employ the following:
   a) treat patients with compassion and respect their privacy and personal dignity at all times
   b) exhibit honesty and act with integrity in all patient, collegial, and professional interactions
   c) demonstrate an understanding of the roles of other healthcare professionals and the means of collaboration with individuals providing medical care or promoting health
   d) demonstrate an understanding of the need to ameliorate the suffering of patients, including but not limited to the relief of pain, and the knowledge of the means to continue to care for dying patients when disease-specific treatment is no longer useful or available.
   e) show courtesy, honesty and respectfulness to all faculty, residents, fellow students and staff associated with the delivery, and all other matters associated with the clerkship.

5. (Compc5) PRACTICE BASED LEARNING AND IMPROVEMENT; to achieve and utilize the following:
   a) perform literature searches on a specific topic to make evidence based decision
   b) utilize the recommended learning resources of the clerkship, and course material, with modifications based on personal strengths and weaknesses
   c) participate in team-based learning exercises and self-directed learning activities
   d) display motivation to learn, and respond effectively to constructive criticism received from faculty and residents, and apply those toward improvement of patient care
   e) display the desire and demonstrate scholarly achievements (e.g. good grades on the NBME, Clinical Skills Examination and faculty evaluation)
   f) review and interpret the medical literature (including electronic databases) pertinent to specific issues of patient care.

6. (Compc6) SYSTEM-BASED PRACTICE; to locate and utilize the following:
   a) identify multiple resources within the health care system to optimize delivery of patients care with acute and chronic neurological diseases
   b) apply and relate cost-effective health care delivery to patients with chronic and debilitating neurological disorders
   c) recognize and implement the involvement of multiple health care professionals, and organizations for patients and family support
d) establish collaborative approach, learn how to generate succinct, accurate and effective reports and create consultative communications with other physicians.

III. TEACHING METHODS, EDUCATION AND LEARNING SESSIONS

Clinical education

The students are required to, and given the opportunity to evaluate inpatients and outpatients adult and pediatric neurology cases, with more emphasis on adult neurology. They are required to obtain accurate and comprehensive medical history, perform complete neurological examination, present and discuss the case with the faculty, review and interpret diagnostic studies and formulate differential diagnosis and therapeutic plan. Then the faculty provides a thorough feedback, and monitors student experience and modifies it as necessary to ensure that the objectives of the clinical education program will be met. The faculty defines the types of patients and clinical conditions that students must encounter the appropriate clinical setting of the educational experiences, and the expected level of student responsibility.

Additionally, the faculty assures that students have acquired and can demonstrate on direct observation the Core clinical Skills, behaviors, and attitudes that have been specified in the clerkship educational objectives, specifically designed to assess students’ skills in problem solving, clinical reasoning and communication.

Students are required to keep a patient’s case log throughout the 4 weeks clerkship course and should see and examine patients with:

- stroke/TIA;
- episodic disorder (e.g., headache, seizure);
- coma and acute altered mental status
- neurodegenerative disease (e.g., dementia, movement disorder); and
- peripheral neurologic disease (neuropathy, neuromuscular disease).

In addition, students should see and/or assist in performance and interpretation of neurologic procedures, including:

- lumbar puncture
- EEG
- EMG/NCS studies;
- CT; and MRI

All attending physicians and residents are expected to provide:

- Daily supervision.
- Direct observation of basic skills.
- Teaching and guidance.
- Written assessment of student performance and constructive feedback.

Educational Sessions

Instructional strategy to enhance active learning, critical thinking and independent study to foster the skills necessary for lifelong learning are implemented. Students receive explicit experiences in using these skills, and evaluation of and feedback on their performance.

We adopt an interdisciplinary approach to integrate the basic biomedical science throughout the entire clerkship rotation thru logic interpretation of the clinical scenario, in the context of correlation with basic neuroscience and its application to human health and neurological diseases.

The educational sessions include;

a) Interactive sessions and formal educational activities
Case based discussion and presentations, videos, questions and answers. The emphases are on learning general principles and a systematic approach to patients with common neurological disorders, and illustrate essential concepts or
required urgent management. Particularly noteworthy neurologic topics that are emphasized include; The neurological history and examination, principles of neurologic localization, laboratory studies and neuroimaging, confusional state and coma, dementia, headache and facial pain, neuro-ophthalmology, disorders of equilibrium, motor and sensory disorders, movement disorders, seizures and syncope, stroke, multiple sclerosis, CNS infectious diseases, neurological emergencies, spinal cord compression.

b) Team-based learning
The department of neurology adopted an instructional strategy of learning and critical thinking by shifting the instructional focus from knowledge transmission to knowledge application to enhance professional competencies that cannot be achieved through lecture-based instruction. This strategy is integrated tightly with a course's design, alongside other learning activities.

Students are provided with reading assignments based on their learning needs, list of learning objectives and sets of questions prior to each TBL session. Students are required to answer the questions individually (individual readiness assurance test- iRAT), then they retake the exact same test again as a team (gRAT), coming to consensus on each question. Students receive immediate feedback on the team test afterwards, which can be a short, specific lecture to enable the instructor to clarify any misperceptions that become apparent during the team test.

c) Independent Self-study
Students given reading assignment with objectives. Self assessment quiz provided. The students are provided with printed material and syllabi, and provided with clerkship web page and electronic database for educational resources and continuous learning including; online videos, clips and textbooks (Clinical Neurology, 8e, David A. Greenberg, Michael J. Aminof, Roger P. Simon), Adams and Victor's Principles of Neurology (Ropper and Samuels, eds) and a list of electronic educational resources on the Neurology Clerkship website.

d) The students are required to attend and interact with
- weekly Neurology Grand Rounds presented by a faculty member, resident or guest speaker
- weekly Neuroradiology conference to review various neuroimaging of clinical cases
- weekly Professor Rounds for interactive presentation and discussion of a clinical case
- monthly Journal Club interactive session to review and interpret the medical literature pertinent to specific issues of patient care (assigned faculty, residents and students)

EDUCATIONAL RESOURCES
The following educational resources are provided electronically and can be accessed online free of charge through the University of South Alabama Biomedical Library website, and the neurology clerkship web site (http://www.usahealthsystem.com/neuroeducation). If you are off-campus you will need your J-number to access these resources.

Clerkship designated textbook
It is very important that students read about their patients' disorders to reinforce their knowledge. The following are excellent references:
- Clinical Neurology, 8e (Greenberg DA, Aminof MJ, Simon RP) is a good brief synopsis of neurology and can be used an alternate reference for the clerkship. It is a practical text keyed to common neurological problems and is available as an electronic resource through the College of Medical library free of charge.

Clerkship required readings
- Review on seizures and epilepsy from Conn's Current Therapy (PDF)
- Clerkship provided syllabi (Management of Epilepsy in Adolescents and Adults, Evaluation and treatment of Lower Back pain, Peripheral Neuropathies and Myopathies, Headaches and Pain)
- NIH Stroke Scale online training (required for 3rd year Clerkship; Certificate of completion from Test “A” must be submitted to Clerkship Coordinator by the end of the third week)
Clerkship Additional Suggested Reading

- Adams and Victors' Principles of Neurology (Ropper and Samuels, eds) is a standard in neurology; it is easy to read, and covers basic signs and symptoms of neurologic illness. A standard book, and especially helpful when approaching a patient whose diagnosis is unknown.
- Localization in Clinical Neurology is helpful when learning to localize lesions, and helpful to use it as needed to improve your localization skills.

Clerkship required videos viewing

- Neurological Exam (courtesy University of Virginia), Epilepsy, Ataxia, Chorea, Dystonia, Parkinson’s Disease, Essential Tremor and Muscular Dystrophy

Helpful Online Resources

- Eye and pupillary movement simulator (courtesy of UC-Davis) Allows you to see what EOM abnormalities look like.
- Brain vascular territories (courtesy Dr. Smithuis, Rijnland Hospital in Leiderdorp, Netherlands) Nice illustration on CT and MRI of brain of areas affected by occlusions of specific blood vessels. (However, emboli are NOT a common cause of lacunar stroke)
- Draw it to know it (courtesy University of Indiana); this tutorial teaches neural pathways by having you draw schematics. A companion book is available.
- Introduction to EEG

IV. EVALUATION, GRADING POLICIES & FEEDBACK

We view evaluation and feedback to students as a very important part of the rotation. We utilize electronic online evaluation system (New Innovations) to assure speed, ease of distribution, automatic tracking and the ability to integrate and network with the administrators. These evaluations are readily available for the students to provide feedback and assessment opportunity.

Evaluations include

- **Midclerkship evaluation** for each student by the clerkship director.

- **Electronic evaluation form**, inclusive of all clerkship attributes completed by a faculty member, or chief resident who observed and mentored the student directly during rotation, Narrative comments written by the evaluators are an important part of the process to provide feedback and justify the final recommended grade.

- **Objective structured clinical skills examination (OSCE)** completed by a faculty member or chief resident is utilized to test a student’s skill level in communication, professionalism, clinical history, performing detailed neurological examination, differential diagnosis and informed decision about diagnostic and therapeutic interventions The student’s skills are tested in timed manner involving one-on-one interaction with clinical patients. A form of the OSCE structure is provided to each student early on, and preparation for the OSCE is provided by a faculty member or a chief resident during the first part of the clerkship.

- **The National Board of Medicine Examiners (NBME)** is utilized to measure the cognitive knowledge of medical students at the end of each clerkship block, and to provide the school with useful performance data that can be compared to a large, representative group of test takers at the same stage of medical educational training. The details of final grades are posted electronically on New Innovations and are accessible to the medical students individually.

Grading Components Details

The clerkship coordinator proctors the NBME examination, and in conjunction with the clerkship director completes the
grading process and submit the grades to the Office of Students Affairs in timely manner (1-3 days). The following grading process is implemented:

- Faculty evaluation 20% of final grade
- OSCE examination 40% of final grade
- NBME percentile score 40% of final grade

Feedback Mechanism

- Daily verbal ongoing feedback from preceptors one-on-one interaction at inpatient’s bedside, outpatient’s clinic and various clinical care
- Weekly Case discussion, and interactive sessions in didactic setting
- Mid-clerkship formative feedback/discussion in meeting with clerkship director
- Pre-clinical skills examination training and feedback by preceptors’
- Formal monitoring patient log
- Direct faculty observation and formative feedback on performance of physical examination

V. EVALUATION OF THE CLERKSHIP, FACULTY AND RESIDENTS BY STUDENTS

Clerkship, faculty and residents evaluation by the students is an important tool to strengthen medical teaching and evaluate our department teaching performance. The students receive an electronic request for clerkship, faculty and residents evaluation. The evaluations are completely anonymous; hence neither clerkship director, faculty nor residents will know which student submits a specific evaluation.

Student’s comments, suggestions and concern are addressed in a constructive way towards improvements for the clerkship. Fundamental changes in clerkship policy are implemented during the next academic year.

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**Educational Interactive Session’s Schedule**

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<th>Team-based learning</th>
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<td>Laboratory Studies</td>
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<td>Headache and Facial pain</td>
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<td>(Chief Resident)</td>
<td>CNS demyelinating diseases (Eckstein)</td>
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<td>Neuro-opthalmology</td>
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<td>Motor disorders</td>
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<td>Neuroimaging</td>
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* Clinical Neurology, 8e (David A. Greenberg, Michael J. Aminof, Roper P. Simon)
  As recommended in the clerkship educational resources section.

**VI. CONTENT OF SUBJECTS TO BE TAUGHT & IMPLEMENTED**

**A.** Develop the skills to perform the Neurologic Examination (as an integral component of the general medical examination)

1. Perform a focused but thorough neurologic examination [see Appendix 1]
2. Perform a screening neurologic examination [see Appendix 2]
3. Perform a neurologic examination on patients with an altered level of consciousness [see Appendix 3]
4. Recognize and interpret abnormal findings on the neurologic examination
B. Recognize localization - general principles differentiating lesions at the following levels

1. Cerebral hemisphere
2. Posterior fossa
3. Spinal cord
4. Nerve root/Plexus
5. Peripheral nerve (mononeuropathy, polyneuropathy, and mononeuropathy multiplex)
6. Neuromuscular junction
7. Muscle

C. Develop proficiency and demonstrate a symptoms complex systematic approach to the evaluation and differential diagnosis of patients who present with:

1. Focal weakness
2. Diffuse weakness
3. Clumsiness
4. Involuntary movements
5. Gait disturbance
6. Urinary or fecal incontinence
7. Dizziness
8. Vision loss
9. Diplopia
10. Dysarthria
11. Dysphagia
12. Acute mental status changes
13. Dementia
14. Aphasia
15. Headache
16. Focal pain (facial, neck, low back and neuropathic pain)
17. Numbness or paresthesias
18. Transient or episodic focal symptoms
19. Transient or episodic alteration of consciousness
20. Sleep disorders
21. Developmental disorders

D. Develop and demonstrate basic competencies in dealing with neurological emergencies, and proficiency in evaluating and managing common neurologic conditions (either because they are important prototypes, or because they are potentially life-threatening):

1. Potential emergencies
   a) Increased intracranial pressure
   b) Toxic-metabolic encephalopathy
   c) Subarachnoid hemorrhage
   d) Meningitis/Encephalitis
   e) Status epilepticus
   f) Acute stroke (ischemic or hemorrhagic)
   g) Spinal cord or cauda equina compression
   h) Head trauma
   i) Acute respiratory distress due to neuromuscular disease (e.g., myasthenic crisis or acute inflammatory demyelinating polyradiculoneuropathy)
   j) Temporal arteritis
2. Strokes
3. Seizures
4. Alzheimer’s disease
5. Parkinson’s disease
6. Essential tremor
7. Multiple sclerosis
8. Migraine
9. Bell’s palsy
10. Carpal tunnel syndrome
11. Diabetic polyneuropathy
12. Brain death

CONTENT AREA: CLINICAL - NEUROANATOMY INTEGRATION

A. Understand basic anatomical and physiological principles of the components of the neuraxis (cerebral hemispheres, basal ganglia, cerebellum, brainstem, spinal cord, spinal nerve roots, plexi, peripheral nerves, neuromuscular junction, and muscle).
B. Describe the major functions of the various cerebral cortex lobes, basal ganglia, thalamus, cerebellum, brainstem and spinal cord.
C. Describe the visual pathway (retina, optic disc, optic nerve, optic chiasm, optic tract, lateral geniculate bodies, optic radiations, and occipital cortex).
D. Localize each cranial nerve nucleus, and location of the corticospinal in the brainstem regions.
E. Describe the vascular supply of the CNS (anterior vs posterior circulation territories, typical distribution of anterior, middle, and posterior cerebral arteries, lenticulostrate arteries).
F. Describe the ventricular system (including foramina) and trace the origin, flow, and absorption of cerebrospinal fluid (CSF).
G. Describe the anatomy of the spinal cord, with special emphasis on the various tracts, conus medullaris locations and functions.
H. Identify the components of the peripheral nervous system; afferent (sensory) root, efferent (motor) root, dorsal root ganglion and relationship of nerve roots to intervertebral foramen.
I. Review the brachial and lumbosacral plexi and discuss the major clinical functions of each of the following nerves; Radial nerve, Median nerve, Ulnar nerve, Femoral nerve, Sciatic nerve, Fibular and Tibial nerve.
J. Describe the physiological and anatomical basis of major tendon reflexes ten (biceps, triceps, brachioradialis, patellar and Achilles reflex).
K. Describe the neuromuscular junction (NMJ) with special attention to physiology of pre-synaptic vesicle function and neurotransmitter release, physiology of post-synaptic neurotransmitter binding.
L. Review the autonomic nervous system (ANS);
   - the sympathetic nervous system (hypothalamus, intermediolateral cell columns, sympathetic chain).
   - the parasympathetic (cranio-sacral outflow) distribution.
   - effect of ANS dysfunction on bladder & bowel function, sexual function, and pupillary action.

CONTENT AREA: NEUROLOGIC SYMPTOMS & DISEASES

Part A: Content Organized by Common Neurological Symptoms

The student should demonstrate a systematic approach to the evaluation and differential diagnosis of patients with the following complaints:
A. Focal weakness
B. Diffuse weakness
C. Clumsiness
D. Involuntary movements
E. Gait disturbances
F. Urinary or fecal incontinence
G. Dizziness
H. Vision loss
I. Diplopia
J. Dysarthria
K. Dysphagia
L. Acute mental status change
M. Dementia
N. Aphasia
O. Headache
P. Focal pain  
   1. Facial pain  
   2. Neck pain  
   3. Low back pain  
   4. Neuropathic pain  
Q. Numbness/paresthesias  
R. Transient or episodic focal symptoms  
S. Transient or episodic alteration of consciousness or awareness  
T. Sleep disorders  
U. Developmental disorders  

Part B: Content Organized by Major Categories of Neurological Disease

The student should demonstrate knowledge of the following major diagnoses, being able to discuss salient diagnostic criteria (to ensure the diagnosis is correct), pathophysiology, symptoms, initial steps in management, and prognosis.

A. Potential emergencies  
   1. Increased intracranial pressure  
   2. Acutely altered mental status (including toxic-metabolic encephalopathy, post-ictal states, and stroke syndromes presenting as “confusion”)  
   3. Intracranial hemorrhage (subarachnoid & parenchymal)  
   4. CNS infection (meningitis & encephalitis)  
   5. Status epilepticus  
   6. Acute ischemic stroke  
   7. Spinal cord or cauda equina compression  
   8. Head trauma/concussion  
   9. Acute respiratory distress of neurologic origin (including myasthenic crisis and acute inflammatory demyelinating polyradiculoneuropathy)  
  10. Temporal arteritis  
B. Stroke  
C. Seizure  
D. Dementia (especially Alzheimer’s disease)  
E. Parkinson’s disease  
F. Essential tremor  
G. Multiple sclerosis  
H. Migraine  
I. Bell’s palsy  
J. Carpal tunnel syndrome  
K. Diabetic polyneuropathy  
L. Brain death  

Part C: Content Organized by Neurological Organ Systems

The student should demonstrate knowledge of the major diagnoses by the following neurologic systems, including presentation of disorders, pathophysiology, formulation of appropriate differential diagnoses, a rational approach to initial evaluation, first steps in treatment, and prognosis.

A. Disorders of motor function: differentiate between disorders causing weakness, incoordination, and involuntary movements based on history and examination.  
   1. Differentiate between upper motor neuron (UMN) and lower motor neuron (LMN) dysfunction.  
   2. Discuss pathophysiology of and examination findings of UMN syndromes of hemiparesis, paraparesis, and quadripareysis.  
   3. Differentiate between spasticity & rigidity.  
B. Disorders of incoordination; discuss the clinical findings and pathophysiology of midline versus hemispheric cerebellar disorders. The student should be able to define “ataxia.”  
   1. Differentiate resting vs action tremor  
   2. Rigidity vs spasticity
3. Differentiate and recognize; asterixis, dystonia, myoclonus, and tics,

C. Discuss the clinical findings, ancillary studies, and treatment of;
   1. Parkinson's disease
   2. Essential tremor
   3. Tardive dyskinesia

D. Differentiate and localize central and peripheral sensory disorders based on distribution of sensory abnormality, modalities affected, associated findings, and presence or absence of pain in each of the following: Hemisensory loss, sensory level, Brown-Séquard syndrome, dissociated sensory loss and peripheral sensory disorders.

E. Assess and localize disorders of vision of the following; visual loss, monocular visual loss, bitemporal visual field defect, homonymous hemianopsia, diplopia

F. Describe the innervation and action of each of the extraocular muscles.

G. Describe the oculocephalic response in health and disease and its role in evaluation of the comatose patient.

H. Localize and name the most common cause of the following syndromes:
   I. Internuclear ophthalmoplegia
      1. Third cranial nerve palsy (pupil-sparing vs non-pupil sparing)
      2. Fourth cranial nerve palsy
      3. Fluctuating or fatigueable ocular weakness sparing the pupil
   J. Recognize nystagmus and list common causes

K. Assess pupillary abnormalities
   1. Trace the sympathetic and parasympathetic pathways that supply the pupil.
   2. Describe the components of Horner’s syndrome.
   3. Describe the pathophysiology & significance of an afferent pupillary defect.

L. Episodic disorders
   1. Discuss common historical and clinical features that help differentiate syncope and seizure; identify common causes of syncope.
   2. Seizure disorders
      3. Outline the International Classification System for common types of seizures, differentiating among the following:
         - Generalized tonic-clonic seizure
         - Absence seizure
         - Complex partial seizure
         - Simple partial seizure
         - Partial seizure with secondary generalization
   4. Distinguish between seizure and epilepsy
   5. List the common causes of seizures by age group
   6. Describe post-ictal paralysis (Todd's phenomenon).
   7. Discuss the routine evaluation of patients with new-onset seizures, risks and benefits of early anticonvulsant treatment, and appropriate lifestyle modifications during initial evaluation.
   8. Discuss commonly used anticonvulsants and their major side effects.
   9. Define status epilepticus and outline its emergent management.

M. Cerebrovascular disease
   1. List major risk factors for cerebrovascular disease and their attenuation by lifestyle modification and pharmacologic treatment.
   2. Define and discuss initial evaluation and management of the following:
      a) Asymptomatic carotid bruit
      b) Transient ischemic attack (TIA)
      c) Ischemic infarction (artery-to-artery embolization, cardiac embolization, large-vessel thrombus), lacunar infarction and hemorrhagic infarction
      d) Parenchymal intracranial hemorrhage and subarachnoid hemorrhage
      e) Transient monocular visual loss (amaurosis fugax)
   3. Describe the major clinical features of infarction in the following cerebral arterial territories:
   4. Anterior cerebral, middle cerebral, posterior cerebral, basilar, vertebral and lenticulostriate arteries.
   5. Describe the emergent management of acute ischemic stroke, with special attention to:
   6. Intravenous thrombolysis, intra-arterial thrombolysis, mechanical clot disruption, anticoagulation and other supportive measures in the acute peri-stroke period.

12
7. Describe the emergent management of acute intracranial hemorrhage, with special attention to:
   a) Most common sites and presentations for hypertensive intracranial hemorrhage
   b) Indications for emergent surgical intervention
   c) Clinical presentation of increased intracranial pressure
   d) Typical presentation of subarachnoid hemorrhage, initial diagnostic evaluation and immediate/emergent management

N. Demyelinating disease
1. Describe common clinical findings in multiple sclerosis, including MRI and CSF examinations.
2. Describe onset, diagnosis, and emergent management of acute inflammatory demyelinating polyradiculoneuropathy (Guillain-Barre disease).

O. Head trauma
1. Define each of the following in terms of temporal profile and initial management:
   2. Concussion, diffuse axonal injury, subdural hematoma and epidural hematoma
2. Understand and apply the Glasgow Coma Scale

P. Dizziness and disorder of hearing
1. Evaluation of dizziness. Distinguish the various meanings of “dizziness,” define vertigo, and differentiate these from disequilibrium and list common causes of these symptoms.
2. Describe the following components of a vestibular examination:
   a) Nystagmus
   b) Dix-Hallpike maneuver
   c) Caloric stimulation
3. Identify salient features distinguishing among the following:
   a) Benign paroxysmal positional vertigo
   b) Vestibular neuronitis
   c) Meniere’s disease
   d) Brainstem ischemia with vertigo
   e) Acoustic neuroma
   f) Auditory symptoms
      - Define tinnitus, conductive hearing loss, and sensorineural hearing loss.
      - Give common causes for these symptoms.
      - Describe Weber & Rinne testing for conductive versus sensorineural hearing loss.

Q. Disorders of higher cognitive function
1. Define and distinguish among the following, giving common causes for each condition: dementia, delirium, amnesia, confabulation, hallucination.
2. Differentiate an acute confusional state (delirium) and dementia
3. Dementia; - Give diagnostic criteria for dementia.
   - List common causes of dementia.
   - Describe the initial evaluation of dementia.
4. Define and distinguish aphasia and dysarthria.
5. Differentiate Broca’s aphasia from Wernicke’s aphasia
6. Alterations in consciousness: define and distinguish among the following: Consciousness, coma, persistent vegetative state, locked-in syndrome and brain death
7. Discuss the minimal neurologic substrate for alertness & consciousness

R. Assessment of the comatose patient
1. List the first three things one must do when confronted with a comatose patient (ABCs).
2. Discuss eliciting, localizing, and interpreting the following findings during neurologic examination of the comatose patient:
   a) Motor (decorticate vs decerebrate rigidity, conjugate deviation of eyes)
   b) Respiratory abnormalities, including Cheyne-Stokes respiration
   c) Pupillary abnormalities (mid-position fixed, pinpoint, unilaterally fixed & dilated)
   d) Eye movements (conjugate roving eye movements, intact vs absent oculocephalic responses)
3. Interpret the above findings with regard to hemispheric vs brainstem localization of causes of coma.

S. Describe the diagnosis and management of increased intracranial pressure (ICP)
1. List symptoms and signs of increased ICP
2. List the effects of uncal herniation on level of consciousness, motor activity, and pupillary reactivity
3. List some methods used to treat increased ICP.
4. Distinguish between communicating and non-communicating hydrocephalus.

T. Headaches and facial pain
1. Compare and contrast clinical features of benign vs potentially serious causes of headache.
2. Describe the clinical feature of the following recurrent headache disorders in terms of onset, evolution, location, character, duration, precipitants, and associated symptoms:
   a) Migraine with and without aura
   b) Tension type headache
   c) Trigeminal neuralgia
3. Describe the clinical features of the following causes of headache:
   a) SAH
   b) Meningitis
   c) Increased ICP/mass
   d) Temporal arteritis
   e) ICH
4. Discuss emergent and non-emergent indications as well as contraindications, risks, and benefits of the following diagnostic tests in patients with headache: MRI or CT, LP, Erythrocyte sedimentation rate, temporal artery biopsy
5. Discuss typical CSF profiles of meningitis vs SAH.
6. Discuss treatment for common headache disorders including symptomatic and prophylactic therapy.

U. Neck and back pain
1. Differentiate between musculoskeletal pain, radiculopathy, and spinal cord compression. List common causes of each.
2. Discuss the significance of back pain in cancer patients.

V. Brain tumors
1. Discuss the common clinical presentation of primary brain tumors in the following locations:
   a) Cerebellopontine angle
   b) Pituitary
   c) Cerebral hemisphere
2. Discuss metastatic tumors to the brain;
   a) List common sources of metastases,
   b) Differentiate from primary brain tumor by clinical features and neuroimaging.
3. Discuss common primary brain tumors

W. Neurologic infectious disease
1. Discuss common clinical presentation, CSF findings, and initial treatment for the following:
   a) Acute bacterial meningitis (most common organisms in infants, children, & adults)
   b) Acute viral meningitis
   c) Encephalitis (including herpes simplex)
   d) Brain abscess
2. HIV and the nervous system
   a) Discuss manifestations of HIV including:
      i. Encephalopathy, ii. Myelopathy, iii. Neuropathy
   b) Discuss opportunistic CNS infections associated with HIV infection

X. Spinal cord disorders
1. Localize the lesions yielding the following findings on examination:
   a) Unilateral UMN findings with ipsilateral decreased joint position sense and contralateral loss of pain and temperature sensation.
   b) Dissociated sensory loss with weakness and areflexia in the arms.

Appendix 1: Guidelines for a Comprehensive Neurologic Examination

All medical students should be able to perform the following parts of the neurologic examination.

A. Mental Status
1. Level of alertness
2. Language function (fluency, comprehension, repetition, and naming)
3. Memory (short-term and long-term)
4. Calculation
5. Visuospatial processing
6. Abstract reasoning

B. Cranial Nerves
1. Vision (visual fields, visual acuity, and funduscopic examination)
2. Pupillary light reflex
3. Eye movements
4. Facial sensation
5. Facial strength (muscles of facial expression and muscles of facial expression)
6. Hearing
7. Palatal movement
8. Speech
9. Neck movements (head rotation, shoulder elevation)
10. Tongue movements

C. Motor Function
1. Gait (casual, on toes, on heels, and tandem gait)
2. Coordination (fine finger movements, rapid alternating movements, finger-to-nose, and heel-to-shin)
3. Involuntary movements
4. Pronator drift
5. Tone (resistance to passive manipulation)
6. Bulk
7. Strength (shoulder abduction, elbow flexion/extension, wrist flexion/extension, finger flexion/extension/abduction, hip flexion/extension, knee flexion/extension, ankle dorsiflexion/plantar flexion)

D. Reflexes
1. Deep tendon reflexes (biceps, triceps, brachioradialis, patellar, Achilles)
2. Plantar responses

E. Sensation
1. Light touch
2. Pain or temperature
3. Proprioception
4. Vibration

Appendix 2: Guidelines for a Screening Neurologic Examination

All medical students should be able to perform a brief, screening neurologic examination that is sufficient to detect significant neurologic disease even in patients with no neurologic complaints. Although the exact format of such a screening examination may vary, it should contain at least some assessment of mental status, cranial nerves, gait, coordination, strength, reflexes, and sensation. One example of a screening examination is given here.

A. Mental status (level of alertness, appropriateness of responses, orientation to date and place)
B. Cranial nerves
1. Visual acuity
2. Pupillary light reflex
3. Eye movements
4. Hearing
5. Facial strength (smile, eye closure)

C. Motor function
1. Gait (casual, tandem)
2. Coordination (fine finger movements, finger-to-nose)
3. Strength (shoulder abduction, elbow extension, wrist extension, finger abduction, hip flexion, knee flexion, ankle dorsiflexion/plantar flexion)
Appendix 3: Guidelines for the Neurologic Examination in Patients with Altered Level of Consciousness

A. Mental Status
   1. Level of arousal
   2. Response to auditory stimuli (including voice)
   3. Response to visual stimuli
   4. Response to noxious stimuli (applied centrally and to each limb individually)

B. Cranial Nerves
   1. Response to visual threat
   2. Pupillary light reflex
   3. Oculocephalic (doll’s eyes) reflex
   4. Vestibulo-ocular (cold caloric) reflex
   5. Corneal reflex
   6. Gag reflex

C. Motor Function
   1. Voluntary movements
   2. Reflex withdrawal
   3. Spontaneous, involuntary movements
   4. Tone (resistance to passive manipulation)

D. Reflexes
   1. Deep tendon reflexes
   2. Plantar responses

E. Sensation (to noxious stimuli)