Cranial Nerves and Common Peripheral Lesions

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http://www.oucom.ohiou.edu/dbms-witmer/peds-rpac.htm

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Basic Organization of the Cranial Nerves

I. Olfactory nerve
II. Optic nerve
III. Oculomotor nerve
IV. Trochlear nerve
V. Trigeminal nerve
VI. Abducens nerve
VII. Facial nerve
VIII. Auditory nerve
IX. Glossopharyngeal nerve
X. Vagus nerve
XI. Accessory nerve
XII. Hypoglossal nerve
Olfactory Nerves (CN I)

- Anosmia: diminished sense of smell
  - Transient (non-neural): upper respiratory tract infection
  - Fracture of cribriform plate
  - Frontal lobe tumor
  - Purulent meningitis or hydrocephalus
- Testing: each nostril separately
  - As early as 32 weeks gestation
  - Familiar odors: coffee, peppermint

From Agur & Lee 1999
Optic Nerve (CN II)

- Optic nerve is technically CNS
- Complicated course from retina to visual cortex
- Quadrants of visual fields
  - temporal vs. nasal
  - upper vs. lower
- Crossing of axons in optic chiasm
- Info from left or right visual field is carried to contralateral visual cortex
- Info from upper or lower visual field is carried lower or upper side, respectively, of calcarine fissure

From Vaughan et al. 1999
Visual Field Defects

- Complicated but predictable
- Optic n.: ipsilateral blindness; retinal a. obstruction, retrobulbar optic neuritis
- Optic chiasm
  - Central: bitemp. hemianop., pituitary tumors, etc.
  - Lateral: ipsilat. nas. hemianop., carotid aneurysm
- Optic tract, radiations, cortex: contralat. homonym. hemianop., stroke, tumor, trauma, quadrantanopia

From Vaughan et al. 1999

From Agur & Lee 1999
Oculomotor N., Trochlear N., & Abducens N. (CN III, IV, & VI)

Oculomotor N. (CN III)
- Somatic innervation: superior, medial, & inferior rectus, inferior oblique, levator palpebrae
- Visceral innervation: constrictor pupillae, ciliary muscle (accommodation)

Trochlear N. (CN IV): superior oblique

Abducens N. (CN VI): lateral rectus
**Oculomotor N. (CN III)**

**Pupillary light reflex**
- afferent limb: retina, optic n., etc.
- efferent limb: visceral oculomotor fibers to constrictor pupillae
- Afferent limb crosses to contralateral side: consensual light reflex
- Oculomotor lesion: ipsilateral dilation but contralateral constriction

**Ophthalmoplegia: Oculomotor lesion**
- Causes: aneurysm, inflammation, cavernous sinus lesion, herniation of temporal lobe
- Effects: strabismus, diplopia, ptosis, mydriasis, downward abducted gaze, loss of accommodation

From Vaughan et al. 1999

From Wilson-Pauwels et al. 1988
Trochlear N. lesions

- Causes: aneurysm, inflammation, cavernous sinus lesion, herniation of temporal lobe (long course & thin caliber makes it delicate)
- Effects: strabismus, diplopia, extortion, weakness in depression & abduction of gaze

Head tilting

- Normally: eyes rotate in opposite direction of tilt
- Fourth nerve palsy compensation: intentionally tilt contralaterally so that normal eye intorts and lines up with affected eye

From Wilson-Pauwels et al. 1988
Abducens N. (CN VI)

Abducens N. lesions

• Causes: aneurysm, inflammation, cavernous sinus lesion, increased intracranial pressure, fourth ventricle lesions, lesions within cavernous sinus or superior orbital fissure, skull base fractures
• Effects: strabismus, diplopia, inability to abduct past midline
• Compensation for sixth nerve palsy: turn head contralaterally to align gaze

From Wilson-Pauwels et al. 1988
Trigeminal N. (CN V)

- Clinical testing: facial sensation corresponding to areas innervated by $V_1$, $V_2$, & $V_3$, masticatory strength, jaw jerk reflex, corneal reflex
- Trigeminal neuralgia (tic doloureux)
- Ophthalmic herpes zoster ("shingles")

From Agur & Lee 1999
Facial N. (CN VII)

Complicated!

- Motor: muscles of facial expression & some others
- Parasympathetic: stimulation of lacrimal, submandibular, sublingual glands, nasal/palatal mucosa
- Special sense: taste to anterior 2/3 of tongue and palate
- Somatic sense: small part of ear area

- Branches travel throughout the head
- Complexity provides basis for clinical testing

From Agur & Lee 1999
Facial N. (CN VII) Lesions & Their Consequences

Sites of lesions and their manifestations

1. Intracranial and/or internal auditory meatus.
   All symptoms of 2, 3 and 4, plus deafness due to involvement of eighth cranial nerve

2. Geniculate ganglion.
   All symptoms of 3 and 4, plus pain behind ear. Herpes of tympanum and of external auditory meatus may occur

3. Facial canal.
   All symptoms of 4, plus loss of taste in anterior tongue and decreased salivation on affected side due to chorda tympani involvement. Hyperacusia due to effect on nerve branch to stapedius muscle

   Facial paralysis (mouth draws to opposite side; on affected side, patient unable to close eye or wrinkle forehead; food collects between teeth and cheek due to paralysis of buccinator muscle)

From Netter 1986
Facial N. (CN VII) Lesions & Their Consequences

Lower Motor Neuron Lesions (LMNL)
- lesion of facial nucleus or more peripheral
- Ipsilateral effects on both upper and lower quadrants of face

Upper Motor Neuron Lesion (UMNL)
- Supranuclear lesion (e.g., cortex)
- Contralateral effects on lower quadrant only
- Upper quadrant receives input from both hemispheres whereas lower quadrant only contralateral input

From Wilson-Pauwels et al. 1988
Auditory N. (CN VIII)

(= Vestibulocochlear, Acoustic N.)

- No extracranial course
- Hearing and equilibrium

- Tumors within internal auditory meatus (acoustic neuromas, meningiomas) will affect not only CN VIII but also CN VII
- A variety of more central lesions or lesions of the end organs (cochlea or labyrinth) can affect hearing, equilibrium, the oculovestibular reflex, etc., producing deafness, vertigo, nystagmus, etc.
Glossopharyngeal N. (CN IX) • motor to stylopharyngeus, parasympathetic outflow to parotid gland, sensation from carotid body & sinus, taste from posterior 1/3 of tongue, somatic sensation from posterior 1/3 of tongue and pharynx • Tested by gag reflex

Vagus N. (CN X) • motor to most all muscles of pharynx & palate; parasympathetic outflow to and visceral sensation from cervical, thoracic, & abdominal viscera; somatic sensation from small areas • Tested by symmetry of palatal elevation; recurrent laryngeal branch commonly injured with effects on glottis

Accessory N. (CN XI) • Motor to sternocleidomastoid & trapezius • Tested by strength of lateral neck rotation & shoulder shrug
Hypoglossal N. (CN XII)

- Innervates all tongue muscles except one
- Lesions uncommon, often due to congenital abnormalities in region of foramen magnum
- Lower Motor Neuron Lesion (LMNL)
  - Peripheral to brain stem
  - Ipsilateral atrophy & deviation
- Upper Motor Neuron Lesion (UMNL)
  - Supranuclear (e.g., cortex)
  - Contralateral atrophy & deviation

From Wilson-Pauwels et al. 1988
References


