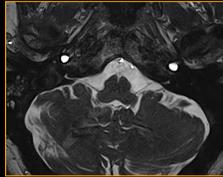


## The Lower Four Cranial Nerves

Wendy R.K. Smoker MD, FACR  
 Professor Emeritus  
 University of Iowa Hospitals and Clinics



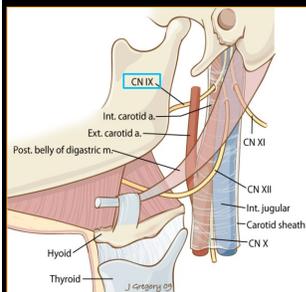
## Learning Objectives

Review the anatomy of the lower 4 cranial nerves

Recognize the clinical findings of lower 4 cranial nerve palsies

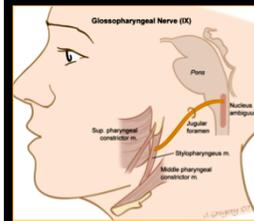
Learn common pathologies affecting the lower 4 cranial nerves

## Glossopharyngeal Nerve (IX)



Nucleus ambiguus in rostral medulla  
 Exits brainstem between olives and inferior cerebellar peduncle  
 Exits skull in pars nervosa of jugular foramen  
 Enters high carotid space

## Glossopharyngeal Nerve (IX)



Innervates: Stylopharyngeus m  
 Sensory fibers: From post 1/3 of tongue and middle ear

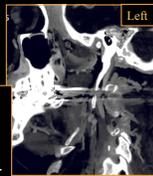
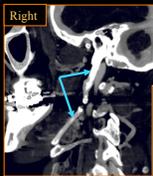
Contributes to Pharyngeal Plexus with X:

- Levator veli palatini m.
- Superior pharyngeal constrictor m.
- Middle pharyngeal constrictor m.
- Palatopharyngeus m.
- Palatoglossus m.

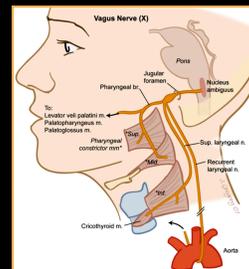
Isolated Glossopharyngeal Neuralgia is RARE

## Eagle's Syndrome

45 y/o male with tongue and posterior pharyngeal pain, accentuated with tongue protrusion; occasional knife-like pain radiating to right ear



## Vagus Nerve (X)



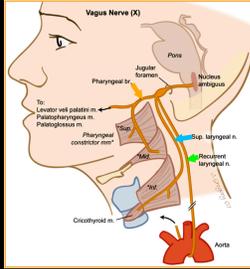
Nucleus ambiguus in rostral medulla

Exits brainstem with IX between olive and inferior cerebellar peduncle

Exits skull base in pars vascularis of jugular foramen  
 Courses through high carotid space

Runs in carotid sheath

## Vagus Nerve (X): Innervations



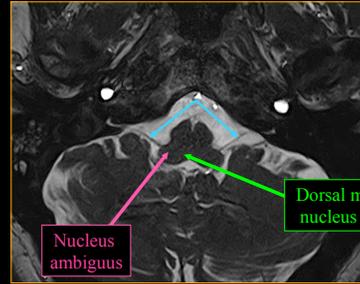
### Pharyngeal Plexus (with IX)

#### Superior laryngeal nerve

Inferior pharyngeal constrictor m.  
Cricothyroid m.

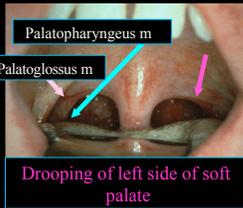
#### Recurrent laryngeal nerve

Endolaryngeal muscles including  
thyroarytenoid (vocalis) m

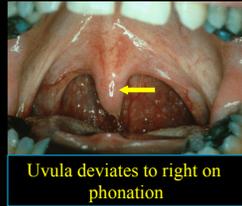


## Pharyngeal Plexus Dysfunction

### Clinical Findings

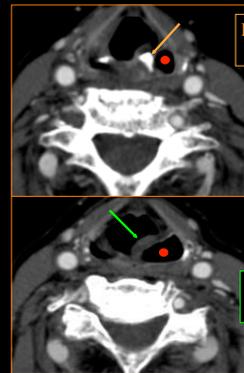


Drooping of left side of soft palate



Uvula deviates to right on phonation

From Perkin D, et al. *Atlas of Clinical Neurology*



Rotation and anteromedial position of ipsilateral arytenoid cartilage (50%)

Ipsilateral pyriform sinus dilatation (77.5%)

Ipsilateral medial positioning and thickening of aryepiglottic fold (77.5%)



Ipsilateral laryngeal ventricle dilatation (77.5%)  
(thyroarytenoid muscle denervation)

Ipsilateral subglottic fullness (22.5%)

Characteristic "pointing" of the thinned vocal cord

57F s/p thyroidectomy with complaints of "voice problems"



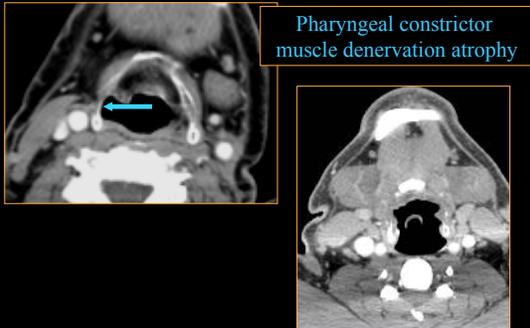
Medial positioning and thickening of aryepiglottic fold

Pyriform sinus dilatation



Atrophy of the right posterior cricoarytenoid muscle

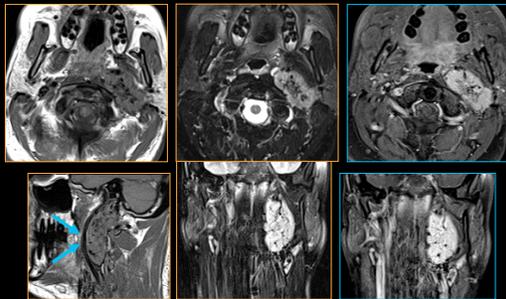
If proximal vagal neuropathy, also have:



### Vagal Paragangliomas

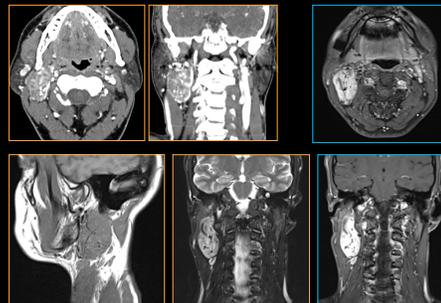
- Arise from paraganglia located around **nodose ganglion**, the more caudal of the two vagus nerve ganglia
- Situated **just below skull base**, lower than typical jugulare and higher than typical carotid body tumors
- Usually **lie entirely within carotid space**; may extend through jugular foramen
- As vagus nerve lies dorsal to ICA, these tumors usually **displace ICA anteriorly**
- Asymptomatic (“neck mass”); CN deficits in 36%-typically X (VCP)

### Vagal Paraganglioma



26M: Mass discovered during w/u for sore throat!

### Vagal Paraganglioma



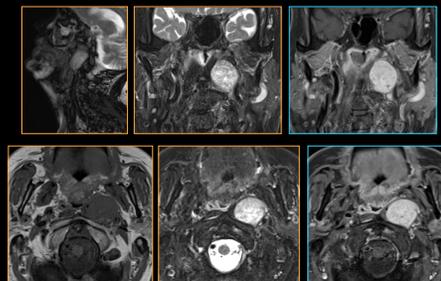
34F: Incidental “neck mass”

### Schwannomas

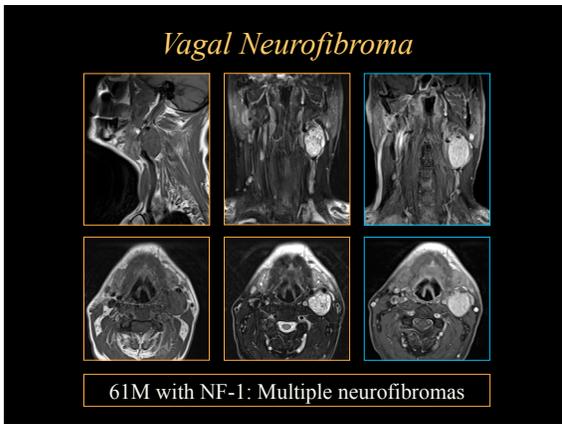
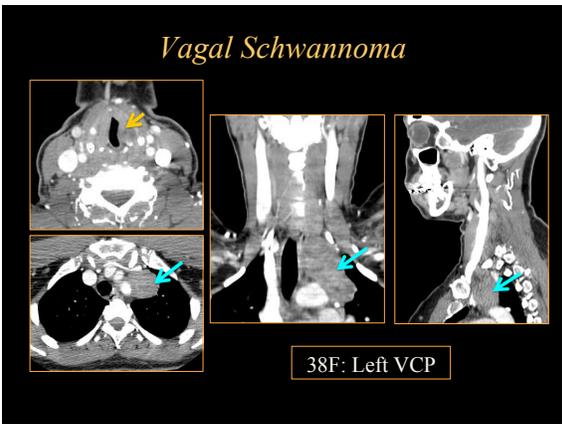
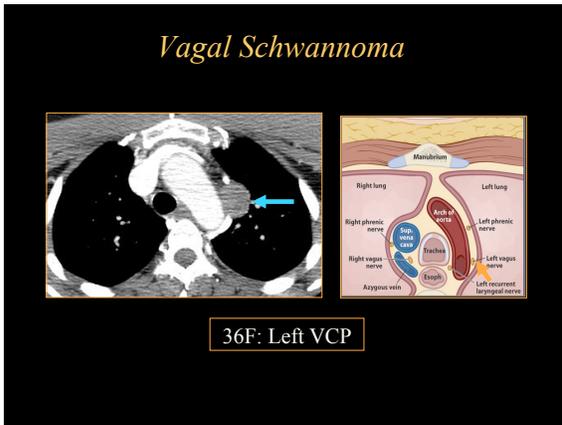
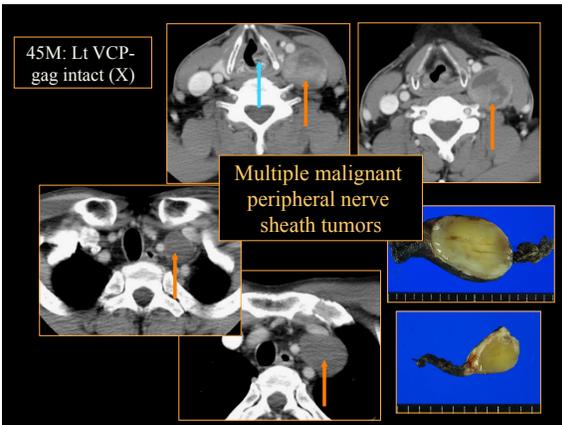
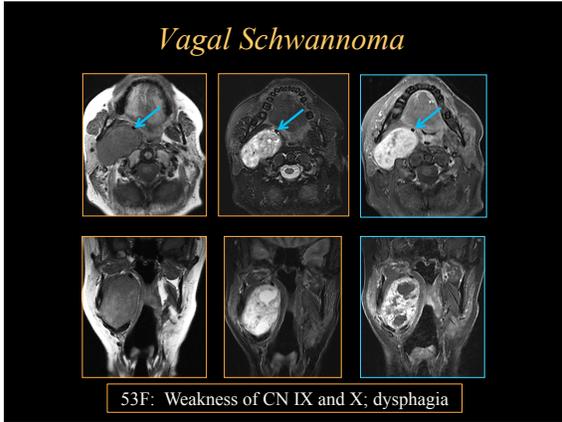
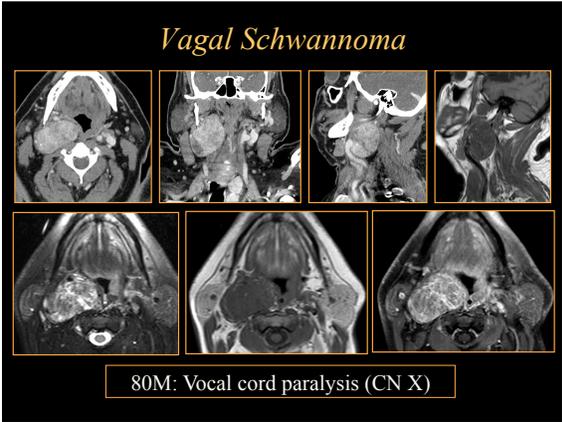
- Arises from Schwann cells wrapping around CNs IX-XII...**X most common** (50%); 2-8cm when detected
- M > F; Average age is 45 years at presentation
- Often asymptomatic but may have Horner syndrome, VCP, dysphagia, sore throat...
- Well-circumscribed; **Displace ICA and PPS anteriorly**
- CS enhancing mass, solid, +/- cystic component
- **No flow voids on MR** vs paraganglioma
- DDx: Neurofibroma (much less common)

*Indian J Otolaryngol Head Neck Surg* 63:310-312, 2011

### Vagal Schwannoma



80M: Rt. Horner syndrome, decreased pinprick and temperature Rt face; palate does not elevate on right.

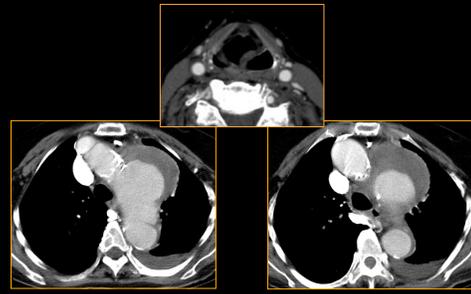


### Vagal Neurofibroma



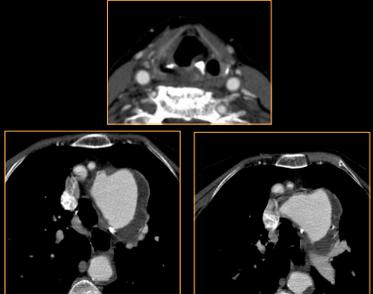
12M

### Aortic Aneurysm with Thrombus



66M: Ortner Syndrome (cardiovocal syndrome)

### Ortner (cardiovocal) Syndrome



78F: Acute hoarseness one morning (left VCP)

### Ductus Aneurysm with Thrombus

62M: Hoarseness, Lt. RLN paresis, gag intact

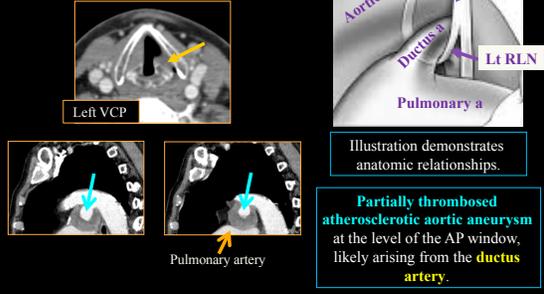
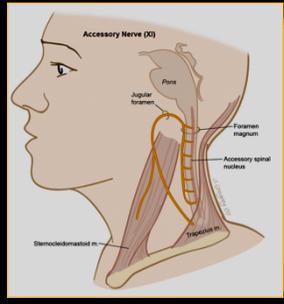


Illustration demonstrates anatomic relationships.

Partially thrombosed atherosclerotic aortic aneurysm at the level of the AP window, likely arising from the ductus artery.

### Spinal Accessory Nerve (XI)

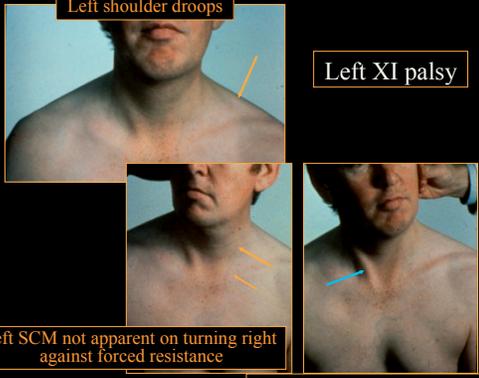


- Consists of cranial and spinal portion (ramus internus and externus)
- Exits the skull base - jugular foramen
- Enters the high carotid space

Innervations:  
Sternocleidomastoid m.  
Trapezius m.

Left shoulder droops

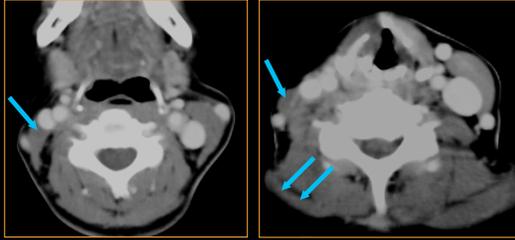
Left XI palsy



Left SCM not apparent on turning right against forced resistance

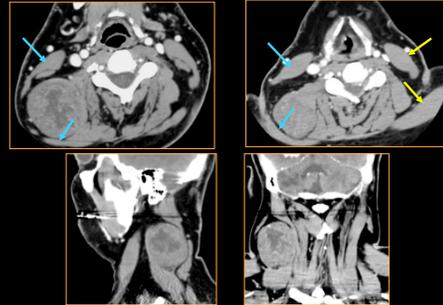
From Perkin D, et al. Atlas of Clinical Neurology

### Spinal Accessory Denervation

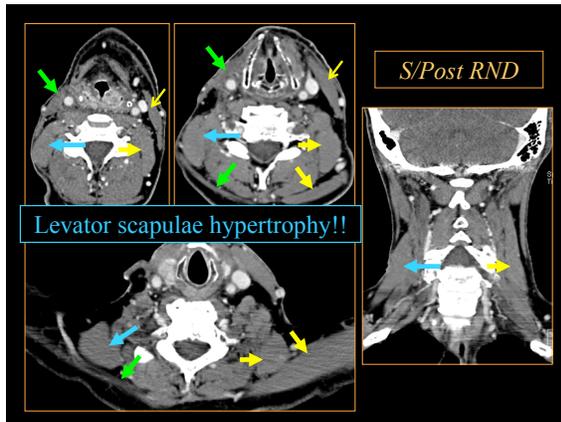


23M: Isolated Rt XI palsy-presumed post-viral

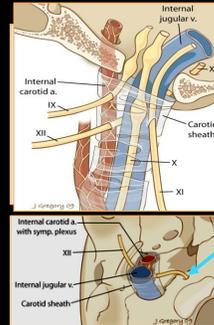
### XI Schwannoma



54M: Isolated Rt XI palsy

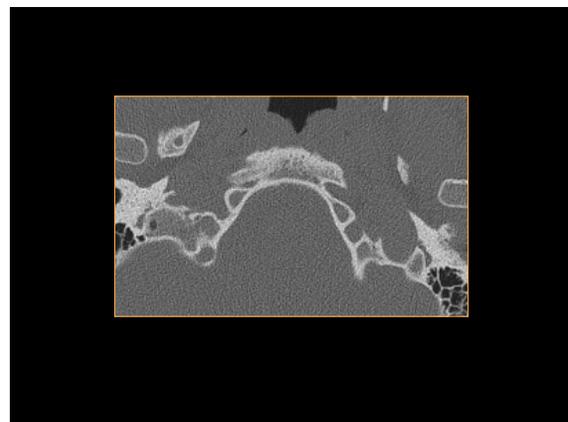
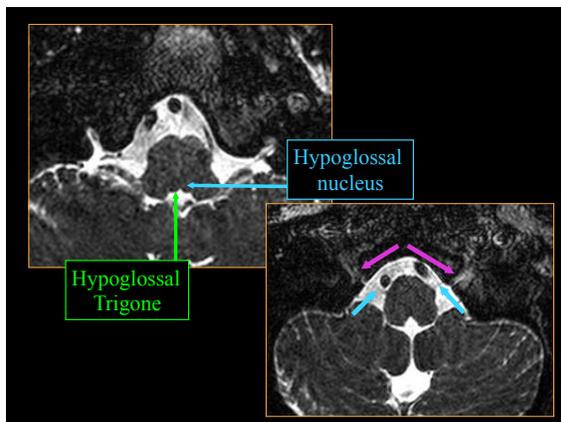


### Hypoglossal Nerve (XII)



- Nucleus in medullary tegmentum
- Rootlets exit brainstem in pre-olivary sulcus
- Exits skull - hypoglossal canal
- Enters the carotid sheath

Innervations: **Intrinsic and extrinsic tongue muscles**



**Central Hypoglossal Nerve Palsy**

- Lesion proximal to the hypoglossal nucleus
- Fasciculation of the tongue **without atrophy** on the affected side
- Tongue deviates to **OPPOSITE** side of lesion

© J Gregory '11

**Peripheral Hypoglossal Nerve Palsy**

- Lesion in or distal to the hypoglossal nucleus
- Paralysis **with atrophy** of the tongue muscles on the affected side
- Tongue deviates to **TOWARD** side of the lesion

© J Gregory '11

**Acute/subacute denervation: early fatty infiltration with hemitongue enlargement**

**2 weeks s/p l tonsillectomy**

**Early chronic denervation: fatty infiltration without volume loss**

**Late chronic denervation: fatty infiltration with significant volume loss**

**XII Schwannoma**

49M: Rt XII palsy

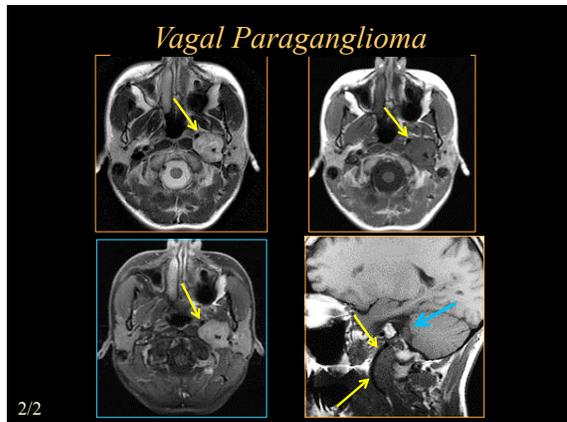
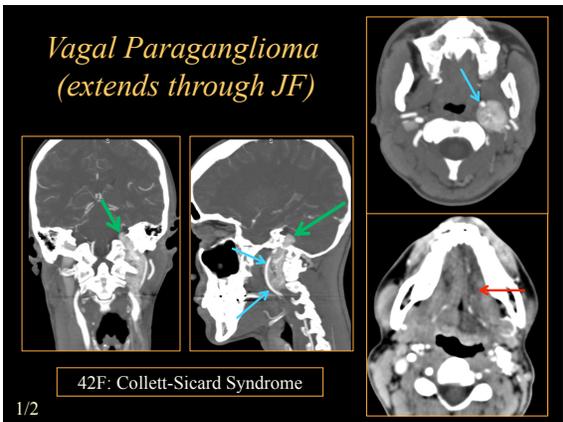
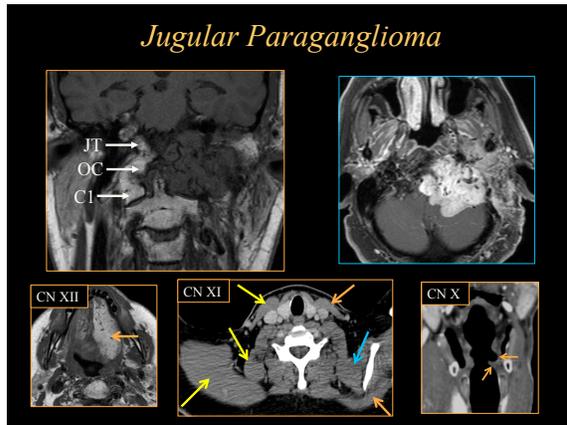
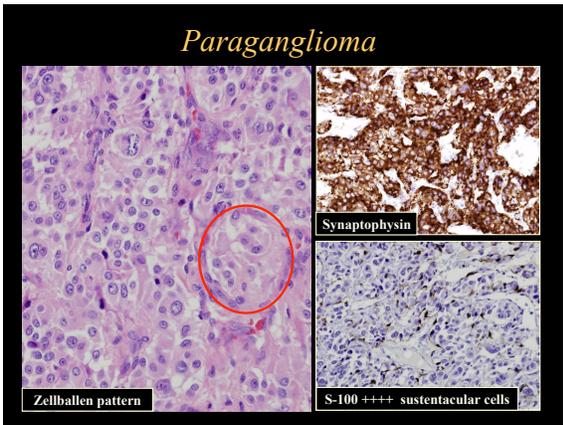
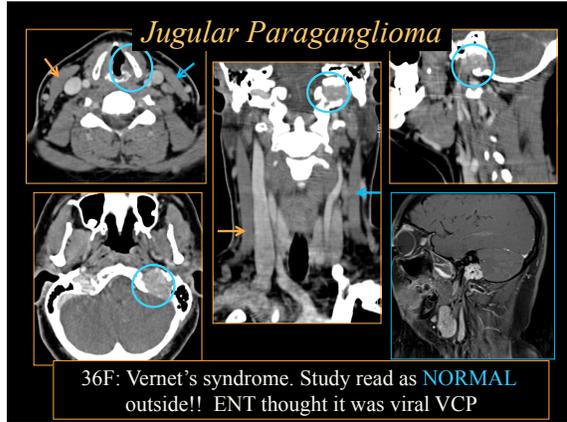
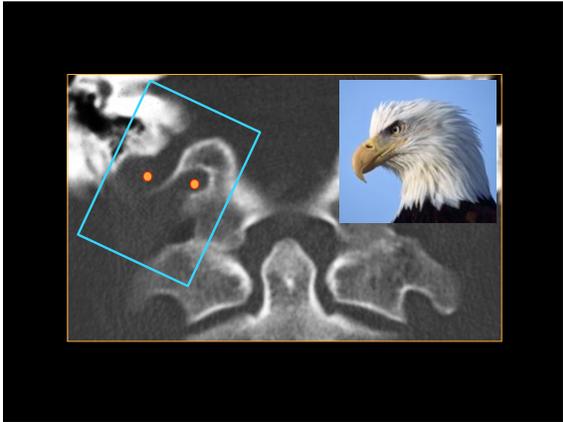
**ICA Pseudoaneurysm**

**Subacute atrophy**

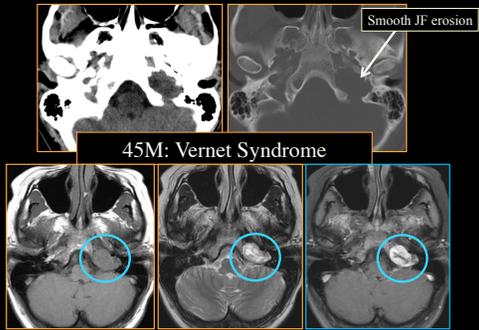
**Isolated XII palsy**

**Vernet (IX-XI) and Collett-Sicard Syndromes (IX-XII)**

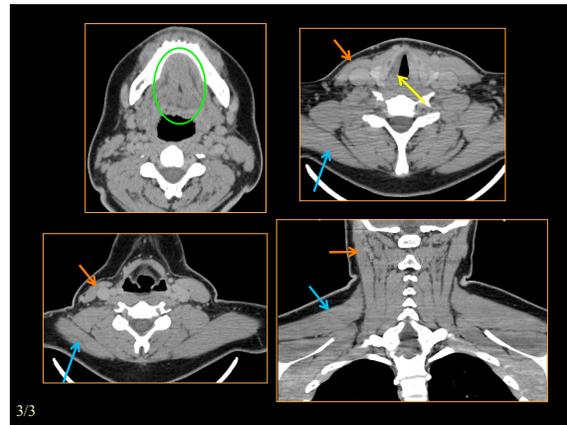
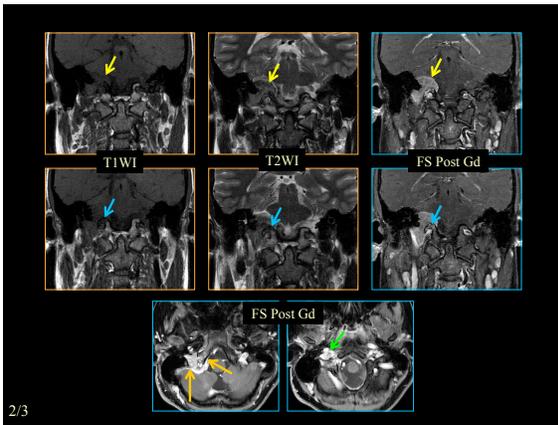
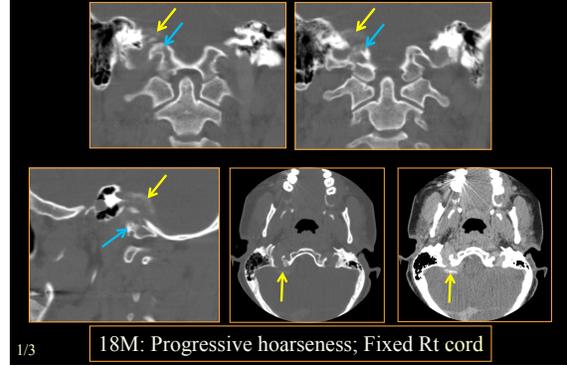
In patients with palsies of the lower four CNs, lesion lies at level of **skull base** or in **HIGH** carotid space just below BOS



### Vagal Schwannoma



### Jugular Meningioma



THANK YOU!!



Olgovango Delta, Botswana, 2012