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# WEAKNESS

## Objectives

- 1) Differentiate fatigue and giveaway weakness from true weakness.
- 2) Recognize the pattern of weakness in upper motor neuron.
- 3) Understand the classification of common motor unit disorders

## Perception of Weakness

The symptom “weakness” as used by patients refers to a wide range of physical ailments (see table). True weakness almost always indicates a disorder of the motor system. It may be due to a central cause (e.g., upper motor neuron disease in the brain or spinal cord), or a disease of the peripheral nervous system (i.e., a disorder of the motor unit).

### Some causes of perceived “Weakness”:

- UNM disease
- Motor unit disorder
- Pain
- Sensory changes
- Systemic illness
- Depression
- Fatigue

## History Taking

### Characterize nature of complaint

Any complaint of weakness should be followed by attempts to delineate its true nature. In particular, fatigue is frequently confused with weakness. *Fatigue* implies either easy tiredness or a disinterest in physical effort. On the other hand, *weakness* means subnormal strength despite a full effort.

The concept of *fatigable weakness* in myasthenia gravis sometimes causes additional confusion. Fatigable weakness is distinct from the fatigue complained by many lay people. In myasthenia gravis, repeated use of same muscle may increase weakness. These patients usually have detectable weakness before exercise.

### Temporal course

Like almost all other aspects of the neurologic history, it is important to assess the mode of onset of weakness and note any temporal fluctuation. *Abrupt* onset (over seconds or hours) of weakness is usually associated with either vascular or traumatic causes ( eg., stroke, peripheral nerve compression after overdose). *Acute* weakness developing over days may be due to vascular, infectious or inflammatory diseases of the nervous system (eg., Guillain-Barre syndrome). Progression over weeks (ie., *subacute*) is much more nonspecific and is associated with a variety of inflammatory , compressive, infiltrative or metabolic diseases (eg., brain tumor). *Very chronic* disease progression over many months or even years usually suggest either a neurodegenerative or hereditary disorder (eg., Charcot-Marie-Tooth disease).

### Functional assessment

Asking about the effect of disease on activities of daily living provides a reliable means to measure progression or resolution of disease. Proximal weakness often manifests as difficulty in combing or washing hair, raising objects (e.g., a gallon of milk) to shelves, rising from low chair and climbing stairs, By contrast, complaints such as hand clumsiness, loss of grip strength, difficulty with opening jars, and tripping on toes suggest distal limb weakness.

### Associated symptoms

Pain, sensory loss, sphincter dysfunction, cranial nerve deficits, and other neurologic symptoms sometimes give additional clues to the anatomic localization or nature of the disease.

## Physical Examination

**Observe!** Make a conscious effort to observe the patient from the moment he/she walks in. Note gait, stance, rise from chair, unbutton jacket, untie shoelace, smiles, facial emotion, hand gestures.

**Strength Grading.** Although the widely used system of grading Strength from 0-5 is rather gross, proper adoption by experienced Examiners (see table) permits useful standardization of muscle strength. Unfortunately, more frequently than not, it is misused

### MRC Grading of Muscle Strength:

- 0- No visible contraction
- 1- Visible contraction but no joint movement
- 2- Nearly complete range w/gravity removed
- 3- Complete range against gravity
- 4- Able to overcome additional resistance
- 5- Normal

**Test simple functions.** Rise from chair, deep knee bend, step onto stool or chair, walk on heels or toes, raise arm above head, raise objects to shelf -these are very useful and often neglected tests in the neurologic examination. They are easily reproducible, and are therefore useful for longitudinal assessment of patients. These tests are often more meaningful than the formal grading of strength! **Palpate** and note muscle atrophy, if any. This is especially useful in the localization of focal nerve lesions.

**Note giveaway weakness, if present.** Nonorganic weakness is characterized by a "collapsing", "sudden give" quality -referred to as *giveaway* or *breakaway* weakness. When a joint is tested through a range of angle, the resistance fluctuates and is inconsistent. Some patients might co- contract agonist and antagonist muscles to mimic weakness. (When there is no true weakness, it makes no sense to grade it). *True weakness means that the patient's best effort is abnormally weak.* With maximal and consistent effort, the resistance felt by the examiner should be uniform.

## Components Of The Motor System

### "Upper Motor Neuron"

*Intracraniallesions* -weakness in contralateral arm and leg.

Spinal cord lesions (*myelopathy*) upper motor neuron weakness below the lesion (involvement of the descending motor fibers), and sometimes, lower motor neuron impairment at the level of the lesion (involvement of the anterior horn cells or spinal roots).

### Motor Unit

Motor unit = one anterior horn cell + all the muscle fibers it innervates

Motor unit disorders therefore encompass diseases of the cell body (motor neuron disease or anterior horn cell disease), spinal root (radiculopathy), peripheral nerve (neuropathy), neuromuscular junction (eg, myasthenia gravis), or muscle (myopathy).

### Clinical examples:

*Intracranial disease* -stroke, multiple sclerosis, neoplasms, trauma.

*Myelopathy* -cord compression multiple sclerosis trauma, vitamm B12 deficiency.

\* Typical ALS (amyotrophic lateral sclerosis) has both upper & lower motor neuron Involvement:

- Hyperreflexia
- Babinski sign
- Muscle atrophy
- Weakness (UMN or LMN)

*Motor neuron disease* -poliomyelitis, ALS\*

*Radiculopathy* -spondylitic or discogenic diseases, leptomeningeal metastasis.

*Neuropathy* -

Polyneuropathy: eg., diabetes, Guillain-Barre, AIDS.

Focal neuropathy: eg., external compression (e.g., Saturday night palsy), entrapment (e.g., ulnar nerve at elbow), vasculitis, trauma-

*Neuromuscular junction disorder* -myasthenia gravis, Lambert-Eaton syndrome, botulism.

*Myopathy* -polymyositis, alcoholic myopathy, Duchenne dystrophy.

## Anatomical Localization

This is absolutely essential. Despite present technologies, we need to know where to look.

	<b>UMN Diseases</b>	<b>Motor Unit Disorders</b>
<b>Pattern of weakness</b>	“Pyramidal” (see below)	Variable (see below)
<b>Function, dexterity</b>	Function affected before weakness is obvious to weakness	Functional impairment due to weakness
<b>Tone</b>	Increased	Decreased (except ALS)
<b>Tendon reflex</b>	Increased	Decreased or normal (except ALS)
<b>Other signs</b>	Babinski sign, other CNS signs	Atrophy if disease of motor neuron, root or nerve

### Pyramidal or Upper Motor Neuron pattern of weakness

Arms -extensors worse than flexors. Legs -flexors worse than extensors. Function/dexterity often affected first.

To screen for CNS lesions:

Pronator drift and decreased rapid tapping of fingers and feet.

Muscles disproportionately affected in UMN disorders: finger abduction (dorsal interossei), ankle/toe dorsiflexion, shoulder abduction, wrist/finger extension, hip flexion, knee flexion.

**Other useful patterns of weakness**

	<b>UMN Disease</b>	<b>Motor Unit Disorders</b>
<b>Hemiparesis</b>		
<i>Face &amp; arm &amp; leg</i>	Contralateral hemiparesis above pons	Mononeuropathy multiplex (extremely rare)
<i>Arm &amp; leg</i>	Conralateral hemiparesis above mid-cervical cord	Mononeuropathy multiplex (very rare)
<b>Monoparesis</b>		
<i>Face or arm or leg</i>	Small cortical lesion (very rare)	Focal disease of nerve, plexus or spinal root
<b>Paraparesis</b>		
<i>Bilateral legs</i>	Spinal cord lesion or bilateral hemispheres	Cauda equina or neuropathy

**Generalized (bilateral) Weakness**

In the absence of depressed level of consciousness or other central neurologic signs, generalized weakness almost always indicates a disorder of the motor unit. The differential diagnosis is aided by the pattern of weakness and muscle atrophy, the deep tendon reflexes, the absence or presence of sensory loss and the temporal mode of onset. This is illustrated below:

	<b>Motor Neuron Disease</b>	<b>Neuropathy</b>	<b>Neuromuscular Junction</b>	<b>Myopathy</b>
<b>Weakness pattern</b>	Variable	<u>Distal</u>	Diffuse	<u>proximal</u>
<b>DTR</b>	Normal, incr. If coexisting UNM	Usually decr.	Normal or decr.	Normal or decr.
<b>Atrophy</b>	Yes	Yes	No	No
<b>Fasciculations</b>	Yes	Sometimes	No	No
<b>Sensory changes</b>	No	Yes	No	No
<b>Serum CK</b>	Normal or incr.	Normal	Normal	Normal or incr.

**Classification of generalized weakness by the mode of onset:**

<b>Acute Onset (days)</b>	Poliomyelitis Rabies	Guillain-Barre diphtheria porphyria poisons (arsenic, shell-fish & others)	Myasthenia gravis  Botulism  NMJ blocking agents	Periodic paralysis  Various necrotic or infectious myopathies
<b>Subacute / chronic (weeks to years)</b>	Amyotrophic lateral sclerosis	Most motor or sensorimotor neuropathies	Myasthenia gravis  Lambert-Eaton syndrome	Polymyositis dermatomyositis steroid myopathy alcoholism hereditary

# STROKE

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## Objectives

1. Know the risk factors of stroke.
2. Know the classification of strokes.
3. Distinguish between large and small vessel strokes.
4. Understand the rationale behind acute and prophylactic management of stroke.
5. Recognize the common causes and presentations of deep and lobar hemorrhages

*Stroke* -cerebral infarction. Manifests usually as abrupt or acute onset of focal neurologic deficits.

*Transient ischemic attack (TIA)*. Neurologic deficits 2° to ischemia persisting less than 24 hrs (typical TIAs are usually last no longer than 20 minutes)

*Large vessel*. Usually those with individually designated names (eg. MCA, ACA, basilar, vertebral)

*Small vessel*. Generally those less than 0.5 mm diameter, often named as a group (eg. lenticulostriate and thalamogeniculate penetrating arteries)

## Risk Factors

### Nonmodifiable

Age

Race

Gender

Family Hx

### Modifiable or Controllable

Hypertension

Diabetes mellitus

TIAs

Prior stroke

Cardiac diseases

Smoking

Hyperlipidemia

Alcohol

Hypercoagulable state\*

Obesity

\* Causes of hypercoagulable state may include pregnancy, cancer, the presence of antiphospholipid antibodies (anticardiolipin or lupus inhibitor) or deficiency of protein C, protein S or antithrombin III, or resistance to activated protein C.

## Classification/Subtypes

### Hemorrhagic

*Subarachnoid*

*Intraparenchymal*

- Transformed ischemic

### Ischemic

#### Mechanistic

*Embolic*

*Artery-to-artery*

*Cardioembolic*

*Thrombotic*

#### Anatomic

*Large arterial*

ACA, MCA, PCA,

vertebro-basilar

*Small arterial*

- A VM rupture                                      Local vessel                                      Perforator disease
- Hypertensive                                      abnormality                                      (lacunar infarcts)
- Amyloid angiopathy
- Drug abuse (cocaine)
- Bleeding into tumors                              *Coagulopathy*                                      *Venous thrombosis*
- Coagulopathy

Arterial thrombi or plaques at carotid bifurcation and aortic arch are major sources of *artery-to-artery* emboli. Carotid or vertebral artery dissections less commonly also contribute to artery-to-artery embolism. Causes of *cardioembolic* strokes include atrial fibrillation, myocardial infarction (old or acute), myocardial aneurysm, mechanical heart valve, septal defect, bacterial endocarditis and marantic endocarditis.

Traumatic causes should sometimes be considered in the differential diagnosis of stroke syndromes. They may lead to epidural hematoma, subdural hematoma, subarachnoid hemorrhage, and intraparenchymal contusion with or without overt hematoma.

## Common stroke syndromes

### Large vessel ischemic strokes

- *Middle cerebral artery (most common)*

	<u>Dominant hemisphere</u>	<u>Nondominant hemisphere</u>
Higher cortical function	Aphasia Alexia Finger agnosia Acalculia Right/left confusion Agraphia	Hemineglect Visuospatial deficits
Weakness	Face,arm>leg	Face,arm>leg
Hemisensory loss	Face,arm>leg	Face,arm>leg
Visual loss	Hemianopia (inferior division of MCA)	Hemianopia (inferior division of MCA)

- *Anterior cerebral artery*

Contralateral leg paresis, sometimes associated with abulia, mutism, frontal release signs.

- *Posterior cerebral artery*

Contralateral homonymous hemianopsia sometimes associated with an amnesic syndrome or acute confusional state.

- *Basilar artery*

Cranial nerve deficits (eye movement and pupillary abnormalities, Horner's syndrome, facial palsy, facial sensory loss, dysarthria, dysphagia), limb ataxia, limb weakness/sensory loss, coma.

## Common lacunar syndromes

- Pure motor hemiparesis (most commonly in internal capsule, but can be seen anywhere along the motor tracts; may even be seen in large vessel strokes).
- Pure sensory stroke (most commonly in thalamus, almost always due to posterior circulation abnormality).
- Sensory-motor stroke (certainly nonspecific, may be seen as well in large vessel strokes).

## Intracranial Hemorrhages

### Intraparenchymal Hemorrhage

The clinical presentation, underlying cause and management of these hemorrhages differ according to the location of the hematoma.

#### 1. *Deep Cerebral and Posterior Fossa Hemorrhage*

Most commonly due to hypertensive vascular changes. Sites affected, in order of frequency, are the putamen, thalamus, pons, and cerebellum. Patients may present with nausea, headache, and neurologic deficits appropriate to the structures involved. Progression to stupor and coma often accompanies bleeding into the ventricles, and subfalcial or transtentorial herniation. Except in the case of cerebellar hemorrhage, patients are generally managed conservatively.

*Putamenal hemorrhage.* Patients commonly present with a contralateral hemiparesis due to involvement of the nearby internal capsule. The eyes may deviate away from the side of the hemiparesis.

*Thalamic hemorrhage.* Contralateral sensory deficits are almost uniformly present in these patients. A contralateral hemiparesis may occur, as may oculomotor findings due to extension of the hematoma into the upper midbrain.

*Cerebellar hemorrhage.* Because surgery can be life-saving in cerebellar hemorrhage, it is imperative to identify bleeding in this location. The patient presents with headache, vomiting and gait instability. It is crucial to examine the patient's gait, since truncal ataxia may be the only physical finding at the early stage. Cerebellar edema or expanding intracerebellar hematoma may lead to compression of the brainstem and fourth ventricle, and eventually cause irreversible neurologic deficits and death. Prompt surgical evacuation often leads to gratifying neurologic outcome.

*Pontine hemorrhage.* Patients with pontine hemorrhage often present with quadraparesis and rapid onset of coma. Examination shows pinpoint but reactive pupils (reactivity may require magnifying glass to ascertain), posturing, and loss of horizontal eye movements. The condition is frequently fatal.

#### 2. *Lobar Hemorrhage*

The most common cause in elderly patients is amyloid angiopathy. This condition primarily affects cortical and leptomeningeal arterioles while sparing vessels elsewhere in the brain and body. In younger patients, arteriovenous malformation (AVM) rupture and illicit drug use are more common causes of lobar hemorrhage.

Patients present with headaches (70%), nausea and vomiting, and focal neurologic deficits

depending on the location of the bleed (hemiparesis, visual field loss, aphasia, neglect, etc.). Although surgical evacuation may be advocated for selected large hemorrhages, surgical treatment of lobar hematoma remains controversial. Conservative treatment measures include maintaining moderate blood pressures and avoiding hypotonic fluids. Mannitol and hyperventilation may aid in decreasing intracranial pressure in impending herniation.

### **Subarachnoid Hemorrhage (from aneurysmal bleed)**

The classic presentation is a severe headache of *instantaneous* onset, followed quickly by neurologic deficits that may include nuchal rigidity, hemiparesis, aphasia, stupor or coma. The neurologic picture depends greatly on the location and amount of blood. An aneurysm at the posterior communicating artery is sometimes accompanied by a third cranial nerve palsy.

Many patients present with large aneurysmal hemorrhage that is easily visible on CT/MRI. However, occasional patients present with small warning leaks that result in so-called *sentinel headaches*. Imaging studies are usually insufficiently sensitive to detect the small amount of subarachnoid blood. In all patients presenting with unexplained severe headache of *abrupt* onset, a negative CT/MRI should be followed by CSF examination for blood or xanthochromia.

Aneurysmal rupture is often complicated by re-bleeding, hydrocephalus and vasospasm. All patients should be emergently referred for neurologic or neurosurgical evaluation.

## **Management of Ischemic Strokes**

This is a complex topic beyond the scope of this syllabus. Management may be subdivided into acute treatment and prevention/prophylaxis. In addition, patients with residual deficits benefit from rehabilitation.

### **Acute treatment**

*Thrombolysis* – Intravenous tPA (tissue plasminogen activator) improves outcome in selected patients treated within 3 hours of stroke onset despite an increase in rate of hemorrhagic transformation. Other thrombolytic agents and treatments given within a longer therapeutic time window are being evaluated for safety and efficacy. The Concentric Retriever, which is shaped like a corkscrew and delivered intra-arterially via a catheter, has received FDA clearance for the treatment of strokes up to 8 hrs after onset.

*Neuroprotection* -The mechanism of neuronal injury may involve free radicals, Ca<sup>++</sup> influx and excitatory amino acids (glutamate and aspartate). Although no agent has shown efficacy in duplicated clinical trials thus far, drugs designed to keep cells in the penumbra, or border, of the stroke alive continue to be investigated.

*Anticoagulation* – The treatment of acute stroke with anticoagulation has not been associated with improved recovery in stroke patients as a whole. Anticoagulation is important for preventing further emboli in cardioembolic stroke but generally the risk of recurrence is low in the first week. Most clinicians wait a few days to a week after a large stroke to reduce the risk of hemorrhagic transformation and then start warfarin without heparin. Another commonly adopted indication for anticoagulation is its use in arterial dissection.

### **Stroke prevention**

*Aspirin* reduces the risk of stroke recurrence and reduces the overall mortality. A dose of 81 mg or 325 mg (one baby aspirin or one adult aspirin) per day is recommended for stroke prevention.

*Aspirin/extended release dipyridamole (Aggrenox)* shows better efficacy in stroke prevention

than aspirin. It may be used as a first line therapy or when aspirin fails to prevent recurrence. It is significantly more expensive than aspirin.

*Clopidogrel* may be used when aspirin is contraindicated. In indirect comparisons, it is less effective than the aspirin/extended release dipyridamole combination for stroke prevention.

*Warfarin (Coumadin)* is indicated for reducing stroke risk in certain high risk patients with chronic atrial fibrillation or with other cardiac diseases predisposing to embolism. It is also used to prevent stroke in patients with certain coagulopathies.

*Treatment of risk factors* has been shown to reduce the chance of stroke significantly. Certain medications, such as the ACE inhibitors used in the treatment of hypertension and “statin” agents used for hyperlipidemia, may have stroke lowering effects over and above their effects on blood pressure or cholesterol.

*Carotid endarterectomy* of plaques causing 50% or greater stenosis in symptomatic patients reduces stroke risk in several large clinical trials. This should only be performed by surgeons with acceptable complication rates. A lesser benefit has been shown for carotid endarterectomy performed in asymptomatic patients with 60% or greater stenosis.

*Angioplasty and stenting* is the preferred treatment of carotid stenosis in patients at high risk for surgery, such as those with significant cardiac or pulmonary disease, those who have received radiation treatment to the region of the vessel or who have had a previous endarterectomy. Angioplasty and stenting are being compared to endarterectomy in trials of patients who are not considered to be at high risk for surgery and also are being investigated for use in intracranial vessel stenosis.

*Extracranial-intracranial bypass*: not beneficial in most patients; may be used in selected cases.

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# SEIZURE & EPILEPSY

## Objectives

1. Know the definition of seizures, epilepsy and status epilepticus
2. know the classification of seizures
3. Understand the selection of anticonvulsants in common types of seizures
4. Learn how to manage status epilepticus

*Seizure* -transient disturbance of cerebral function due to abnormal neuronal discharges

*Epilepsy* -a disorder characterized by recurrent seizures

Seizures may be *convulsive* or *nonconvulsive* depending on the prominence of motor features.

A seizure may be *idiopathic*, or it may be *symptomatic* of another disease. Immediate causes may include metabolic, infectious or traumatic disturbances, or the seizure may reflect remote brain injury.

## Classification of Seizures

### **Partial (focal)**

Simple (motor, sensory, autonomic, psychic)

Complex with impairment of consciousness (eg., temporal or frontal lobe epilepsy)

Secondarily generalized

### **Generalized**

Absence

Tonic-clonic Tonic Clonic

Myoclonic Atonic

### **Unclassified**

## Causes of seizures

CAUSES	AGE		
	0-20 yrs	20-50 yrs	50+ yrs
Congenital, inborn errors, birth defects	+++		
Trauma, infection	+	+++	+++
Neoplasm, stroke	+	+	+++

### **Relative risk of subsequent epilepsy**

Head trauma -military	~600	Encephalitis	16
civilian, severe	25	Alcoholism	10
Stroke	22	Alzheimer disease	10

Meningitis	2-4	Mild-Mod head trauma	2-4
Drug use	2-4	FMH of epilepsy	2

## Diagnosis

Aura	Ictus	Post-ictal state
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Since most seizures are unobserved by physicians, the diagnosis is usually made retrospectively. The observers' descriptions of the ictus and the post-ictal state are crucial to a clinical diagnosis.

- Stereotyped occurrences during ictus such as automatisms (eg. lipsmacking, chewing, scratching), unilateral sensory disturbances, or repetitive twitching of a limb are important.
- Goal-directed behavior is almost never due to a seizure. However, don't be too quick to make a diagnosis of pseudoseizure, as some partial complex seizures have bizarre features.
- The typical generalized tonic-clonic seizures last 1-2 minutes; if much longer, it may be either status epilepticus (then it is an emergency) or it may be pseudo-seizure (you'll need specialist help). This rule of thumb doesn't apply to other seizure types-
- The post-ictal confusional state that follows a generalized seizure typically lasts more than 10-15 minutes. Headache, tiredness and confusion may also follow loss of consciousness of other causes (eg. syncope), but they are usually briefer (5-10 minutes).
- Urinary incontinence and a few jerking movements of the limbs may be seen in syncope.

The patient's own recollection may also be useful.

- Aura associated with seizures of focal onset (eg. déjà vu, jamais vu) may provide a clue to the origin or type of seizure-
- The loss of consciousness during a generalized seizure is typically sudden and complete. In contrast, in syncope, the patient may remember dimming of vision and falling to the ground before loss of consciousness.

## Differential Diagnosis:

	Seizure	Hypoglycemia	Syncope	TIA
<b>Posture relationship</b>	-	-	++	+/-
<b>Aura</b>	+/-	++	+/-	-
<b>Duration</b>	1-2 minutes	many minutes	30 sec	Min - hrs
<b>Ass. Signs</b>	flush, cyanosis	sweats, pallor	sweats, pallor	focal signs
<b>Bodily injuries</b>	+/-	-	+/-	-
<b>Incontinence</b>	+/-	-	+/-	-
<b>Recovery</b>	slow	rapid	rapid	slow

The diagnosis of pseudo-seizure is best left to the specialist. The table below is intended principally for illustration of typical features of true epileptic seizures.

	<b>Seizure</b>	<b>Pseudo-seizure</b>
<b>Onset</b>	Abrupt	Usually gradual
<b>Occurrence during sleep</b>	Common	Uncommon, but possible
<b>Aura</b>	Special senses, epigastric, unilateral sensory or motor sxs	Same, but also palpitation, malaise, choking, dizziness
<b>Cry</b>	Epileptic cry at onset, grunting during ictus	During ictus
<b>Motor</b>	Synchronous movements; rarely rigidity alone	Rigidity, flailing, pelvic thrusting
<b>Injury</b>	Tongue, lips, bruises	Same
<b>Avoidance test</b>	Respond only during post-ictal state	Respond to avoidance test
<b>Duration</b>	<2 minutes (range: 50-90 secs, mean ~70 sec)	Variable (range: 3 sec-30 minutes, ~50%>2 minutes)
<b>Micturition</b>	++	+
<b>Defecation</b>	+	-
<b>EEG</b>	Epileptiform activities during ictus	No epileptiform activities during ictus
<b>Signs</b>	Pupillary dilatation during ictus, post-ictal focal signs	No objective sign

## Management Issues

### Anticonvulsant (ACD) Use

1. Establish seizure type, then start ACD (see table).
2. Slowly increasing dosage while monitoring compliance, blood level, toxicity.
3. Balance efficacy & toxicity – If good control is achieved, continue same regimen. If not, first reassess diagnosis and classification of seizure. If diagnosis is correct, decide if dosage is adequate.
 

In the adjustment of ACD dosage, *don't rely solely on blood levels*. The decision on dosage should be based primarily on clinical assessments (i.e. side effects, seizure frequency, and history of compliance).
4. If there is occasional increase in seizure frequency, consider: compliance, intercurrent illness, alcoholism, stress, sleeplessness and drug interactions.

### Selection of anticonvulsants: **Complex partial & secondarily generalized**

- Carbamazepine
- Phenytoin
- Valproate
- Phenobarbital
- Primidone
- Gabapentine
- Lamotrigine

### **1° generalized seizure**

- Absence – ethosuximide, valproate
- Myoclonic – clonazepam, valproate
- Tonic Clonic – phenytoin, valproate, primidone

5. Add ACD, or change ACD only after considering Steps 2-4.

### **Discontinuation of ACD**

- *Relapse rate* after ACD discontinuation: ~25-30% even in successfully treated cases.
- Favorable prognostic factors:
  - seizure free >2 years
  - single seizure type, well-controlled right away
  - normal neurologic examination and IQ
  - normal EEG

## **Status Epilepticus**

Refers to continuous seizures or multiple discrete seizures occurring close together without recovery of consciousness. This is a true emergency, since uncontrolled convulsions are complicated by hyperthermia, metabolic and respiratory acidosis, cardiovascular dysfunction, and occasional sudden death. Uncontrolled neuronal discharges during seizures lead to irreversible brain cell injury or death.

### **Initial assessment/treatment:**

Airway. Vital signs.

Lab studies (glucose, CBC, lytes, Ca<sup>++</sup>, Mg<sup>++</sup>, ABG, LFT, BUN/Cr, tox screen)

### **Pharmacologic treatment:**

Assume baseline ACD level is zero in calculation of dosage (unless there is good evidence to the contrary); be prepared to intubate; monitor EKG and BP frequently; avoid neuromuscular blockade as much as possible as it obscures your clinical endpoint; neuromuscular blockade makes EEG monitoring mandatory .

1. Lorazepam 0.075mg/Kg IV at 2 mg/min; followed immediately by full fosphenytoin load (18 fig/Kg IV at 150 mg/min). Phenytoin may be used instead of fosphenytoin (50 mg/min).
2. if continuing seizure, phenobarbital load (18 fig/Kg IV at 50-75 mg/min).
3. if continuing seizure, another 7 fig/Kg of phenobarbital (same IV rate).
4. if continuing seizure, ICU with EEG monitoring, midazolam anesthesia.

### **Subsequent management:**

1. History (neuro history , prior sz, compliance, intercurrent illness, drug use, etc. ).
2. General support; continue maintenance ACD; workup underlying neurologic disease.
3. *Continuing status epilepticus may be increasingly subtle under treatment," consider EEG monitoring if patient fails to improve neurologically"*

# STUPOR & COMA

## Objectives

1. Learn the anatomic basis of stupor and coma.
2. Learn how to perform neurologic examination on a comatose patient.
3. Able to differentiate metabolic coma from those due to structural causes.
4. Learn the management and diagnostic evaluation of patients in coma.

*Consciousness* -awareness of self and surroundings

Various states of consciousness:

*Delirium* -clouding of consciousness, often 'associated with perceptual disturbances, incoherent speech, disturbed sleep-wake cycles and increased/decreased psychomotor activity

*Lethargy* -lies between stupor and alertness

*Stupor* -unresponsiveness from which the subject can be aroused only by vigorous and repeated stimulations

*Coma* -a state of unarousable unresponsiveness

## Anatomy / Pathophysiology

Alertness depends on the integrity of 2 regions: *bilateral cerebral hemispheres* and brainstem *reticular activating system* (RAS) above the level of mid-pons. Coma may result from structural lesions in either of these 2 regions.

1. *Supratentorial lesions* affecting both hemispheres ( eg., various hematoma and mass lesions, subarachnoid hemorrhage, unilateral stroke with preexisting contralateral disease ),
2. *Infratentorial lesions* affecting the RAS (eg., pontine hemorrhage, basilar artery thrombosis, posterior fossa tumors, cerebellar hemorrhage with mass effect on the brainstem).

Coma may also be a result of metabolic causes. (*metabolic encephalopathy*, see Table). The neurologic approach discussed below usually will distinguish it from structural causes. Subarachnoid hemorrhage, meningitis and encephalitis, though not strictly metabolic disorders, may also present clinically as a syndrome of metabolic encephalopathy.

### Causes of Metabolic Encephalopathy:

- Illicit drugs or medications
- Electrolyte disorders (hypernatremia, hyponatremia, hypercalcemia)
- Hepatic dysfunction
- Hypo- or hyperglycemia
- Myxedema
- Uremia
- Hypoxia, hypercapnia
- Wernicke encephalopathy
- Post-ictal state

## Approach to Patients

### **Initial emergency management**

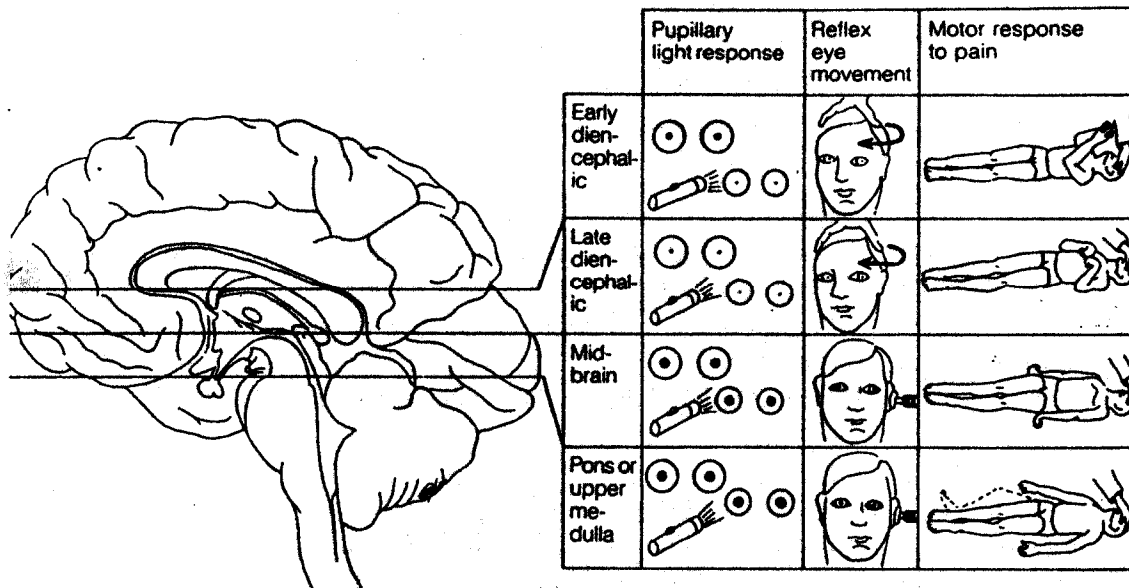
- 1 Ensure adequate airway, breathing/oxygenation, blood pressure/pulse.
- 2 Quick exam for signs of trauma, pupillary reaction, meningeal sign.
- 3 Establish IV access. Draw blood for CBC, glucose, lytes, liver function tests, BUN/Cr, PT/PTT, tox screen, ABG.
- 4 Infuse 25g glucose, 100mg thiamine, consider naloxone or flumazenil.
- 5 More detailed neurologic examination (see below).
- 6 Get brief history (more detailed history later).
- 7 Other tests as indicated: CT/MRI, LP, E KG, EEG, CXR, urine tox screen.

### **Examination to assess:**

- signs of trauma (scalp injuries, hemotympanum, depressed skull fractures, ecchymosis such as raccoon eyes and Battle sign [ecchymosis typically takes 2-3 days to appear]).
- Optic fundi (papilledema, retinal or sub hyaloid hemorrhages).
- pupils -by far most important -size & reactivity (see below).
- eye movements -oculocephalic reflex test (ie., doll's-head maneuver) or oculovestibular test (ie., ice-water caloric).
- motor response to pain -apply painful stimuli to supraorbital ridge, sternum or nail bed - observe for decorticate or decerebrate posturing, purposeful withdrawal, asymmetric response or hemiparesis.
- tendon reflexes, plantar response.

## Interpretation of PE findings

- *The hallmark of metabolic coma is the finding of reactive pupils in the setting of otherwise impaired brainstem function.*  
Exceptions: acute anoxia or profound hypotension, hypothermia, overdose of opioids, glutethimide or anticholinergics. Also early transtentorial herniation may have little pupillary abnormality (but should have asymmetric motor response).
- *Asterixia, myoclonus, or tremors* tend to favor metabolic encephalopathy.
- *Asymmetric neurologic examination or a history of aphasia or hemiparesis early in the course of coma supports a structural lesion.*  
Exceptions: metabolic causes such as nonketotic hyperosmolarcoma, hypoglycemia, hepatic encephalopathy may manifest focal signs.
- The rostral-caudal progression of neurologic deficits in transtentorial herniation is characteristic of structural hemispheric lesions (see figure).



**Figure.** Progression of Neurologic Deficits in trans tentorial herniation (from Simon, Aminoff & Greenberg "Clinical Neurology")

- **Extraocular movements** The vestibular nuclei and their connections to the extraocular nuclei transverse the midbrain to the upper medulla.

If fully functional, ice-water irrigation of the tympanic membrane will produce full, conjugate deviation of both eyes to the side of irrigation. *Intact oculovestibular or oculocephalic reflexes implies integrity of much of the brainstem, and makes a posterior fossa cause of coma unlikely.*

Certain metabolic causes of coma, most likely sedative or anticonvulsant overdose, also abolish the oculovestibular and oculocephalic reflexes-

- **Acid-base abnormalities** This is useful in the differential diagnosis of metabolic coma:

*Respiratory acidosis :*

sedatives, pulmonary insufficiency

*Respiratory alkalosis:*

hepatic encephalopathy, salicylates, sepsis

*Metabolic acidosis:*

lactic acidosis (hypoxia, ischemia, sepsis, post-seizure)

drugs (ethylene glycol, methanol, INH, salicylates)

uremia

diabetic ketoacidosis

## References

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# Delirium & Dementia

## Objectives

1. Define and contrast the clinical features of delirium and dementia.
2. Describe the initial approach and differential diagnosis of delirium, dementia and other altered mental states.
3. Know the components of the mental status examination, including the assessment of aphasia.
4. Contrast the clinical features of Alzheimer disease and vascular dementia, including their demographics.
5. List risk factors for dementia, including specific neurologic diseases associated with an increased risk of dementia.

*Delirium* An acute, fluctuating disturbance of cognitive function affecting attention, and thought processes. Synonyms: metabolic encephalopathy, acute confusional state.

*Dementia* A progressive disturbance of cognitive function impairing functional abilities and two or more areas of cognition including memory.

## Clinical Triggers for Evaluation

The following symptoms presented by the patient or caregiver during an interview should prompt an evaluation of altered cognitive status:

### 1. *Memory change*

New onset, progressive, persistent, functionally significant memory problems.

### 2. *Orientation*

Persistent trouble tracking dates, finding things and places, or difficulty with driving.

### 3. *Judgment and problem solving*

Inappropriate acts or behaviors, change in personality, or difficulty solving problems which the patient was previously able to solve.

### 4. *Language*

Increased difficulty understanding or expressing language (with the caveat that decreased comprehension might be due to hearing loss).

### 5. *Functional ability*

Difficulty coping with everyday affairs in the community or at home unrelated to physical disability. Personal care declines only late in typical dementias. Functional status decline may be the first indication of dementia.

## Contrasting Delirium and Dementia

	<b>Delirium</b>	<b>Dementia</b>
<b>Onset</b>	Acute	Chronic, insidious
<b>Clinical course</b>	Fluctuating	Progressive
<b>Duration</b>	Days to weeks	Months to years

<b>Neurologic Exam</b>	+/- tremor, asterixis	Usually normal (see below)
<b>Behavior</b>	Agitated, fearful	Apathetic, disinhibited
<b>Attention</b>	Fluctuating attention	Normal, later impaired
<b>Memory</b>	Can't register (inattentive)	Impaired recall
<b>Language/Speech</b>	Anomic/dysarthric	Aphasic and anomic
<b>Perception</b>	Hallucinations	Normal at early stage
<b>Prevalence</b>	eg., 60% post-hip surgery	5-10% >age 65 years 1% at 60, doubles every 5 years

## Diagnosis

### History

-Interview the patient ~ a reliable informant.

-Detail chief complaint:

- Focus on onset, duration and course:

Acute versus gradual onset

Duration

-months to years duration is not delirium

-subacute course (<3 months) suggest delirium, depression, structural lesions (stroke, tumor, subdural hematoma)

Steady versus stepwise decline, fluctuations if any

- Characterize functional changes: eg., handling money, shopping, hobbies, cooking, current events, keeping track of dates, driving and travel.

-Review medical, social, cultural and medication history (including nonprescription drugs & alcohol).

### General Physical Examination

-vital signs, vision and hearing

-search for stigmata of medical illnesses.

-signs of physical abuse.

### Neurologic Examination

-tremor, asterixis, or myoclonus suggests delirium.

-focal signs (asymmetry in face, pronator drift, fine motor function, arm swing, or tendon reflexes; Babinski or other primitive reflexes such as glabellar, pout, palmomental or grasp).

-asymmetry is exceptional in Alzheimer disease, if present consider vascular dementia and structural lesions.

-any sign of Parkinsonism? (tremor, rigidity, akinesia or bradykinesia, postural instability = "TRAP")

#### Differential Diagnosis of Delirium:

- Drugs (including alcohol, prescription, illicit and over-the-counter drugs)
- Metabolic, endocrine (see **Laboratory Studies**)
- Nutritional deficiency (thiamine)
- Cardiopulmonary disease
- Infectious (meningoencephalitis)
- Primary CNS disorders
- Seizures (are there episodic alterations of level of consciousness, staring or unresponsive spells, or generalized seizures?)

-gait disorder suggests coexistent idiopathic Parkinson's disease, other causes of Parkinsonism, hydrocephalus, or cerebrovascular disease.

-signs of peripheral neuropathy (decreased lower extremity reflexes, decreased vibratory sensation) may suggest alcoholism, B12 deficiency or other causes of neuropathy.

-ataxia (cerebellar signs: finger to nose, heel to shin, gait ataxia) may suggest alcoholism, cerebrovascular disease, neoplasm or unusual dementias such as Creutzfeld-Jacob disease, or progressive ataxias.

### Laboratory Studies

-Hematologic, metabolic, nutritional and endocrine studies: CBC, ESR, electrolytes {including Ca, Pi, Mg}, BUN/Cr, liver enzymes, B12, folate, glucose, TSH, urinalysis, chest X-ray. -neuroimaging (CT or MRI to exclude tumors, hydrocephalus, subdural hematoma and cerebral infarctions, and also to detect patterns of atrophy seen in Alzheimer disease, and focal cortical degeneration syndromes).

-electroencephalogram (EEG) -indications: young onset, rapid progression, fluctuations, or presence of myoclonus.

Diagnosis of dementia is in question.

-lumbar puncture (LP) -indications: young onset, rapid progression, myoclonus history of cancer risk factors for infection.

history suggesting inflammatory disorders

-cerebral blood flow studies (SPECT, PET) - indications: focal degenerative syndromes or subtle cases

-special serology: FTA, HIV, Lyme if risk factors present.

-neuropsychologic testing: for subtle or questionable cases, to establish baseline or for follow-up evaluations

### Differential Diagnosis of Dementia:

- Alzheimer disease (50 – 75%)
- Cerebrovascular disease (15 – 25%)
- Miscellaneous reversible causes (10 – 15%): see causes of delirium above
- Structural CNS disorders
- Miscellaneous irreversible causes:
  - frontal lobe dementias (Pick's disease, fronto-temporal degenerations)
  - other focal cortical degeneration syndromes
- Dementia associated with motor signs
  - Parkinsonism with Alzheimer disease
  - Progressive supranuclear palsy
  - Huntington's disease
  - Motor neuron disease
  - Multiple sclerosis
- Depression (underdiagnosed in the elderly, may coexist with other neurologic diseases)

### Standardized Mental Status Evaluation (MSE)

Standardized Instruments are reliable and valid, facilitate communication between professionals, and improve follow-up (eg., MMSE -attached to end).

-brief instruments are not comprehensive, ignore functional status, lack sensitivity to change at the extremes of clinical disease.

-age, ethnicity, education and language affect performance on standardized MSE.

-cutoff <24 on MMSE: sensitivity=0.80; specificity=0.80.

The following elements of the mental status examination should be addressed:

*Orientation:* Location (place, city, state), date (time, day, month, year).

*Attention:* Say the months of the year in reverse order, digit span.

*Memory:* Repeat four unrelated words, check recall later, +1- cue.

*Visuospatial skills:* draw a clock and place the hands at II: 10.

*Language* (Aphasia, see below)

Spontaneous speech (fluent or non-fluent?)

Naming: items and parts (body parts, object parts)

Repetition: please repeat the following: "If he comes to the celebration, then I will go

away."

Comprehension: ask about repetition sentence, multistep task.

Reading: provide a simple paragraph to read.

Writing: write a sentence spontaneously

*Praxis:* show me how you would blowout a candle, brush your teeth, drink from a cup, cut a piece of bread, bow. Body part as object is abnormal. Test real object use.

*Frontal function:* "List all the animals you can think of in one minute." "Tell me how you would change a tire if you got a flat."

## Alzheimer disease and Vascular dementia

	Alzheimer Disease	Vascular Dementia
<b>Onset</b>	Gradual, insidious	Acute, sudden, "a stroke"
<b>Progression</b>	Steadily progressive	Stepwise, but may be steady
<b>Risk Factors</b>	Age Family hx (Apo E4) Female sex Low education Head trauma	Age Smoking, HTN, DM, cholesterol Male sex Race (Asians, African Americans) Family history
<b>Neurologic Exam</b>	Normal	Focal signs
<b>Imaging</b>	Hippocampal atrophy Ventricular dilatation	White matter changes, strokes Ventricular dilatation

### Subtypes of Vascular Dementia

- Multiple infarcts, large infarcts
- Severe white matter disease
- Strategic: internal capsule genu, thalamus, hippocampi, angular gyrus
- Is the patient aphasic? Interferes with MSE

aphasia subtypes: anomia, non-fluent (Broca's), fluent (Wernicke's), impaired repetition (conduction), preserved repetition (transcortical)

## Hydrocephalus

The clinical tetrad of progressive cognitive impairment, gait disorder and urinary incontinence, and hydrocephalus on imaging suggest normal pressure hydrocephalus (NPH), a condition potentially treatable with surgical shunting. An identified etiology ( eg., prior history of meningitis, subarachnoid hemorrhage) is a good prognostic indicator. Conversely, a long duration of disease and the presence of anomia are poor prognostic indicators.

### Diagnostic Problems

This may be seen in vascular dementia.

Ventricular dilatation is common in Alzheimer disease.

## Management of Altered Mental Status

1. Treat the treatable
  - medical diseases

- psychiatric problem (don't forget about depression)
- 2. Educate the family and caregivers (including other staff) about the present functional status and the prognosis of disease. Referral to appropriate resources ( eg., Alzheimer's Association).
- 3. Management of progressive dementia: behavioral, pharmacologic and cognitive therapies
- 4. Reevaluate at regular intervals: mental status, functional status, behavior.

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Siu AL. Screening for Dementia and Investigating its Causes. Annals of Internal Medicine.1991; 115: 122-132.

Whitehouse PJ. Dementia. F A Davis, Philadelphia, 1993.

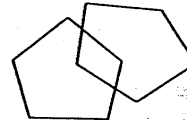
### ADCO MINI-MENTAL STATE EXAMINATION (MMSE)

Patient Name	Medical Record #
Evaluation Date	Evaluating Clinician
Name of Person Completing Form	Date Completed

Instructions: 1. Facilitate consistent administration of the MMSE, the examiner should pose questions as worded below. Please note instructions specific to each test item in italics. Please record subject's responses.

- Score**
- ORIENTATION**
- (5)  What is the (year) (season) (date) (day) (month)? *(Draw line through each correct answer. Accept exact year, date, day, month. Season will be scored correct if within a week either way of: 9/21-Fall, 12/21-Winter, 3/21-Spring, 6/21-Summer)*
- (1)  What state are we in? *(Oregon)*
- (1)  What city are we in? *(Portland)*
- (1)  What is the name of this hospital/office/clinic? *(Accept Oregon Medical School, OHSU, University Hospital, or similar variations. Do not accept Multnomah County Hospital, Pill Hill)*
- (1)  What county do you live in? *(County where patient lives)*
- (1)  What floor are we on? *(exact)*
- REGISTRATION**
- (3)  I am going to name 3 things, and I want you to say them after me. Are you ready? The three things are *(1 second per word)* iceberg, lion, cactus. Now you say them. *(Score 1 for each item correctly repeated on the first trial) Repeat as often as necessary until patient can say all three. Record number of trials here.*
- ATTENTION AND CALCULATION**
- (5)  Spell "world" backwards. Have patient spell WORLD forward *(correct if necessary)*, prior to spelling it backward. Score is the number of letters in correct order. Count 1 error for each omission or letter transposition *(switching adjacent letters)* (e.g., dlrow = 5, dlrv = 4, dlorv = 4, dohv = 3) Please record patient's response \_\_\_\_\_
- RECALL**
- (3)  Now name those 3 things I asked you to remember earlier. *(Score 1 for each correct object)*
- LANGUAGE**
- (1)  What is this called? Show the patient a pencil. Must be a pencil. A pen is not acceptable.
- (1)  What is this called? Show the patient a watch. *(If patient has trouble with a digital watch, show an analog watch.)*
- (1)  Repeat the following: "No ifs ands or buts". *(Must be repeated verbatim on the first trial (e.g., "No if ["s" dropped] ands or buts" is not accepted). Allow only one trial. Score 0 or 1.)*
- (3)  Give the patient a piece of plain blank paper and repeat the three step command. *(Ask all at once. Draw line through each step correctly executed. Score 1 for each.)*  
"Take this paper in your right hand, fold it in half, and put it on the floor."
- For the next three items use the back of this form. Fold in thirds so that patient can perform each task without being distracted by text or drawings in the other two sections.
- (1)  Read this and do what it says. *(Hand patient the paper (folded as noted above) with the words "Close your eyes". Can repeat entire instruction if needed. Score 1 only if patient actually closes eyes.)*
- (1)  Write a sentence. *(Do not dictate - must be written spontaneously. Must have a subject, a verb and make sense. Correct grammar and punctuation are not necessary.)*
- (1)  Copy this design. *(All 10 angles must be present and the intersection of the two pentagons must be rhomboid (four-sided). Tremor and rotation are ignored.)*
- (30)  Total Score

Close your eyes



ADCOMMSE - 003 2/24/94

# HEADACHE

## Objectives

1. Learn the important questions to ask in evaluating a patient with headache.
2. Recognize the most common headache syndromes.
3. Familiarize with the treatment of chronic headache syndromes.
4. Recognize the clinical features and therapeutic implications of temporal arteritis and subarachnoid hemorrhage.

A good history is without question the most important element in the clinical evaluation of headaches. The key questions are:

1. Is the headache new or old? Old headaches tend to be benign, as long as the recent headaches are qualitatively similar to the old ones.
2. What is the temporal profile of the headaches? This includes the mode of onset, the duration of each headache, and the frequency of attacks. These temporal features have important diagnostic and therapeutic implications.
3. What are the precipitants of the patient's headaches? This is useful not only in the practical management, but also in the differential diagnosis of headaches.

## Migraine headache

### Clinical Features

Although migraine headache may begin at any age, 90% of patients had their first attack between childhood and age 40. The typical history is that of *recurrent episodic* headaches. Typical attacks develop gradually 1-2 hours and last a total of 4-10 hours (rarely, persisting for days).

The location of pain may be hemicranial or holocephalic. Headaches when severe are frequently throbbing in quality. There may be associated nausea or vomiting, photophobia and sensitivity to noise. Most patients are aware of several precipitants of their headaches (see Table). *Classical migraine* headaches in addition are associated with transient focal neurologic disturbances, such as scotoma, light flashes, or zigzag lines.

With the exception of the neurologic accompaniments of classical migraine, none of the above clinical features is sufficiently specific to permit a diagnosis when present in isolation. On the other hand, most patients present with a constellation of typical symptoms, and diagnosis is seldom difficult after a careful clinical history.

### Pharmacological Treatments

*Abortive* treatment is used only at the time of a headache. *Prophylactic* treatment is aimed at reducing the frequency and/or severity of recurrent attacks. In general, prophylactic treatment is to be taken on a daily basis (regardless of presence or absence of headaches) and is reserved for patients with frequent disabling attacks.

### Precipitating factors of Migraine Headache:

- Vigorous exercise
- Sleep deprivation
- Excessive sleep
- Glare
- Stress
- Menstruation
- Hunger
- MSG or other foods

**Abortive**

Triptans

Ergotamine 2 mg/hr PO, &lt;8 mg/attack

Dihydroergotamine (0.2-0.8 mg IV)

Aspirin

NSAIDs

Midrin (1-4 tabs/ attack)

Opiates

**Prophylactic**

Propranolol 40-320 mg/d (others: Nadolol, atenolol)

Amitriptyline 10-175 mg/d ( others: Nortriptyline)

Verapamil 160-480 mg/d

Methysergide 2-8 mg/d

Ergonovine 0.4-2.0 mg/d

Anticonvulsants (Depakote, Topamax)

## Cluster headache

### Clinical Features

Males outnumbered female by a ratio of about 6: 1. The typical age of onset is between 20-50 year .The temporal profile is distinctive and is crucial for its diagnosis. Like migraine headache, cluster headache is also a *recurrent episodic* headache. In contrast to migraines, the typical attacks of cluster headache develop much quicker (over 2 to 15 minutes), last a shorter period (30 minutes to 3 hours), and often follow a remarkable circadian pattern. There is also a tendency for the attacks to cluster over a few weeks, with many months or years of remission between two cluster bouts. The pain is always unilateral, either periorbital or temporal in location. During an attack, patients may notice ipsilateral lacrimation and rhinorrhea, and careful observation may reveal an ipsilateral Horner's syndrome.

**Precipitants of cluster headaches:**

- Alcohol (only during cluster bouts)
- Nitroglycerin
- Glare
- Stress
- Relief from stress

### Pharmacological Treatments

**Abortive**

Triptans

Ergotamine

Dihydroergotamine

Oxygen

Intranasal lidocaine

**Prophylactic**

lithium 600-900 mg/d

prednisone 60 mg/d x 1 wk,  
then taper

verapamil 160-480 mg/d

methyl sergide 2-8 mg/d

## Trigeminal Neuralgia (Tic Douloureux)

Repetitive, brief, electric shock-like pain

V2 and V3 more than V 1

Trigger site over trigeminal distribution

Treatments: Medications: carbamazepine, valproate, phenytoin, baclofen, Tomiramate

Surgery: decompression of vessel on trigeminal nerve

## Temporal Arteritis (Giant Cell Arteritis)

Over age 50, most over age 60

Clinical features:

- Headache in most patients, but *location of head pain is variable*
- Constitutional symptoms (weight loss, malaise, fever)
- Polymyalgia rheumatica (shoulder and hip girdle stiffness and pain)
- Jaw claudication
- Temporal artery tenderness (present in *less than 50%* of patients)
- Elevated ESR in about 95%
- Anemia, elevated liver enzymes

Common myths are that the headache is always temporal in location and temporal artery tenderness is usually present. This is a *systemic* arteritis. The temporal arteries are frequently but not invariably involved.

Most feared complication is monocular or binocular blindness (acute ischemic optic neuropathy, AION). This often occurs without warning; amaurosis fugax is rare. Prompt prednisone treatment prevents blindness, and may be initiated before temporal artery biopsy. The rate of positive biopsy is probably not significantly diminished by a few days of steroid treatment.

## Aneurysmal Subarachnoid Hemorrhage

Clinical features:

- Abrupt, explosive onset
- Usually severe headache
- Neck stiffness and depressed consciousness with significant bleed (see **Stroke** section)

## Intracranial Tumors

Most patients present with focal neurologic signs.

Clinical features of headache:

- Intermittent, but increases in intensity over weeks
- Disturbs sleep
- Worsened by cough or strain
- Nausea or vomiting

# PERIPHERAL NEUROPATHY

## Objectives

1. Learn to recognize the clinical hallmarks of common polyneuropathies.
2. Learn to recognize the most common focal neuropathies.
3. Understand the use of laboratory tests in patient evaluation.

*Peripheral neuropathy* refers to the dysfunction of sensory, motor or autonomic nerve fibers. The term encompasses a wide spectrum of clinical disorders.

- **Polyneuropathy** is characterized by simultaneous involvement of numerous peripheral nerves manifesting in a diffuse or confluent (often symmetric) pattern. This is often a result of systemic diseases such as diabetes, toxic exposures, and nutritional deficiencies
- **Mononeuropathy** or **focal neuropathy** leads to a focal or localized pattern of symptoms and signs. This may be a result of physical injuries, or localized vascular or inflammatory lesions.
- In **mononeuropathy multiplex**, two or more single nerves are involved, resulting in a pattern of *multifocal* sensory and motor deficits. This is most often due to a systemic vasculitic or inflammatory disease.

## POLYNEUROPATHY Clinical Syndromes

### Distal Symmetric Polyneuropathy (DSPN)

This is without question the most common syndrome and is encountered widely in clinical practice. The syndrome is non-specific, and encompasses neuropathies associated with a wide range of common systemic diseases (such as diabetes, alcoholism, hypothyroidism, B12 deficiency, uremia, HIV infection). This neuropathy has 3 key clinical features:

1. *Subacute onset* -Symptoms usually evolve insidiously over months. Patients are usually unable to date the exact onset. A faster or slower clinical course is often a clue to a different syndrome and a need to expand the differential diagnosis.
2. *Length-dependent deficits* -In other words, the longest axons are affected first. Symptoms therefore begin in the toes. *Fingers and hands are almost never affected initially*, and they become involved only after a considerable period of disease progression. Early hand involvement suggests a different neuropathy or other neurologic disorder (eg., myelopathy).
3. *Predominance of sensory symptoms* -In most polyneuropathies, sensory and motor nerve fibers are affected simultaneously. However, practically speaking, sensory disturbances are often the first symptoms. (Potential explanations: Only a few abnormal sensory neurons are needed to cause noticeable paresthesias. Weakness is often not apparent before loss of 50% or more motor axons. Weakness and atrophy of the most distal muscles, ie., intrinsic foot muscles, often go unnoticed. )

## Clinical Findings in DSPN

Little or no weakness.

Elevated sensation threshold to vibration in toes.

Diminished cutaneous sensation (pin-prick, temperature) with a distal gradient (if severe enough: *'long' stocking - with or without glove*).

Diminished or absent ankle jerks. *Brisk ankle jerks should make you at least hesitate in making a diagnosis of polyneuropathy.*

## Guillain-Barre Syndrome or Acute Inflammatory Demyelinating Polyneuropathy

Contrast these clinical features with those of DSPN :

- Progression over days. Monophasic illness, with nadir reached within 4 weeks.
- Prominent and diffuse weakness -proximal, distal muscles, and respiratory muscles.
- Sensory loss, if present, may be relatively mild.
- Early loss of tendon reflexes in most (but not all) patients.
- Cranial nerve and autonomic involvement not infrequent, especially in severe cases
- Elevated CSF protein.
- *Management:*  
Diagnosis- EMG/NCS (d.dx: NMJ disorders, other acute neuropathies-see below).  
Monitor respiratory function. Supportive care, treat complications.  
Plasmapheresis or IV immune globulin.  
Rehabilitation.

## Chronic Immune-mediated Polyneuropathies

Chronic inflammatory demyelinating polyneuropathy (CIDP) is the classic prototype. Clinically, it resembles a chronic form of Guillain-Barre (prominent distal and proximal weakness, areflexia, high CSF protein). It typically follows a subacute time course, but the course is unpredictable. Some patients may have a relapsing-remitting disease.

Many variants of CIDP have been recognized. The distinctions of these various syndromes have therapeutic and prognostic significance. Some syndromes have important association with systemic diseases, such as malignancy, paraproteinemia (usually without overt myeloma), collagen vascular diseases, and various antibodies directed against nerve or myelin antigens. Management of CIDP and its variants is best left to the specialists.

## Temporal Course: Use in Differential Diagnosis

Time Course	Polyneuropathy/ Mononeuropathy Multiplex	Focal Neuropathy
<b>Abrupt onset (minutes)</b>	None	Trauma Vascular (diabetes, vasculitis)
<b>Acute onset (days)</b>	Infectious ( eg., CMV) Immune-mediated (eg., Guillain-Barre, CIDP, vasculitis) Toxins (eg., diphtheria, tick, arsenic) Porphyria	Trauma Diabetes Vasculitis Infectious (eg., zoster) Ischemic neuropathy ( eg., due to hemodialysis shunt)
<b>Subacute (months -few years)</b>	MOST COMMON POLYNEUROPATHIES Infiltrative diseases (eg.,	Nerve entrapment Infiltrative diseases ( eg., sarcoid, lymphoma, leprosy)

	sarcoid, lymphoma, leprosy)	
<b>Chronic (many years)</b>	Charcot-Marie-Tooth (genetic)	
<b>Relapsing/ Remitting</b>	Inflammatory neuropathies Paraproteinemia Toxins/drugs Porphyria Vasculitis	Nerve entrapment

## EMG/NCS: Use in Polyneuropathy

EMG/NCS serves several roles: confirmation of diagnosis, assessment of severity, and classification of a neuropathy as either axonal or demyelinating.

	<b>Axonal</b>	<b>Demyelinating</b>
<b>Acquired</b>	<i>Alcohol</i> <i>Diabetes Mellitus</i> <i>Uremia</i> <i>Hypothyroidism</i> <i>B 12 deficiency</i> <i>Heavy Metals</i> <i>Pyridoxine</i> <i>Other toxins / drugs</i> <i>Amyloid</i> <i>Paraneoplastic</i> <i>HIV infection</i> <i>Other infections</i>	<i>Guillain-Barre</i> <i>CIDP</i> <i>Glue-sniffing (n-hexane)</i> <i>Paraneoplastic</i> <i>HIV infection</i>
<b>Hereditary</b>	<i>Charcot-Marie-Tooth (axonal form)</i> <i>Hereditary Sensory NP</i>	<i>Charcot-Marie-Tooth (demyelinating form)</i> <i>Dejerine-Sottas Refsum's</i>

## Selected polyneuropathies

<b>Disorder</b>	<b>Abnormal Laboratory Tests</b>	<b>Neuropathy Syndrome</b>
<b><i>Diabetes mellitus</i></b>	elevated blood glucose & hemoglobin A 1 c	distal symmetric sensorimotor PN, diabetic amyotrophy, mononeuropathies, thoracoabdominal radiculopathy, autonomic polyneuropathy
<b><i>B12 deficiency</i></b>	decreased serum B12 level, elevated homocysteine & methyl malonate	sensorimotor PN, also usually has paresthesias from post. column involvement
<b><i>Paraproteinemia</i></b>	<ul style="list-style-type: none"> <li>• IPEP, SPEP, UPEP</li> <li>• Subset of pts also have Ab to gangliosides (e.g., GM 1) Ab to MAG</li> </ul>	various neuropathy syndromes, some demyelinating, some with multifocal conduction block
<b><i>HIV/AIDS</i></b>	HIV antibody; depr. CD4	distal symm sensorimotor PN, chronic demyelinating PN, mononeuropathy multiplex, Guillain- Barre syndrome, lumbosacral polyradiculopathy
<b><i>Charcot-Marie-Tooth Type IA</i></b>	Duplication in Chromosome 17	demyelinating sensorimotor PN

(DNA test not yet available in most other types of Charcot-Marie- Tooth Disease)

PN = polyneuropathy

# FOCAL NEUROPATHIES

## Sensory Symptoms

Well-delineated diagrams of dermatomes and cutaneous nerve innervations are widely available in textbooks. However, several words of caution in regard to their applicability are necessary.

1. Sensory disturbances are totally dependent on the observers (patient and examiner).
2. There are overlapping innervations of spinal roots and peripheral nerves (especially large overlap for dermatomes).
3. Paresthesias ('tingling', 'pins & needles' -*ie.*, *positive* phenomena) are often felt over a much wider area than peripheral anatomy would dictate (eg., when you hit your 'funny' bone, can you say that the paresthesias are solely limited to the ulnar fingers?).

Therefore, locations of sensory complaints provide only a rough guide to identification of lesion.

## Motor Deficits

Weakness if present is generally more reliable than sensory abnormality for anatomical localization, provided the examiner is knowledgeable in strength examination and peripheral anatomy.

## Carpal tunnel syndrome (CTS)

History holds the key to the diagnosis of CTS.

- *Paresthesias* -Almost all patients notice them. Most common: 'pins & needles', 'tingling'. 'Numbness' though a common complaint, seldom means true loss of sensation in CTS. Complete anesthesia does not occur even in very severe cases. Distribution of paresthesias: Paresthesias shouldn't be solely in the palm or forearm; fingers are always involved. Involvement of 'all 5 fingers' is reported by ~50% of patients.
- *Intermittency of symptoms* -Characteristic exacerbation with use of hands or sustained posture of the wrist is a useful historical feature. Also useful (but nonspecific) is nocturnal paresthesia which is present in 60- 70% of patients.
- *Pain* -Variable complaint. Severe in some, none at all in others. Pain alone without paresthesias is seldom CTS.
- *Weakness* -Weak grip is a common complaint, but probably has more to do with sensory disturbances and pain. Thenar atrophy and weakness are seen only in advanced cases.

*Diagnosis* -Experienced clinicians can make the diagnosis with 70-80% accuracy (but far from 100%). Electromyography (EMG) and nerve conduction studies (NCS) are sensitive and specific tests, and provide a measure of severity.

*Treatment* -Splinting, corticosteroid injections and NSAIDs are temporary measures. Avoidance of aggravating activities often helps, but may be impractical. Surgery is effective in most cases.

## Saturday Night Palsy (Radial Neuropathy at the upper arm)

- Wrist drop. Minimal sensory complaints.
- Acute onset, typically on awakening. Some patients admit to drunkenness or drug use prior to sleep. The cause is presumably nerve compression at the radial groove in the upper arm.
- Motor examination is the key to diagnosis. The key muscles to examine are:
  - *Sparing* of triceps (radial, C7), forearm pronation (median, C6/7) and finger flexors (median, C7/8).
  - *Weakness* of wrist and finger extensors (radial, C7), brachioradialis (radial, C5/6 -this is a muscle you have to observe and palpate).

- Additional weakness of triceps suggests more a proximal lesion (eg., crutch palsy).  
*Diagnosis* -EMG/NCS if localization is uncertain, or if prognostic information is desired.
- *Treatment* -none except wrist splint; most patients spontaneously improved over several months, unless noncompressive causes are involved.

### **Ulnar Neuropathy**

- Subacute onset. Less commonly on awakening ( eg., from general anesthesia).
- Variable clinical presentation. Variable combination of sensory symptoms (over 4th and 5th digits) and motor deficits (wasting and weakness of the intrinsic hand muscles, with sparing of the thenar muscles). Some patients may not notice weakness and present only because others notice the atrophy.
- May be difficult to distinguish from a C8 radiculopathy or severe polyneuropathy just on clinical grounds.
- *Diagnosis* -EMG/NCS may help localization, especially in identifying potential nerve entrapment sites such as the elbow (very common) or the wrist (less common).

### **Foot Drop (Peroneal Neuropathy at Fibular Head)**

- Acute onset, often on awakening. May occur after general anesthesia, drunkenness or drug use. Some may occur after excessive and severe weight loss (Slimmer's palsy).
- Sensory symptoms may be minimal.
- Motor examination is the key to diagnosis:
  - *Sparing* of ankle invertors (sciatic/tibial, L5), calf muscles (sciatic/tibial, S 1 ), thigh abductor (superior gluteal, L5/S 1) and ankle jerk (sciatic/tibial, S 1 ).
  - *Weakness* of toe dorsiflexors, ankle dorsiflexors and evertors (sciatic/peroneal, L5)
- *Diagnosis* -EMG/NCS if localization is uncertain, or if prognostic information desired.
- *Treatment* -none except perhaps ankle-foot orthosis; most patients spontaneously improve, unless the peroneal neuropathy is due to non-compressive causes.

# MOVEMENT DISORDERS

John Nutt, M.D.

## Objectives

1. Know the features of the syndrome of parkinsonism, the differential diagnosis of parkinsonism and the basic principles of management of the disorder.
2. Understand the classification of hyperkinetic movement disorders by type of involuntary movements and how common examples of each

## Syndrome of Parkinsonism

Parkinsonism is a syndrome characterized by 1) bradykinesia, 2) rigidity and 3) tremor.

1. *Bradykinesia*, considered the most essential component of the triad, is manifest by slowness in movement and loss of fine motor dexterity. Many common tasks such as eating, dressing and other fine motor tasks are performed slowly and clumsily. Handwriting is typically slow, laborious, irregular and smaller.
2. *Rigidity* is a passive resistance to movement of the limb by the observer. It must be differentiated from an inability to relax, spasticity and gegenhalten (paratonia, a variable resistance to passive movement elicited in many patients with dementia). Although rigidity is frequently not appreciated by patients, many patients do note a stiffness or discomfort in the most affected limb, particularly if it is the arm. The first signs of parkinsonism are often mistaken for bursitis, tendinitis, or other muscular skeletal disorders.
3. *Rest tremor* is tremor present when the limb is in repose, commonly observed when the patient is standing or walking with the arms hanging by the side. Rest tremor is almost pathognomonic for parkinsonism. However, rest tremor is not required for the diagnosis of parkinsonism and many patients have postural tremor, either alone or in combination with a Rest tremor. The most common diagnostic error is the confusion of essential tremor (see below) and parkinsonism.

Diagnosis of parkinsonism is made when bradykinesia is combined with rigidity and/or tremor.

## Etiology of Parkinsonism

There is a long differential for the diagnosis of parkinsonism. The most important cause to exclude is drug-induced parkinsonism because it is reversible with cessation of the offending drug. Drugs commonly causing parkinsonism include the neuroleptics (eg., thiorazine and haloperidol), antiemetics and other drugs for gastrointestinal complaints ( eg., compazine and metaclopramide ), and antihypertensives (alpha-methyldopa, reserpine, some calcium channel blockers). Hydrocephalus and multiple strokes, particularly in the deep white matter and basal ganglia, may cause a subacute syndrome of bradykinesias, rigidity and gait instability. Other structural lesions, that sometimes mimic parkinsonism include subdural hematomas and tumors in the basal ganglia. A variety of progressive neurodegenerative disorders may have parkinsonism as a component of the illness (see Table):

The vast majority of patients with the syndrome of parkinsonism will have idiopathic Parkinson's disease. This is characterized pathologically by the loss of dopamine neurons in the substantia nigra compacta and the presence of Lewy bodies (an eosinophilic inclusion), found in the remaining dopamine neurons as well as other neurons in the brain stem and cortex. Idiopathic Parkinson's disease is characterized by an insidious onset of symptoms (often unilateral and most commonly affecting one arm) which spread to involve the other ipsilateral limb and then eventually crosses over to affect the other side of the body. Idiopathic Parkinson's disease generally responds to levodopa and failure to respond to levodopa raises a question about the diagnosis of idiopathic Parkinson's disease. If the history is atypical or the neurologic exam suggests features other than parkinsonism, an MRI scan is indicated to look for evidence of other causes parkinsonism. The MRI is normal in idiopathic Parkinson's disease.

#### Differential Diagnosis of parkinsonism:

##### *Idiopathic Parkinson's disease*

##### *Drugs (see text)*

##### *Structural lesions*

- Subdural hematoma
- Anoxic encephalopathy (including carbon monoxide & cyanide poisoning)
- Punch-drunken syndrome
- Basal ganglia tumors
- Multiple strokes (especially subcortical white matter small vessel disease)

##### *Neurodegenerative diseases*

- Alzheimer disease
- Multiple system atrophy
- Corticobasal ganglionic degeneration

##### *Metabolic / Toxic diseases*

- Wilson's disease
- Toxins (eg., methanol, manganese)
- MPTYP

#### Treatment of Parkinsonism

Depletion of dopamine in the basal ganglia is the neurochemical hallmark of most cases of parkinsonism. Symptomatic therapy is largely directed to replacing dopamine. The most potent dopaminergic drug is the dopamine precursor, levodopa. Levodopa is usually administered in combination with carbidopa to reduce the decarboxylation of levodopa in the periphery and thereby allow more levodopa to enter the brain. Long-term use of levodopa is associated with levodopa-induced involuntary movement (dyskinesia) and a fluctuating response ("on-off" phenomenon). To delay the appearance of these adverse effects, most clinicians delay starting levodopa until the patient's symptoms moderately impair their activities or when they begin to develop problems with balance. The dopamine agonists which are drugs that act at dopamine receptors are generally less potent than dopamine and are used as adjuncts to levodopa. The anticholinergic drugs and amantadine are other adjunct drugs that generally have minor antiparkinsonism actions.

Recently stereotactic surgery has become increasingly important in the management of advanced parkinsonism. Stereotactic thalamotomy (a destruction of a particular subnucleus of the thalamus, Vim) markedly reduces contralateral tremor that is not controlled by drug therapy. Pallidotomy (ablation of the globus pallidus interna) is effective therapy for levodopa-induced dyskinesia and relieves some of the symptoms of parkinsonism as well. Chronic stimulation of the thalamus, globus pallidus interna and subthalamus by implanted electrodes is also being explored as therapy. It is thought that the chronic stimulation temporarily inactivates the stimulated structure or jams the circuits. The advantage of stimulation is that the size of the effective lesion may be altered by varying the parameters of stimulation. Also, it is safer to use when there are bilateral procedures, because bilateral thalamotomies or pallidotomies are often associated with severe speech and swallowing difficulties. Stereotactic surgery appears to be effective only in those patients that respond to levodopa. Failure to respond to levodopa and dementia are relative contraindications to surgical interventions.

Protective therapies are gaining increasing attention but we have no proven therapy which protects, that is, delays the progression of the disease. Deprenyl, a selective monamine oxidase B inhibitor, has been touted as such but the evidence for this action is tenuous.

# Hyperkinetic Disorders

## Dystonia

Dystonia is an involuntary movement characterized by sustained muscle contractions, often of agonist and antagonist muscles and commonly producing twisting movements of limbs. Dystonia may be confined to one body part, in which case it is termed a *focal dystonia*. Examples of focal dystonia include blepharospasm, torticollis, and writer's cramp. If a limb or axial muscles are involved, it is a *segmental dystonia*. If more than one limb is involved, it is a *generalized dystonia*.

Dystonia is a sign and not a disease. Dystonia has a long differential. However, many cases of both focal and generalized dystonia are idiopathic. Early onset generalized dystonia which has been called *dystonia musculorum deformans* and *torsion dystonia*, is often autosomal dominant with incomplete penetrance. Many of the familial cases are associated with a gene on chromosome 9.

Dystonia is generally resistant to drug therapy although a few cases respond to levodopa and to anticholinergics. Injection of botulinum toxin (Botox) into overactive muscles is effective for focal dystonias, particularly blepharospasm and torticollis.

## Chorea

Chorea is arrhythmic, rapid, purposeless movements which may be simple or complex, involve axial and distal muscles, and produce large amplitude or very subtle movements. If the movements are of very large amplitude, very quick and involve the limbs, they are called *ballism*. Like dystonia, chorea is a neurologic sign with a long differential. Common choreiform disorders include the autosomal dominantly inherited *Huntington's disease*, *neuroleptic-induced tardive dyskinesia*, and *levodopa-induced dyskinesia* in patients with Parkinson's disease. Hemiballism is frequently unilateral and caused by an infarct in the contralateral subthalamic nucleus or putamen. Many medical conditions can cause chorea including SLE, pregnancy, hyponatremia, hypoglycemia and hypocalcemia, as well as a number of drugs in addition to neuroleptics and levodopa mentioned above.

Treatment of chorea is generally directed at the underlying cause if there is a remedial cause. Otherwise, chorea may be suppressed with antidopaminergic drugs such as the neuroleptics or dopamine depleters (eg. reserpine). However, it is important to realize that suppressing the chorea often does not improve the motor disorder, namely clumsiness and incoordination that may accompany chorea in disorders such as Huntington's disease.

## Tics

Tics are involuntary, repetitive, stereotyped movements. Oftentimes they affect face, neck or shoulder muscles so that common tics are jerks of one shoulder, eye blinks or facial grimaces. However, tics may be more complex and seemingly more voluntary, such as repetitively tapping the knee twice with each step, or repetitive gestures. Tics may also involve the production of sounds which may be simple grunts, sniffs or throat clearings, or be repetitive words. *Coprolalia* refers to tics which involve profanity. The most common cause of tics is *Tourette's syndrome*, which is an autosomal dominant disorder appearing in childhood. It is often associated with obsessive compulsive behavior and hyperactivity. Tics may also be produced by encephalitis and rarely, head trauma. Tics are often not treated and education of the patient and the people in contact with the patient on the nature of tics is sufficient. However, if the tics are severe and cause social disability, neuroleptics or clonidine (an alpha-2 adrenergic agonist) is used to suppress the tics. Obsessive compulsive behavior associated with Tourette's syndrome is treated with the selective serotonin re-uptake inhibitors.

## Tremor

Tremor is classified by the activities in which tremor is most evident.

- *Rest tremor* -a tremor that occurs in the limb when it is apparently at rest, such as lying in the lap or with the hands hanging at the side -is almost pathognomonic for parkinsonism.
- *Postural tremor* -a tremor that appears when the Causes of postural tremor: limbs are maintaining a posture -is the most common form of tremor.

Oftentimes postural tremor is maximum when the hands are held close to the face. Historically, many patients may describe difficulty with drinking from a cup because of the tremor. Postural tremor may be produced by a variety of metabolic abnormalities and drugs. However, the most common cause of postural tremor, if there are no metabolic or toxic causes, is essential tremor or benign familial tremor. This is a tremor that affects the hands, head, and voice and only rarely the legs. It may appear anytime during life. It is autosomally dominant inherited. Typically it is very responsive to alcohol. Postural tremors produced by drugs or metabolic abnormalities are treated by correcting the underlying disorder. Essential tremor may respond to propranolol or primidone. For extremely severe cases thalamotomy is sometimes employed.

### Causes of postural tremor:

*Essential or familial tremor*

*Drugs*

- Caffeine
- Aminophylline, terbutaline, and other beta-agonists
- Lithium
- Tricyclic antidepressants
- Neuroleptics
- Valproic acid
- Amiodarone
- Cyclosporine

*Some peripheral neuropathies*

*Endocrine – hyperthyroidism,*

*pheochromocytoma*

*Alcohol withdrawal*

- *Action (intention) tremor* -This tremor is most apparent in action and particularly as a limb approaches its target. It is commonly observed during performance of the finger to nose test. If tremor *only* occurs during action, it is 'almost pathognomonic of cerebellar dysfunction. There are no drugs that effectively treat this tremor nor is it particularly responsive to thalamotomy.

## Akathisia

Akathisia is extreme restlessness. It is actually defined by the sensation of restlessness that requires the patient to move to relieve the sensation. The movements associated with akathisia are nonnal restless movements. Akathisia is most commonly seen as a side effect of chronic neuroleptic treatment where it must be differentiated from agitated depression. However, it may also be seen in patients with Parkinson's disease. Akathisia often responds to changing the neuroleptic dosing or to treatment with propranolol.

*Restless leg syndrome* is closely related to akathisia in symptomatology. In this disorder patients describe an irresistible need to move their legs to rid them of a creepy crawly sensation that occurs when the legs are at rest. This typically occurs at the end of the day when patients are quiet and relaxed and almost invariably at night as they try to fall asleep. The sensation is relieved by walking. The restless leg syndrome is responsive to dopaminergic drugs such as levodopa or pergolide. Other drugs that are effective include clonazepam and codeine.

# THE DIZZY PATIENT

## Objectives

1. Understand the approach to patients with episodic or chronic dizziness or disequilibrium
2. Familiarize with the common causes of vertigo.

*Dizziness* is a nonspecific term widely used to refer to a variety of symptoms.

*Vertigo* implies a sensation of movement, usually rotational but may be translational. Even if a patient uses the term 'vertigo', never take vertigo at face value and spend time exploring the exact sensation.

## Initial Approach

The first step is to clarify the nature of the symptoms. Avoid putting words in the patient's mouth. Ask: "What do you mean by dizzy?", rather than "Was the world spinning?"

### Vertigo

- Patients may complain of "spinning", "whirling", "tilting" or "rocking."
- This implies a disorder of the peripheral vestibular system or it's immediate central connections, such as the cerebellum.

### Presyncope

- "Very lightheaded", "about to faint", "like getting up too fast." There may be associated cardiac or autonomic symptoms. Some patients may have experienced true syncope. Symptoms may be associated with postural change (eg, vasovagal syncope) or micturition.
- This implies a circulatory or cardiovascular disorder leading to generalized decrease in cerebral blood flow. May also be global or central in origin or side effect of medication.

### Disequilibrium of gait or stance

- "I might fall."
- This usually implies a disease of the Proprioceptive or Cerebellar system, and more rarely the vestibular system.

### Ill-defined light-headedness

- "I am just dizzy." This is nonspecific and very common. Often psychogenic, reaction to medications or simply related to age.

•

## Vertigo

The 8th cranial nerve consists of 2 different nerves, vestibular and cochlear. They run together until they reach the pontine brainstem where extensive connections exist between VIII and the oculomotor nuclei, the vestibulospinal tract and the cerebellum. Examination should include the following:

1. Screen for hearing loss (finger rub, etc.)
2. Weber and Rinne tests, to assess *sensory neural vs conductive* hearing loss
3. If sensory neural hearing loss is present, speech discrimination testing helps to distinguish retrocochlear lesions (impaired speech discrimination, eg., acoustic schwannoma) from cochlear hearing loss (relatively preserved discrimination, eg.,

Meniere's disease). This is more reliably done by an audiogram, but may be done by whispering words into one ear.

4. Test for eye movements, especially noting latency, direction and persistence of nystagmus. The *Hallpike* maneuver should be performed, again carefully noting the nystagmus and vertigo.
5. General neurological examination with special attention towards brainstem function.

**Unilateral Peripheral Vestibular Lesion**

- Fast-phase nystagmus away from side of lesion.
- Slow-phase nystagmus toward side of lesion.
- Romberg sign falling toward side of lesion.
- Positional changes in nystagmus
- Latency of nystagmus

**Central Vestibular Lesion**

If any of the criteria for peripheral vestibular, lesion fails to hold, one should suspect central nervous system disease. This is especially true if:

- Bilateral nystagmus occurs in the same head position.
- Vertical nystagmus is present.
- Other brainstem signs are present.

	<b>Central</b>	<b>Peripheral</b>
<b>Nystagmus</b>	May be vertical does not fatigue may not be present when pt experiences vertigo	Unilateral horizontal/rotational fatigues after repeated episodes usually present when pt experiences vertigo
<b>Hallpike Maneuver</b>	nystagmus -no latency	nystagmus- 5 to 20 sec latency after change of position
<b>Nausea, vomiting</b>	may be minimal	often severe
<b>Brainstem signs</b>	may be present	absent

**Differential Diagnosis of Vertigo**

- **Peripheral vestibular diseases**

Labyrinthitis/Vestibular neuronitis -Typical history is that of viral illness followed by severe vertigo persisting for days, followed by complete recovery in 3-6 weeks. PE shows a classic peripheral vestibular syndrome. Labyrinthitis has associated cochlear hearing loss; vestibular neuronitis does not.

Meniere's Disease –Episodic vertigo associated with tinnitus, cochlear type hearing loss, classic peripheral vestibular syndrome. Unlike labyrinthitis, residual hearing loss, recurrent tinnitus and vertigo are common. Patients may be very disabled, and should be referred to specialist for treatment.

Benign positional vertigo (BPPV) -Typical history of severe vertigo occurring a few seconds after laying down with the head to one side (**Hallpike Maneuver**) or tipping the head back. The world spins in one direction and the patients had a sensation of

falling in the opposite direction. Vertigo stops if the patient does not move. The symptomatic ear is the down most ear in the supine position. With repeated change in posture, habituation occurs.

Head trauma/Temporal bone fracture-acute vertigo and hearing loss. May also result in perilymphatic fistula with valsalva induced vertigo and associated hearing loss.

Acoustic neuroma -Important cause of peripheral vestibular dysfunction and cochlear hearing loss. Vertigo is often not prominent due to the slow growth of the tumor providing a chance for adaptation. Diagnosis: audiogram, CT /MRI with special views of internal auditory meatus, brainstem auditory evoked potentials.

Ototoxicity (eg, aminoglycosides)- Disequilibrium syndrome with high frequency hearing loss.

Otic Syphilis-rare

- **Central vestibular diseases**

Drugs (alcohol, sedatives)

Multiple Sclerosis -Usually with clear CNS signs: Occasionally mimic vestibular neuronitis.

Tumors at the cerebellopontine angle

Vertebrobasilar ischemia -Though vertigo may be the sole symptom, ischemia' is usually accompanied by other brainstem symptoms.

### **Symptomatic Treatment of Peripheral Vertigo**

*Antihistamines -moderately sedating* -Dramamine (dimenhydrinate, 50 q6h), Benadryl (diphenhydramine, 50 q6h)

*Phenothiazine -moderately sedating* -Phenergan (promethazine, 25 q6h)

*Belladonna alkaloid -mildly sedating* -scopolamine transderm patch.

*Piperazine -mildly sedating* -Antivert (meclizine, 25-50 q6h)

*Vestibular Rehab*-physical therapy to promote adaptation and prevent falls. Preferable to medications if symptoms persist.

*Canalith Repositioning maneuvers (Epley/Semont) for BPPV*

## **Presyncope/Syncope**

*Orthostatic Hypotension*

- Polyneuropathy (eg., diabetes, amyloidosis)
- Hypovolemia
- Medications
- Other causes of dysautonomia (eg., Shy-Drager syndrome)

*Vasovagal Syncope*

*Cardiac arrhythmias valvular disease*

*Micturition syncope*

## **Disequilibrium**

*Cerebellar ataxia* -degenerative diseases, tumors @ the cerebellopontine angle, etc.

*Proprioceptive deficits* -severe neuropathy, posterior column disorders.

*Movement disorders*-May be presenting or consistent complaint in Parkinson's disease, progressive supranuclear palsy

*Multiple sensory deficits syndrome* -Often seen in elderly patients, due to a combination of visual loss (eg., cataracts), auditory disturbances, neuropathy, and possibly other disturbances of the sensory systems.

*Psychogenic dizziness*-cause of dizziness in up to 20% of chronic dizziness seen in tertiary referral centers. Associated with chronic anxiety, depression, somatization and conversion disorders.

## **Treatment of Central Disorders**

*Identify and treat causes, such as medications, cardiovascular dysfunction, thyroid disease.*

*Benzodiazepines helpful at low doses*

# CLINICAL NEUROPHYSIOLOGY

## Electromyography & nerve conduction study (EMG/NCS)

The term EMG is often used loosely to refer to both the needle EMG examination and the nerve conduction study, as the two are usually performed together.

The *needle electromyographic (EMG) examination* employs a needle electrode (26 or 27 G) to record electrical activities from muscles. It is useful for evaluating weakness, denervation, reinnervation, and myopathic disorders of muscles. Each of these conditions are associated with characteristic EMG patterns.

*Nerve conduction study (NCS)* uses electrical stimuli to evoke responses from sensory or motor nerve fibers. It measures the speed of nerve conduction (nerve conduction velocity) and the size of the sensory and motor responses (amplitude of the response from muscles or nerves). These values are then compared with normative values of the laboratory. The pattern of any abnormality present provides important clues to underlying disease. NCS is most commonly used to evaluate neuropathies, both focal and generalized neuropathies. It may identify sites of nerve entrapment (eg, carpal tunnel syndrome or ulnar neuropathy), or may help to confirm or characterize a diffuse nerve disorder (ie. polyneuropathy). A variant of the technique -repetitive nerve stimulation -is used to assess neuromuscular junction disorders (eg, myasthenia gravis).

### **Clinical Use:**

1. Confirm or establish diagnosis / localize lesion: eg, entrapment neuropathies or other focal neuropathies, radiculopathies, polyneuropathies, myopathies or neuromuscular junction disorders.
2. Characterize the disease (eg, demyelinating or axonal neuropathy), hence narrow the differential diagnosis.
3. Assess severity: Therefore, useful in longitudinal follow-up (eg, during treatment of neuropathy).
4. Assess prognosis: The amplitudes of sensory and motor responses reflect the number of functional or surviving nerve fibers and are useful prognostic indicators ( eg., prognosis after nerve injuries).

### **Limitations:**

1. Assess only large-diameter nerve fibers. (Autonomic function testing may be more useful in assessment of occasional neuropathy affecting predominantly small-diameter fibers.)
2. Uncomfortable. Though most patients find the procedure tolerable, occasional patients are unable to finish the testing.
3. Requires physician specially trained in neuromuscular diseases and the electrodiagnostic procedure. Results obtained by unqualified personnel are all too often misleading.
4. Expensive. These procedures are time consuming and therefore expensive.

# EEG and Evoked Potentials

Barry s. Oken, MD

## I. EEG

- What is an EEG? Electrical activity generated in the cerebral cortex that is most commonly recorded from the scalp.
- Types of abnormalities. 1- too slow 2- too paroxysmal (epileptiform activity).
- Epilepsy - sensitivity of a single interictal EEG about 40%. Repeated EEGs with special recording techniques increase sensitivity to 65-85%. False positive rate for paroxysmal abnormalities is less than 2%.
- Assist in diagnosis of encephalopathies/dementia/psychiatric illness
- Additional techniques
  - Sleep deprivation (an activation procedure known to increase yield of spike or sharp waves)
  - Special electrodes (e.g., sphenoidal electrodes to record from the anterior/mesial temporal lobe)
  - Ambulatory EEG (prolonged recording to increase chance of recording paroxysmal activities)
  - Video-monitoring (prolonged recording that additionally provides clinical/EEG correlates of ictal or other paroxysmal activities)
  - Polysomnographic recording (All-night sleep recording and multiple sleep-latency test (MSLT). These tests are used for evaluation of sleep disorders (e.g., sleep apnea and narcolepsy)
  - Confirmatory test for brain death – documentation of electro-cerebral silence (ECS)

## II. Evoked Potentials

- What is an EP? An electrical potential generated in the peripheral or central nervous system following some stimulus that evaluates sensory conduction in the central or peripheral sensory pathways.
- Visual EP (VEP)- measures conduction from eye to visual cortex following visual stimulation.
- Brainstem auditory EP (BAEP)- measures conduction from ear to lower midbrain following auditory stimulation.
- Somatosensory EP (SSEP)- measures conduction from electrical stimulation of peripheral nerve (usually median in the arm and posterior tibial in the leg) to cortex.
- Other special EPs (motor, cognitive, movement-related)

### Clinical applications

- Multiple sclerosis (where exam and MRI do not generate a definite diagnosis)
- Assessment of hearing/visual impairment in infants
- peripheral nerve/root diseases- in general, EMG/NCS is better than EPs
- tumors
- intraoperative monitoring
- prognosis of coma

The utility of all clinical neurophysiologic techniques depends on the expertise of the neurologist/clinical neurophysiologist, and the ability of the referring physician to ask a specific question that can be answered with these techniques.

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