**Imaging the Cranial Nerves CN 9-12**

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"The key to CN imaging!"
- Brainstem to 'end-organ' innervation
- Imaging the pathology
- MRI
- Clinical presentations & syndromes
- "red flag" findings

**FOUR STEPS TO CN IMAGING**

1. A (good!) clinical history
2. Tailor your MRI to that CN
3. Scrutinize the course of that nerve
   - Which segment is abnormal?
   - Are other nerves abnormal?
4. DDx is derived from the segment of nerve involved

**Cranial Nerves 9, 10 & 11**

**Anatomical points:**
- Complex shared brainstem nuclei
- Jugular foramen to carotid sheath

**Imaging points:**
1. If all nerves → jugular for / carotid sheath
2. If CN12 also → skull base mass
3. If hoarseness is presentation [CN10]
   - ?upper or lower vagal neuropathy?

**Imaging Neuropathies: CN9-12**

- **Anatomy**
- The key to CN imaging!
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- MRI
- Clinical presentations & syndromes
- "red flag" findings

- **Motor**
  - Nucleus ambiguus
  - Spinal access, nucleus (11)

- **Parasympathetic**
  - Inferior salivary (9)
  - Dorsal motor nucleus (10)

- **Sensory**
  - Nucleus solitarius (9+10)
  - Spinal tract nucleus of CN5

- **CN 9, 10 & 11**
  - Jugular foramen
  - Posterior skull base nerves
  - CN 9 Glossopharyngeal
  - CN10 Vagus
  - CN11 Accessory
  - CN12 Hypoglossal
**CN9 - Glossopharyngeal**

- **Jug. Foramen:** Jacobsen (sensory ME & parotid PS)
- **Motor:** stylopharyngeus
- **Parasympathetic:** carotid body
- **Taste:** posterior third tongue
- **Sensory:** palatal arch, post tongue, EAC

**Neck Branches**

- **PROXIMAL**
  - Pharyngeal plexus
  - Motor soft palate and sup & middle pharyngeal constrictors
  - Superior laryngeal n.
  - Motor infraradicular & cricothyroid
  - Sensory hypopharynx & supraglottic larynx

- **DISTAL**
  - Recurrent laryngeal n
  - Motor endolaryngeal m.
  - Sensory subglottis & cervical esophagus

**CN10 - Vagus**

- **Jug. Foramen:** Arnold’s n (sensory: ear, EAC, TM)
- **Neck:** Prox & distal vagal branches
- **Abdomen:** Parasymp & sensory to viscera, BP

**CN10 Vagus**

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  - Pharyngeal plexus
  - Motor soft palate and sup & middle pharyngeal constrictors
  - Superior laryngeal n.
  - Motor infraradicular & cricothyroid
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- **DISTAL**
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**Distal vagal neuropathy**

- Hoarseness only!
- Soft palate & constrictor muscles intact & intact gag reflex

**Reciprocal laryngeal nerve palsy**

- Medially rotated arytenoid
- Medial AE fold → dilated pyriform sinus
- Cord ‘hangs’ → enlarged ventricle
Motor:
Sternocleidomastoid & trapezius muscles

Anteriorly
- Pars Nervosa
- CN 9 & inferior petrosal sinus

Posteriorly
- Pars Vascularis
- CN 10 & 11 and internal jugular vein

Jugular Foramen DDx

- Schwannoma
  - Most often vagal nerve

- Glomus
  - Jugulare, jugulotympanicum

- Meningioma
  - En plaque, trans-jugular to carotid space

- Metastasis
  - Typically based in bone not CPA mass

56yr hoarseness and loss of sensation & taste in posterior tongue

Jugular Foramen Schwannoma
Left-sided hoarseness & pulsatile tinnitus

Glomus Jugulare

CT: smooth expansion, MR: sharply defined

Glomus Jugulare

CT: permeative, MR: flow voids

Meningioma

CT: hyperostosis, MR: dural tail

Metastasis

Typically based in bone not foramen

Jugular foramen DDx
CN 9, 10, 11

Schwannoma
CT: smooth expansion, MR: sharply defined

Glomus
CT: permeative, MR: flow voids

Meningioma
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Metastasis
Typically based in bone not foramen

46yr M
Hoarseness → DL
Left recurrent laryngeal nerve paralysis
CN10 & CN11

78-year-old man
Woke up one morning with hoarseness

Cardiovocal Syndrome
(Ortner syndrome)

Any nonmalignant thoracic process with RLNP
ASD, PDA, Eisenmenger's, PPH, thoracic aortic aneurysm
**Cranial Nerve 12**

- **Function:**
  - Innervates tongue muscles

- **Clinical presentation:**
  - Tongue moves towards side of injury

- **Imaging points:**
  1. Hypoglossal canal normally enhances
  2. Tongue denervation may be mistaken for pharyngeal tumor!

**CN12 Hypoglossal**

- **Landmarks:**
  - Inferior 4th– hypoglossal eminence
  - Pre-olivary sulcus
  - Hypoglossal canal

**Jug Foramen & Hypoglossal Canal**

- **Anteriorly**
  - Pars Nervosa
  - CN 9, IPS
- **Posteriorly**
  - Pars Vascularis
  - CN 10 & 11, IJV

**Hypoglossal Schwannoma**

- Tongue deviated to left, atrophic and fasciculations = CN12 denervation
Right CN12 denervation

Anatomy

The key to CN imaging!

Brainstem to innervation site

"red flag" findings

📍 CN12: Not tongue base tumor

Look to skull base for metastasis

SUMMARY CN9-12

Metastatic breast carcinoma

Left CN12 denervation