

# Demystifying Nystagmus and oscillation of the eye

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# Disclosures

No Disclosures



# Objectives

- Review the different types of nystagmus
- Review how to classify the nystagmus
- Review the neurologic pathologies associated with nystagmus
- Review the treatment and management of nystagmus



# Case 1- Dizzy , shaky and blurry vision

34 y.o. male with a past medical history of migraine. Has not seen a doctor in 10 years.

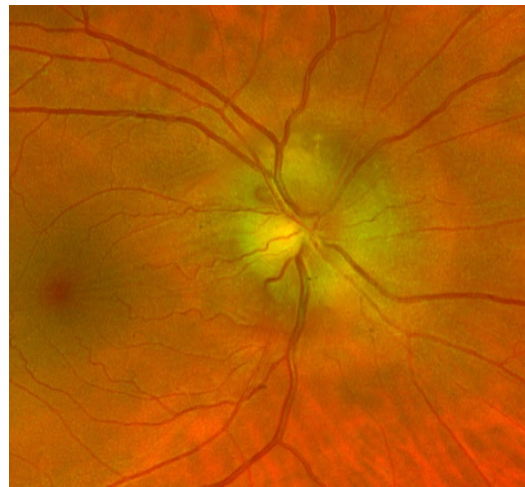
- Frequent headache in the last two years - positional
- Photophobia
- Double vision
- Blurry vision
- Episodic oscillopsia with associated dizziness, (episodes have been getting more frequent).
- Surgical hx/ Social hx unremarkable.
- FH- Migraine/HTN (father), Brain aneurysm (MGF)
- Not taking any meds



# Exam

	OD		OS
VA	20/25		20/20
Confrontation	Full		Full
Pupils	Normal		Normal
EOM	-1 R LR weakness		MR overaction
Anterior segment	Normal		Normal

OD

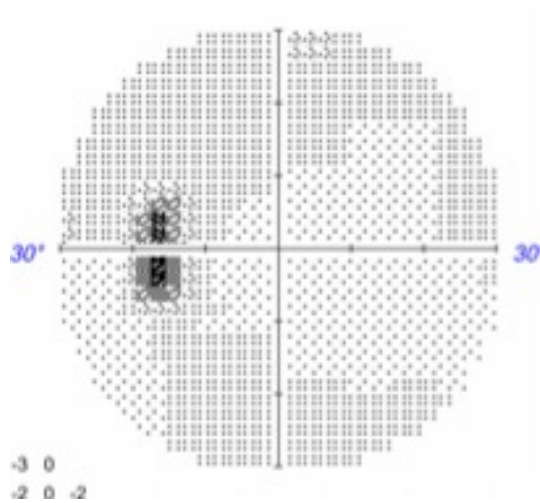


OS

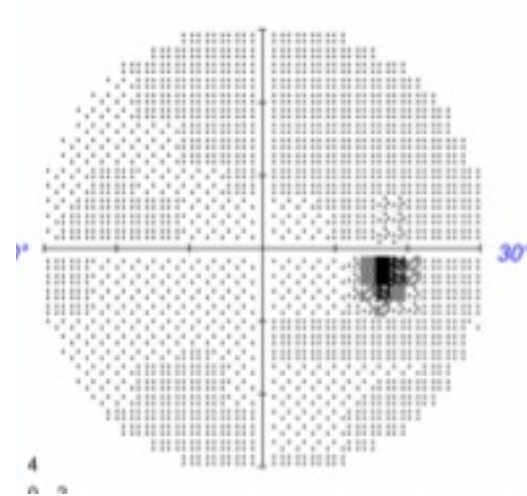


# HVF 30-2- Enlarged Blind spot

OS



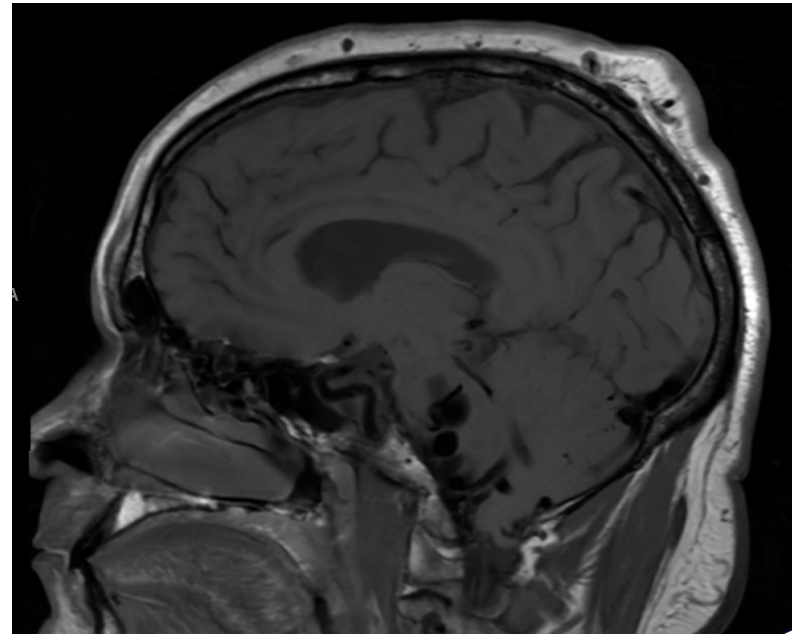
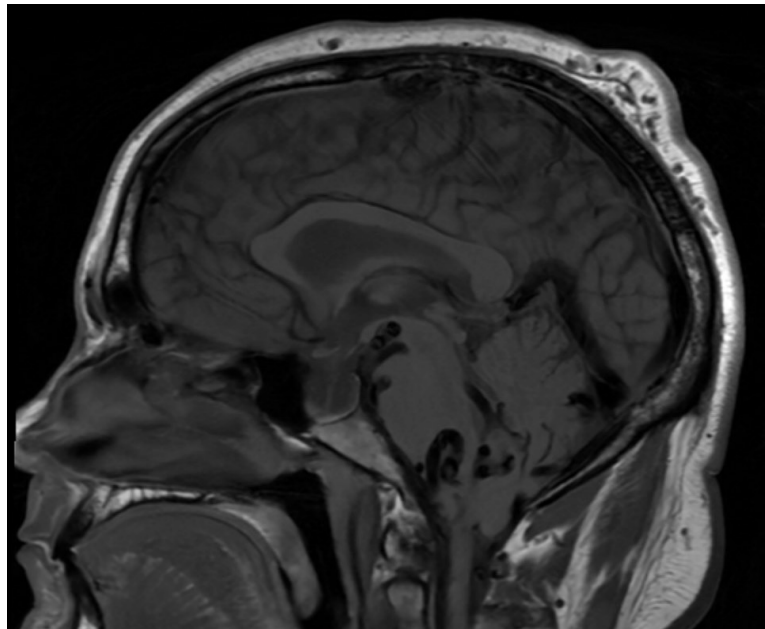
OD



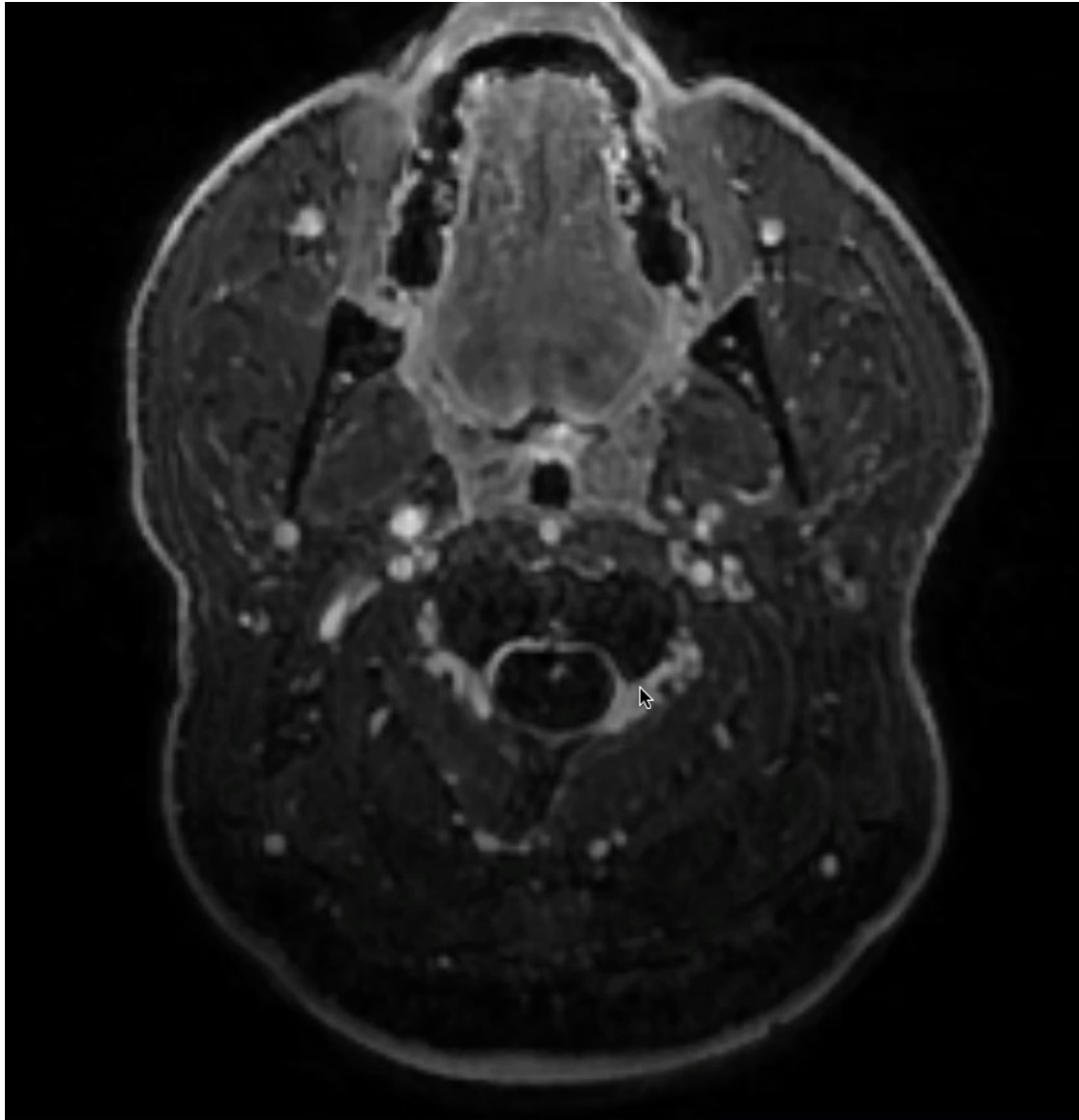
# Exam



# MRI BRAIN







# MRI Brain w/wo Contrast

Treatment: embolization of a dural fistula in a month and a stage II embolization another month later



# Post embolization Video



# Nystagmus

- Nystagmus is a rhythmic, repetitive oscillation of the eyes
  - initiated by a *slow* eye movement that drives the eye off target
  - followed by a fast movement that is corrective (jerk nystagmus) or
  - another slow eye movement in the opposite direction (pendular nystagmus).



# Oscillopsia

Cannot Hold Eyes Still  
= Oscillopsia

## Clinical Neuro-Ophthalmology

6th Edition

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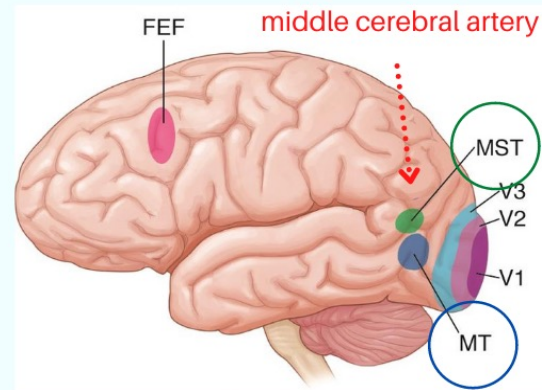


# Ocular Motility

## Smooth Pursuits



# SMOOTH PURSUIT SYSTEM



Smooth "PIMP"

**P**arietal lobe  
**I**psilateral  
**M**iddle cerebral artery  
**P**ons

## Parietal Lobe

**MT/V5 (medial temporal area)**  
 initiates pursuits for visual targets

**MST (medial superior temporal area)**  
 initiates pursuits while head is moving

## Pons

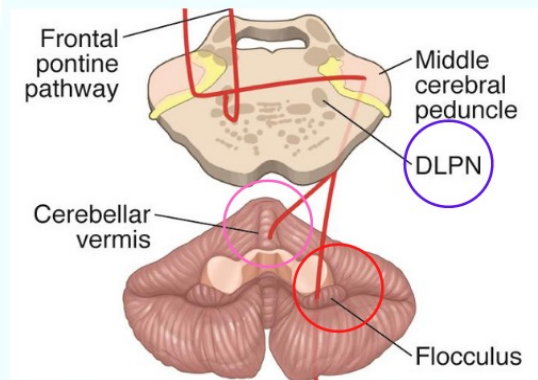
**DLPN (dorsolateral pontine nuclei)**  
 and lateral pontine nuclei

## Cerebellum

**Paraflocculus** and **dorsal vermis**

## Vestibular nuclei

## Gaze centers



**double-decussation** (pons + cerebellum)

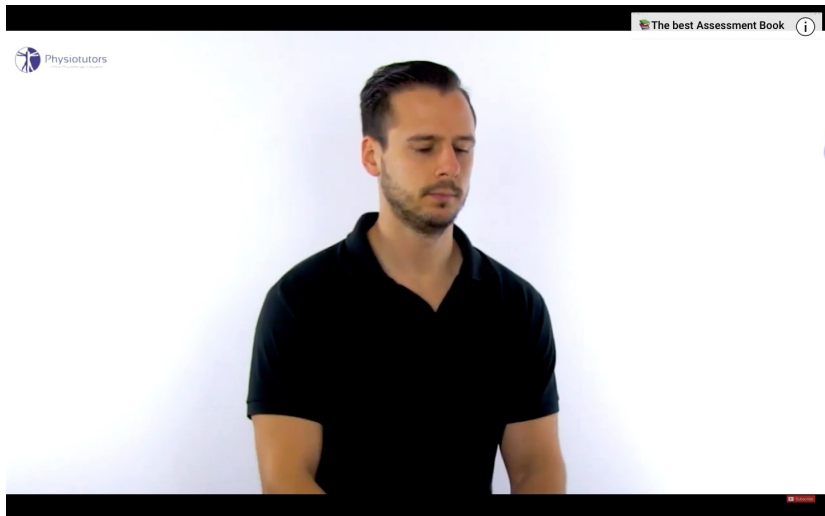
↳ **ipsilateral**

(R parietal lobe lesion → ↓ R pursuits)

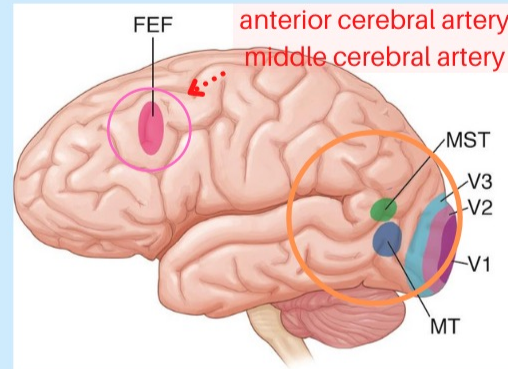
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# Ocular Motility

## Saccades



# SACCADIC SYSTEM



## Frontal Lobe

**FEF (frontal eye fields, Brodmann 8)**  
initiates **forced** (voluntary) saccades

## Parietal Lobe

initiates **reflexive** saccades

## Subcortical Structures

basal ganglia, thalamus (internal medullary lamina and pulvinar), superior colliculus

## Pons and Gaze Centers

Vertical (midbrain): riMLF  
Horizontal (pons): PPRF

### single-decussation

↳ **contralateral**

(R frontal lobe lesion → ↓ L saccades)

### The "FACS" of saccades

**F**rontal eye fields

**A**nterior cerebral artery

(MCA more commonly affected)

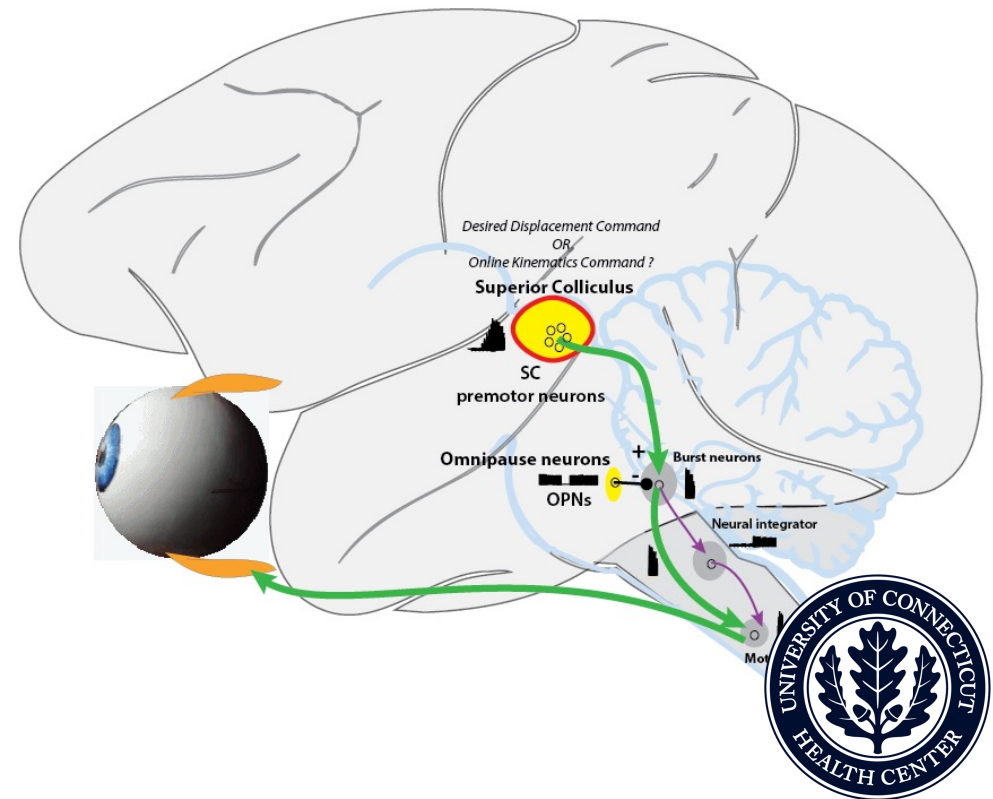
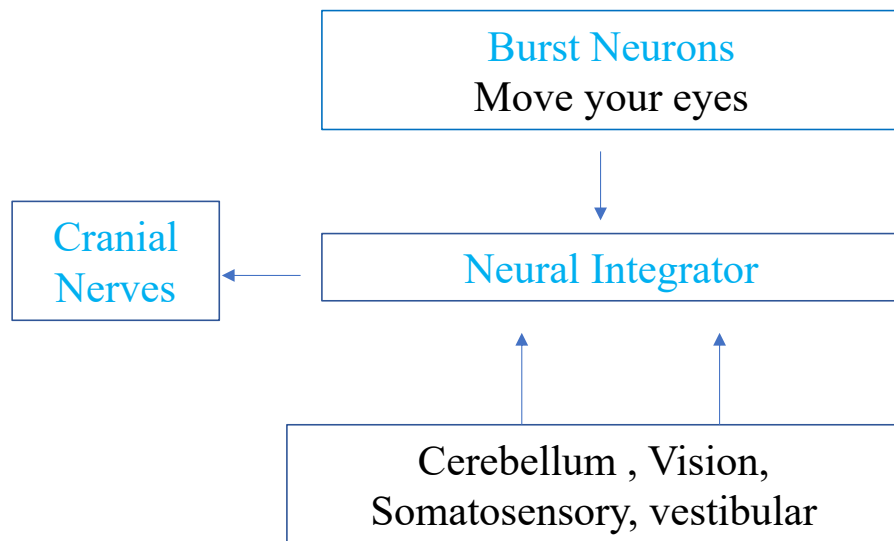
**C**ontralateral movement

**S**ubcortical structures

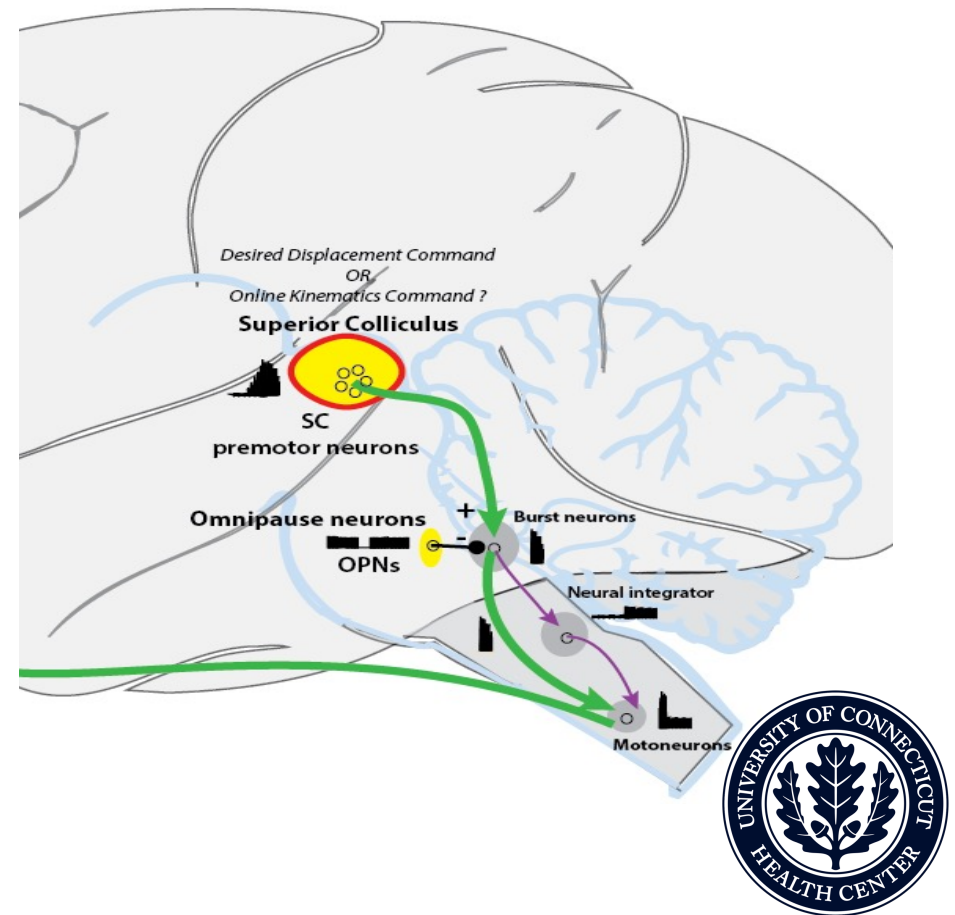
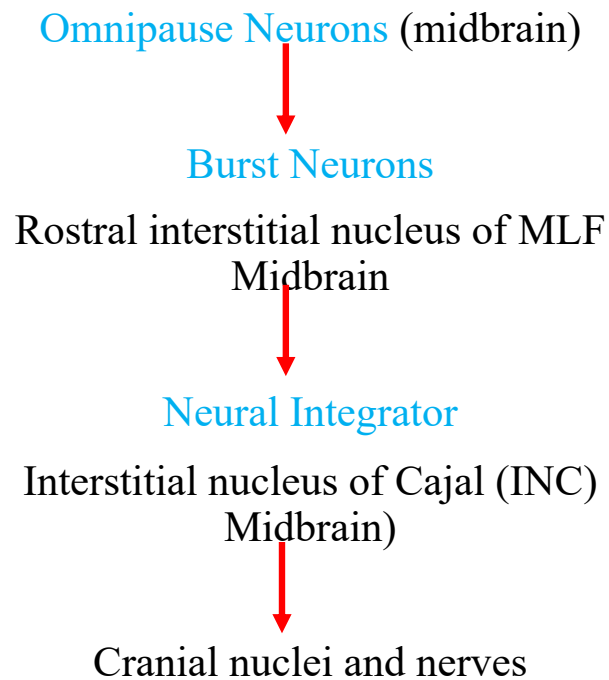
(esp. **s**uperior colliculus)

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# Eye Movement Initiation

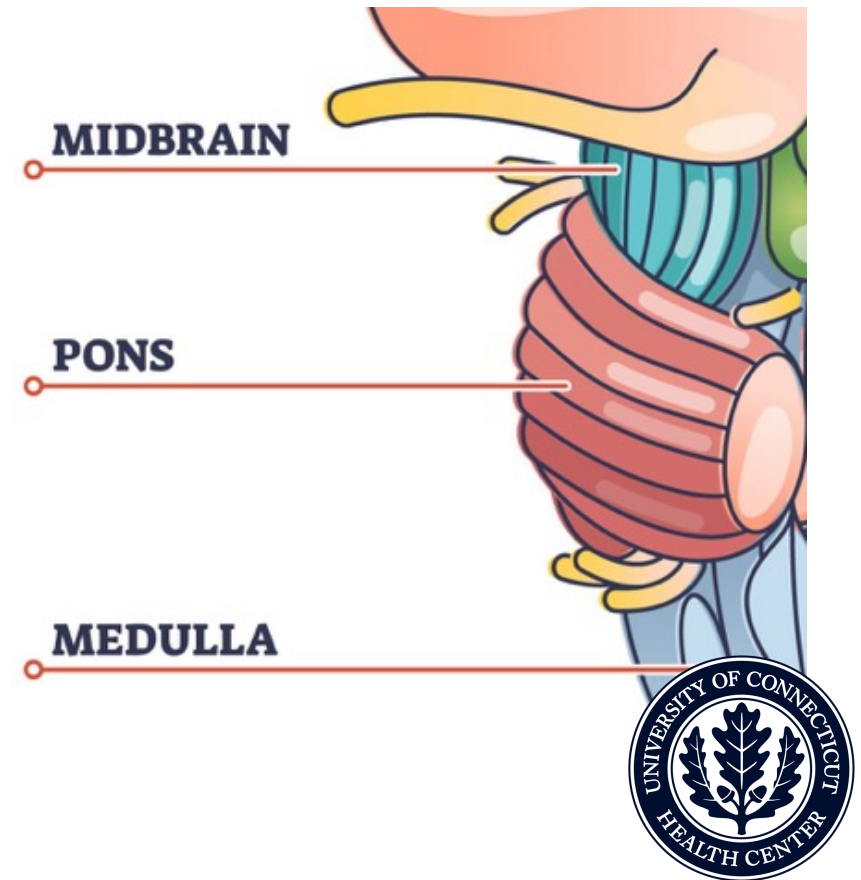
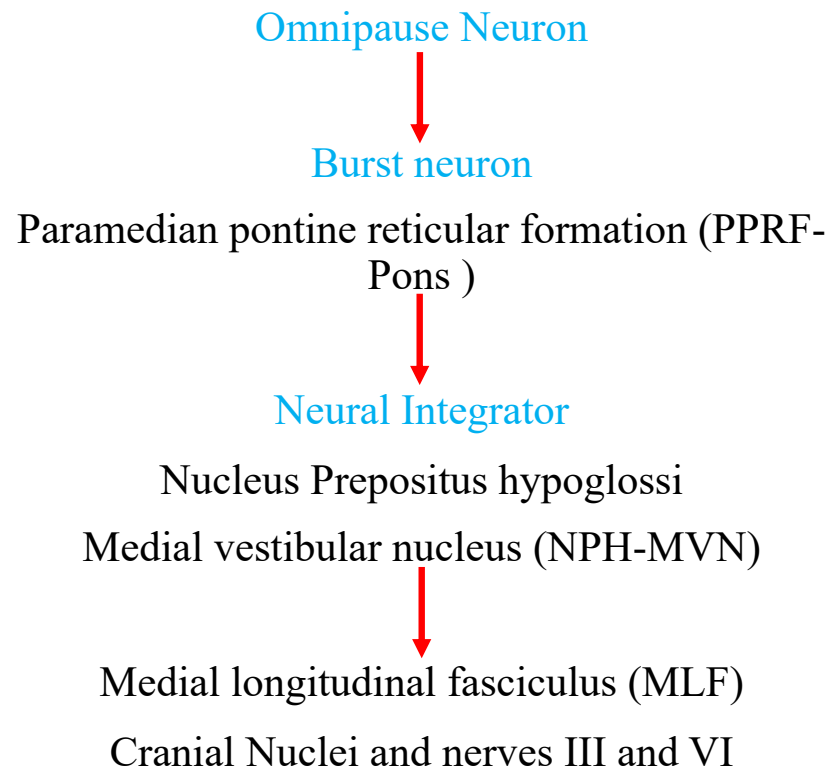


# Vertical gaze center





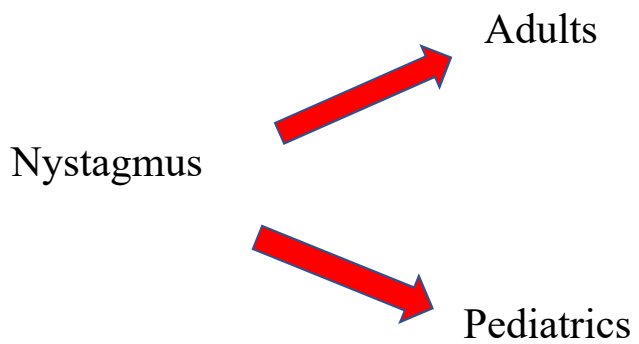
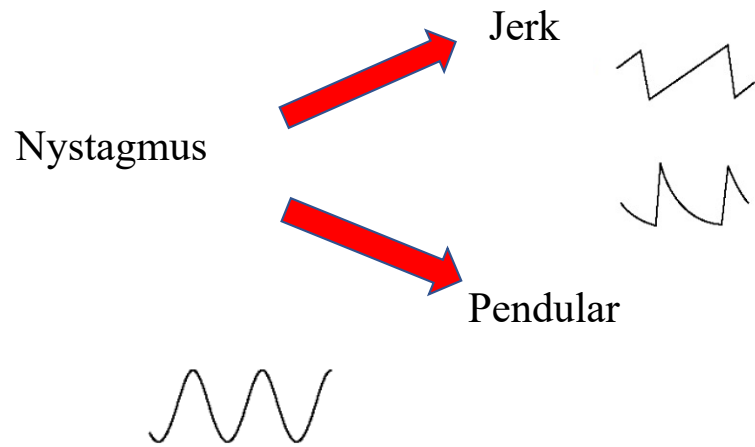
# Horizontal Gaze Control



# What is Nystagmus ?

- Rhythmic
- Biphasic oscillation of the eyes
- Slow phase eye drift initiates the movement





Type	Childhood	Any Age
Jerk	Latent	Vestibular
		Peripheral and central
		Gaze-evoked
		Physiologic
		Pathologic
		Brun's
		Dissociated
		Periodic alternating (PAN)
		Downbeat
		Upbeat
		Convergence retraction
		Epileptic
		Drug-induced
	Optokinetic	
	See-saw	
Pendular	Spasmus nutans	Oculopalatal
	Monocular nystagmus due to visual deprivation/loss	Oculomasticatory myorhythmia
		See-saw
Either pendular and/or jerk in the same patient	Congenital	

# Nystagmus

- Physiologically in response to environmental stimuli
  - optokinetic nystagmus (OKN)) or
  - from rotation of the head (vestibular-ocular reflex (VOR)
- Pathologic - signify damage to
  - the peripheral or
  - central vestibular pathways or
  - visual pathways.



# Physiologic nystagmus?



# Nystagmus

## Pendular nystagmus

- phases are of equal velocity
- and there are no corrective saccades.



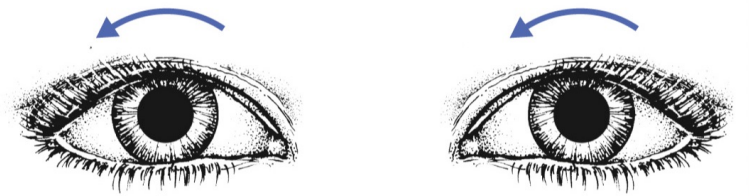
## Jerk nystagmus

- slow (pathologic) phase followed by a fast (corrective, position reset) phase in the opposite direction.



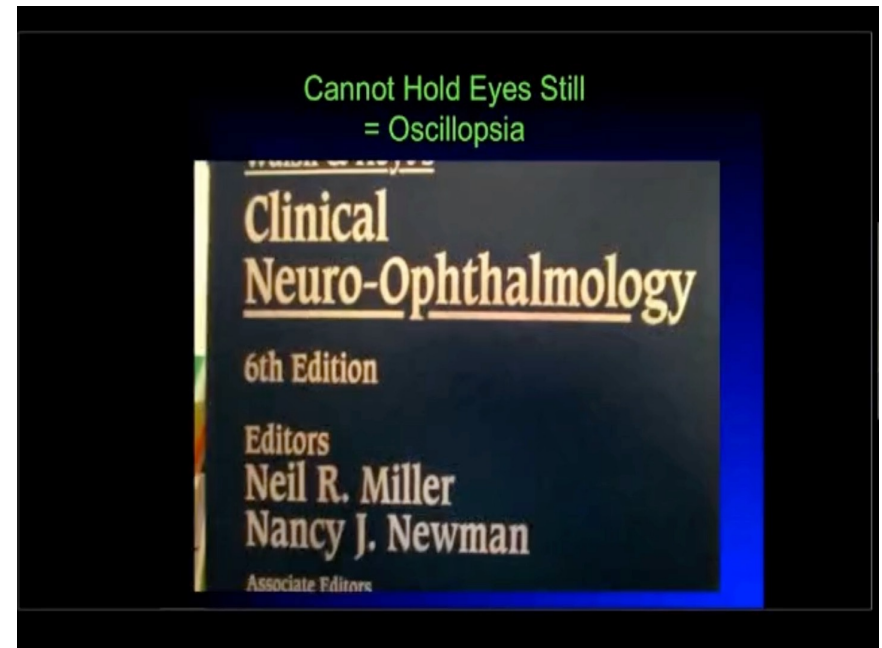
# Nystagmus

- Frequently, jerk nystagmus associated with vestibular disorders will have a torsional component.
- Torsional nystagmus is named by whether the top pole of each eye beats toward the patient's right or left shoulder



# Symptoms Associated with Nystagmus

- Nystagmus –
  - asymptomatic or
  - Symptomatic – *oscillopsia*- a jumping of the visual environment (with acquired nystagmus)
- With jerk nystagmus, the environment is perceived to move in the direction of the fast phase.



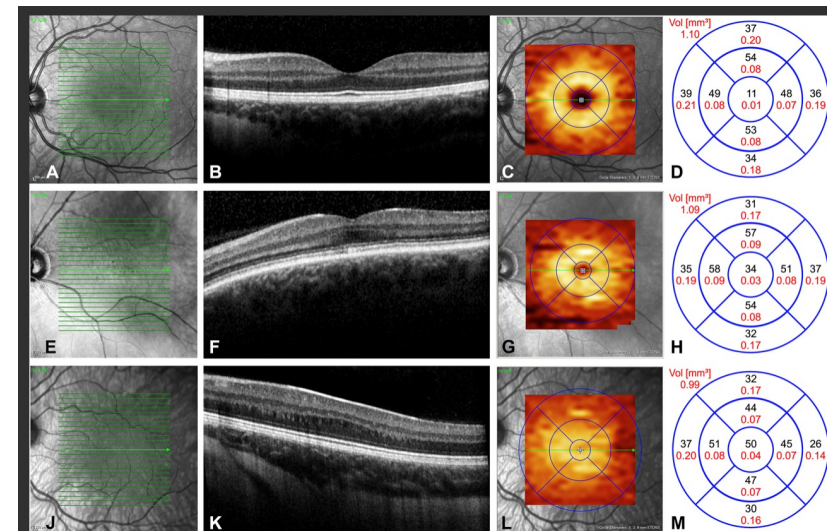


# Congenital Nystagmus

- Patients with oscillopsia and dizziness or vertigo are likely to have a vestibular disorder.
- In contrast, patients with congenital nystagmus typically have a reduction in visual acuity without oscillopsia.



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 Professor of Neurology  
 Director, Neurovisual Disorders  
 Harvard Medical School  
 Massachusetts General Hospital



# How to examine ?

- Observe patient in primary gaze
- Pay Attention to the direction and quality of nystagmus or nystagmoid movement
- Is there tilting or turning of the head, or ptosis
- Look in all positions of gaze - ensure a normal range of eye movements
- Observe whether the nystagmus changes direction or its amplitude in lateral and vertical gaze.
- Check Smooth pursuit and saccades.
- An abnormality of either the saccadic or the pursuit system suggests a central cause for the nystagmus.
- Check Ocular alignment.



# How to characterize Nystagmus

- Are there oscillations ?
- Is there a fast phase ?
- Direction(s) (horizontal, vertical, torsional)
  - Peripheral: Horizontal-torsional
  - Central: more pure
  - Peripheral remains same at upgaze and downgaze
- Present in primary gaze (does it affect function )?
- Conjugate?
- Associated findings: Change direction, gaze palsy, duction deficit: INO; signs of inner ear or neurological diseases



# Peripheral vs Central Nystagmus

	<b>Peripheral</b>	<b>Central</b>
Feature	Unilateral <sup>a</sup> disease of vestibular organ or nerve Usually benign disease: labyrinthitis, Meniere disease	Disease of the brainstem and its connections with the vestibulocerebellum Any CNS disorder
Direction	Horizontal component <sup>b</sup> Mixed: horizontal/torsional, sometimes vertical component Fast phase away from lesion	Torsional pure Vertical pure Horizontal pure <sup>c</sup>
Visual fixation	Inhibits nystagmus	No inhibition
Frenzel goggles or darkness (inhibition of fixation)	Peripheral nystagmus increases in intensity	Central nystagmus is not changed
Severity of vertigo	Severe	Mild (except for Wallenberg syndrome)
Induced by head movements	Often	Rare
Associated eye movement deficits	None	May have pursuit or saccadic defects
Other findings	Hearing loss	May have cranial nerve or long tract signs No tinnitus or hearing loss

# Nystagmus and Localization

- Convergence –retraction nystagmus
  - Parinauds syndrome or dorsal midbrain syndrome
- Downbeat nystagmus
  - Cervicomedullary junction (chiari malformation)
- Upbeat nystagmus
  - cerebellar vermis , medulla
- See-saw nystagmus
  - chiasm
- Ocular flutter /Opsoclonus
  - Cerebellum/brainstem
- Acquired pendular nystagmus
  - Brainstem , cerebellum



Take videos videos videos !!  
Of course with patients permission !!

Most forms of nystagmus can be interpreted at the bedside.

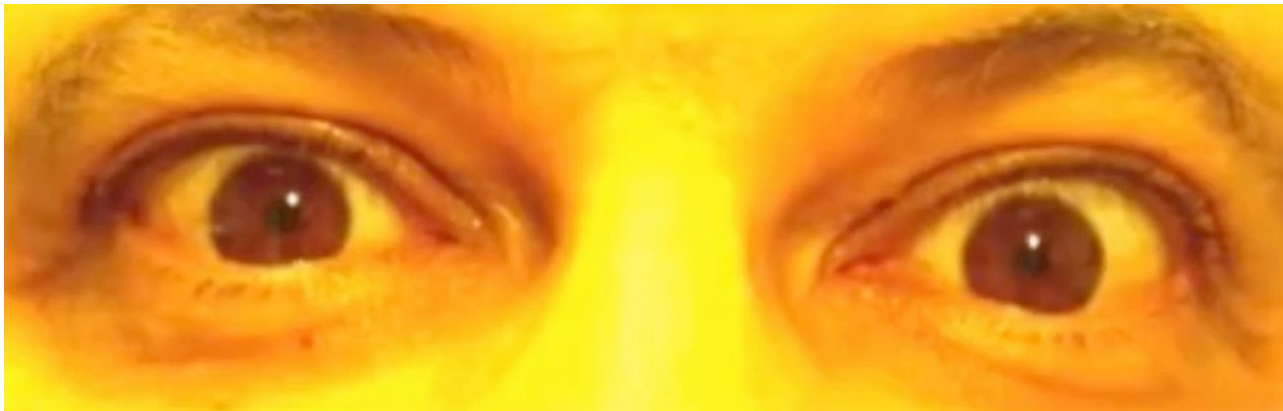
However, eye movement recordings can more accurately characterize the pathophysiologic substrate of the nystagmus.



# CASES



# Case : Man with abnormal eye movement



1. Oscillation?
2. Slow Phase ?
3. Present in primary gaze?
4. Conjugate?
5. Dimension :
6. Associated findings

## **Pattern:**

Conjugate vertical oscillopsia  
Fast phase downwards  
Worse in R and L gaze

**Diagnosis:** Post Fossa arachnoid cysts s/p VPS



# Down beat nystagmus

- Properties: Fast phase downwards (drifts upwards real cause)
- Localizations: Lesion in cervical medullary junction like Chiari malformation( decrease input from anterior semicirc canal, lesion of the flocculus, nodulus)
- Work up : MRI Brain w/wo contrast
- Rx: Gabapentin, clonazepam (GABAA agonist), 4-aminopyridine).

# Case: 40 YOM with abnormal eye movement



1. Oscillation?
2. Slow Phase ?
3. Present in primary gaze?
4. Conjugate?
5. Dimension :
6. Associated findings

**Pattern:**

Up-beating nystagmus  
Horizontal gaze paresis  
LINO

**Diagnosis:** Pontine Glioma

# 28 YOM with blurry vision



1. Oscillation?
2. Slow Phase ?
3. Present in primary gaze?
4. Conjugate?
5. Dimension :
6. Associated findings

## **Pattern:**

Conjugate horizontal oscillations , Gaze evoked nystagmus

Downgaze – upgaze – horizontal

Slight see saw

Oscillopsia in childhood

Learn to foveate with time. Achiasma

**Diagnosis :** Congenital Nystagmus

# 35 YOM Man with oscillopsia



1. Oscillation?
2. Slow Phase ?
3. Present in primary gaze?
4. Conjugate?
5. Dimension :
6. Associated findings

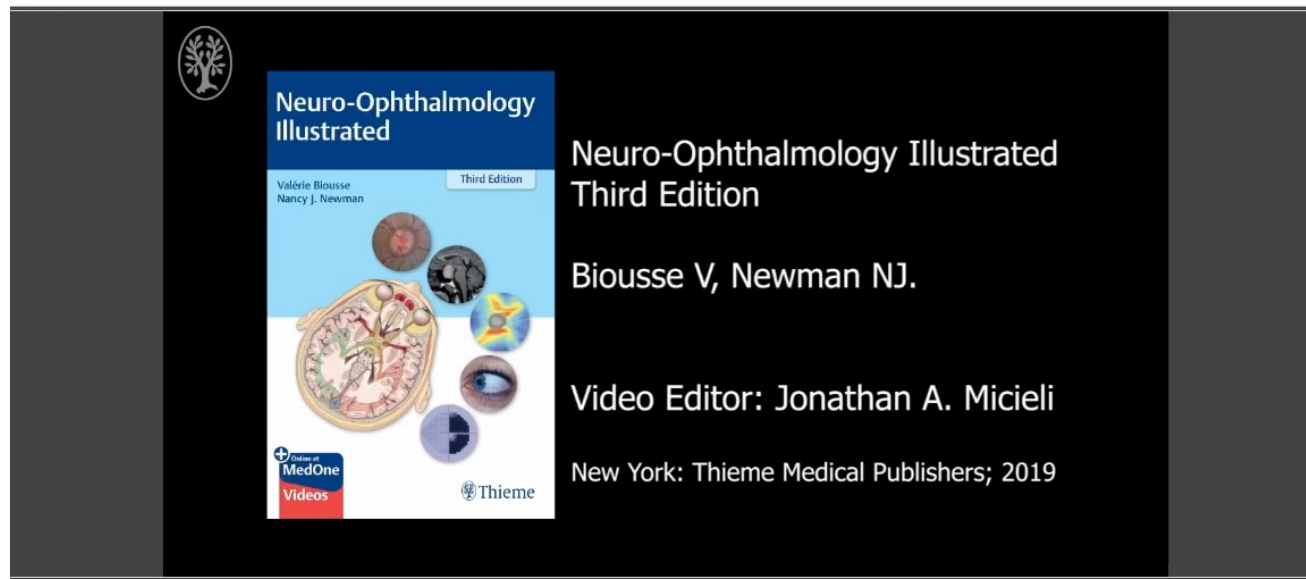
## Pattern

- Gaze evoked nystagmus
- Bilateral INO

Diagnosis : MS on natalizumab

# Saccadic intrusions- Ocular Flutter

Saccadic intrusions (opsoclonus and flutter) are abnormal rapid eye movements (back to back saccades) that have no slow phase.



# Saccadic intrusions- Opsoclonus



## Pattern :

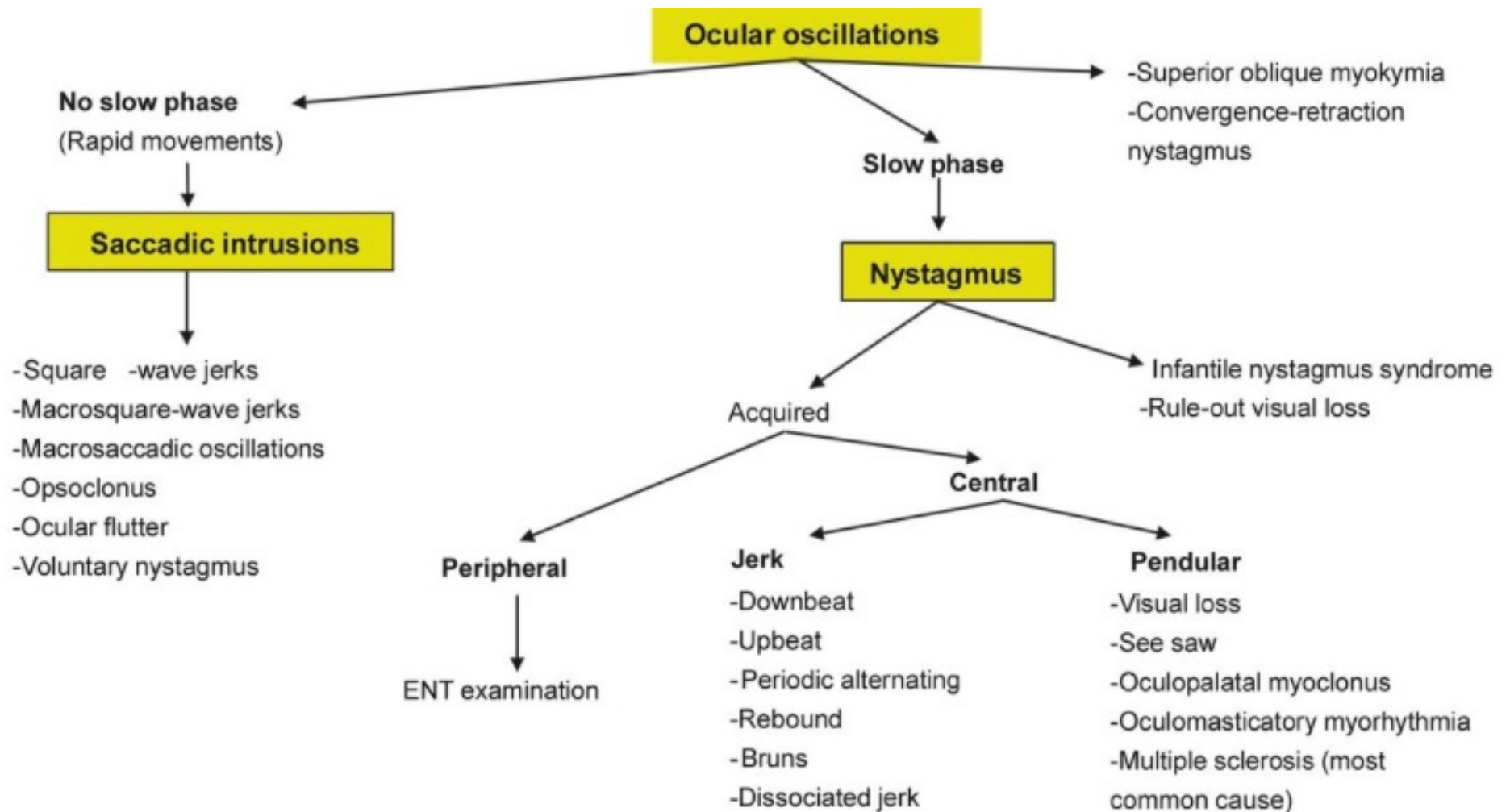
Characteristic conjugate  
Chaotic multidirectional  
saccades and blinking

-Seen in Opsoclonus-  
myoclonus-ataxia  
syndrome, aka myoclonic  
encephalopathy of infancy  
-50% have underlying  
occult neuroblastoma

**Diagnosis:** Thoracic neuroblastoma. Her abnormalities, which also included ataxia, resolved after tumor resection and immunosuppression.



Ref: Dr Grant Liu



Thank you

Questions!

