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Management of the Patient with Facial Paralysis

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Day 1

The face is the image of the soul
Outline

**Webinar 1**
- Anatomy and Physiology of the Facial Nerve
- Etiology of Facial Paralysis
  - Central
  - Peripheral*
    - Bell's palsy
- Impairments, Functional Limitations, and Disability

**Webinar 2**
- Evaluation
- Assessment
- Treatment
- Case Studies
Anatomy of the Facial Nerve

Cranial Nerve VII

Intracranial vs. Exacranial
Intracranial: Facial Nerve

- The motor nucleus of the FN arises in the pons, as both a motor and sensory root. It then traverses through the internal acoustic meatus.

- Enters the S shaped facial canal where the two roots form the facial nerve, then come together as the geniculate ganglion, then gives rise to the
  - greater petrosal nerve
  - stapedius nerve
  - chorda tympani

- Exits the canal at the stylomastoid foramen, just below the mastoid process to form the extracranial branches of the facial nerve

- Segments of facial nerve: pontine, meatal, labyrinthine, tympanic, mastoid

Intracranial branches: Facial Nerve

**Greater petrosal nerve**: (parasympathetic fibers)
- lacrimal gland

**Chorda Tympani nerve**: (sensory and parasympathetic fibers)
- anterior 2/3 of the tongue
- Salivary glands: Submandibular and sublingual

**Stapedius nerve** (motor fibers)
- Stapedius muscles of the middle ear
Extracranial: Facial Nerve

- **Cervical Branch**: Innervates the platysma.
- **Zygomatic Branches**: Innervate the orbicularis oculi.
- **Buccal Branches**: Innervate the orbicularis oris, buccinator, and zygomaticus.
- **Marginal Mandibular Branch**: Innervates the mentalis.

An anterior view showing superficial muscles on the right side of the face, and deeper muscles on the left side of the face.

- Epicranial aponeurosis
- Frontal belly of occipitofrontalis
- Orbicularis oculi
- Nasalis
- Zygomaticus minor
- Zygomaticus major
- Orbicularis oris
- Risorius
- Platysma
- Mentalis (cut)
- Temporalis
- Corrugator supercilli
- Procerus
- Levator labii superioris
- Levator anguli oris
- Masseter
- Buccinator
- Depressor anguli oris
- Depressor labii inferioris
- Thyroid cartilage of the larynx
- Clavicle
<table>
<thead>
<tr>
<th>Branch of CN VII</th>
<th>Muscle</th>
<th>Actions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Posterior auricular</td>
<td>Posterior auricular</td>
<td>Pulls ear backward</td>
</tr>
<tr>
<td></td>
<td>Occipitofrontalis, occipital belly</td>
<td>Moves scalp backward</td>
</tr>
<tr>
<td>Temporal</td>
<td>Anterior auricular</td>
<td>Pulls ear forward</td>
</tr>
<tr>
<td></td>
<td>Superior auricular</td>
<td>Raises ear</td>
</tr>
<tr>
<td></td>
<td>Occipitofrontalis, occipital belly</td>
<td>Moves scalp forward</td>
</tr>
<tr>
<td></td>
<td>Corrugator supercilii</td>
<td>Pulls eyebrow medially and downward</td>
</tr>
<tr>
<td></td>
<td>Procerus</td>
<td>Pulls medial eyebrow downward</td>
</tr>
<tr>
<td>Temporal and zygomatic</td>
<td>Orbicularis oculi</td>
<td>Closes eyelids and contracts skin around eye</td>
</tr>
<tr>
<td>Zygomatic and buccal</td>
<td>Zygomaticus major</td>
<td>Elevates corners of mouth</td>
</tr>
<tr>
<td></td>
<td>Zygomaticus minor</td>
<td>Elevates upper lip</td>
</tr>
<tr>
<td></td>
<td>Levator labii superiors</td>
<td>Elevates upper lip and midportion nasolabial fold</td>
</tr>
<tr>
<td></td>
<td>Levator labii superiors alaeque nasi</td>
<td>Elevates medial nasolabial fold and nasal ala</td>
</tr>
<tr>
<td>Buccal</td>
<td>Risorius</td>
<td>Aids smile with lateral pull</td>
</tr>
<tr>
<td></td>
<td>Buccinator</td>
<td>Pulls corner of mouth backward and compresses cheek</td>
</tr>
<tr>
<td></td>
<td>Levator anguli oris</td>
<td>Pulls angles of mouth upward and toward midline</td>
</tr>
<tr>
<td></td>
<td>Orbicularis</td>
<td>Closes and compresses lips</td>
</tr>
<tr>
<td></td>
<td>Nasalis, dilator naris</td>
<td>Flares nostrils</td>
</tr>
<tr>
<td></td>
<td>Nasalis, compressor naris</td>
<td>Compresses nostrils</td>
</tr>
<tr>
<td>Buccal and marginal mandibular</td>
<td>Depressor anguli oris</td>
<td>Pulls corner of mouth downward</td>
</tr>
<tr>
<td></td>
<td>Depressor labii inferioris</td>
<td>Pulls lower lip downward</td>
</tr>
<tr>
<td>Marginal mandibular</td>
<td>Mentalis</td>
<td>Pulls skin of chin upward</td>
</tr>
<tr>
<td>Cervical</td>
<td>Platysma</td>
<td>Pulls down corners of mouth</td>
</tr>
</tbody>
</table>
Central Connections

Voluntary facial expressions arise from efferent discharge from the motor face of the cerebral cortex. Signals from the cortex travel through the corticobulbar tract to the internal capsule, through the upper midbrain to the lower brainstem, where they synapse in the pontine facial nuclei. Lower facial muscle fibers then cross over to the contralateral side, whereas the fibers of the upper facial muscles receive bilateral cortical input.

Lower facial muscle fibers

Upper facial muscles receive inputs from both motor cortex

A. Facial nerve lesion (Bell's palsy)

B. Supranuclear lesion

Nucleus of facial nerve (cranial nerve VII)

Lesion in facial nerve

Facial nerve

Supranuclear lesion

Facial nerve

CONTINUED

7
Etiology of Facial Paralysis

Bell’s Palsy

- Acute inflammatory process of the facial nerve, causing rather sudden (over the course of 12-72 hours) unilateral facial paralysis
- Likely due to the Herpes Simplex Virus (HSV-1) that lives in the geniculate ganglion
- Almost always unilateral
Bell’s Palsy

- First described by Sir Charles Bell in 1800s, defined as “acute peripheral facial nerve palsy of unknown cause”
- Accounts for ~ ½ of all cases of facial palsy
- Annual incidence between 13-34/100,000 (<.02% of the population)
- No race, gender or geographic predilection
- Diabetes is present in 5-10% of patients
- 3x greater in pregnancy
- Treated with Prednisone and Valtrex


Prognosis of Bell’s Palsy

- ~85% of people who get BP recover spontaneously (as early as 3 weeks, and can continue to recover spontaneously up to 6 months)
- Facial Rehab typically for the 15% who don’t make the spontaneous recovery
  - No evidence to suggest that early intervention makes a difference in long term outcome
  - Arrive at FNC after 6 months
- Prognosis is more favorable if
  - Recovery began within 3 months of onset
  - You are younger
  - You received steroids and antivirals
Etiology of Facial Paralysis (continued)

Ramsey Hunt Syndrome
- Acute inflammatory process caused by the Herpes Zoster Virus or Varicella Zoster (HZV),
  - manifested with blisters on the pinna/canal
  - typically effects cranial nerve VIII as well (vertigo, imbalance, and hearing loss), and pain
  - Unilateral

Lyme Disease
- Infectious disease caused by the Borrelia bacteria, that is carried by a deer tick
  - Unilateral, but can be bilateral

Etiology of Facial Paralysis (continued)

- **Tumors**
  - Facial nerve schwannomas
    - Abnormal formation of schwann cells on the facial nerve
    - Occurs anywhere along the course of the FN within canal
  - Facial nerve or geniculate ganglion hemangiomas
    - Rare benign vascular malformations
    - Occurs anywhere along the FN, with predilection for the geniculate ganglion
  - Acoustic neuroma (vestibular schwannoma)
    - Tumor of abnormal schwann cells, near the cerebellopontine angle at the vestibulochochlear nerve
    - **Surgical trauma to the FN within the parotid or temporal bone, or posterior fossa.**
Acoustic Neuroma

- Clinical signs:
  - Asymmetric hearing loss
  - Imbalance/Dizziness
  - Abnormal facial sensation...less often facial weakness

- Diagnosed:
  - Hearing test/audiogram
  - CT with contrast, MRI

- Treated:
  - Surgical removal
  - XRT
  - Watchful waiting

- Risks of surgery
  - Imbalance/dizziness, hearing loss, headaches,
  - FACIAL PARALYSIS, 4-15%

Acoustic Neuroma

Symptoms Present at time of Diagnosis
Meta-Analysis

[Bar chart showing symptoms present at time of diagnosis with error bars for Hearing Loss, Tinnitus, Headache, Balance Disturbance, Facial Weakness, Facial Numbness, Lower CN Palsy]
Etiology of Facial Paralysis
(continued)

- Parotid Gland Tumors (extracranial)
- Otitis Media
- Trauma: temporal bone fractures
  Immediate paralysis: nerve transection
  Delayed paralysis: severed or stretched or inflamed
- Autoimmune: Sarcoidosis, Melkerson Rosenthal, Guillain Barre Syndrome
  - Usually Bilateral Facial Paralysis

Etiology of Facial Paralysis
(continued)

Central Nervous System Disorders

- Stroke
- Multiple Sclerosis
- Following brainstem tumor excisions
Etiology of Facial Paralysis: Congenital

-**Unilateral**
  - Facial nerve trauma related to delivery (forceps)
  - Lack of development of the facial nerve in utero

-**Bilateral**
  - Moebius Syndrome
  - Neurofibromatosis -2

Recurrent Facial Paralysis

- Recurrence of FP typically indicate a tumor, (hemangioma) or autoimmune disease
- Recurs in Bell’s Palsy, ~ 12% chance
  - Recurrence is more likely in people with a family history of BP
    - 36% on same side, but work up for other causes (tumor)
    - 64% on opposite side
Evaluation of Facial Paralysis

- **History**
- **Clinical Exam**
  - Sensation
  - Cranial nerves: hearing /balance
  - Palpation: mass
  - Physical Examination: Motor
    - Forehead elevation*
    - Eye closure
    - Wrinkle nose
    - Pucker lips
    - Smile
    - Show lower teeth
    - SYNKINESIS

**Synkinesis**

- Defined as aberrant nerve regeneration following nerve injury
- Results in misrouting of nerve fibers as the fibers grow back
- Results in unwanted movement, during intended movement; *e.g. eye closure when puckering*
- Can be the most disfiguring, discouraging sequela of peripheral facial nerve injury
- **BP/RH/LD: incomplete recovery develop synkinesis**
Results in misrouting of nerve fibers as the fibers grow back
Examples of Synkinesis

Eye closure:
- Cheek, chin, and neck contract
- Zygomaticus, mentalis, and platysmal synkinesis

Pucker
- Eye, chin and neck contract
- Ocular, mentalis and platysmal synkinesis

Examples of Synkinesis

Smile:
- Eye, chin and neck contract
- Ocular Platysmal and Mentalis Synkinesis with Smiling
House-Brackmann Scale

<table>
<thead>
<tr>
<th>Grade</th>
<th>Description</th>
<th>Characteristics</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>Normal</td>
<td>Normal facial function in all areas</td>
</tr>
<tr>
<td>II</td>
<td>Mild dysfunction</td>
<td>Slight weakness noticeable on close inspection; may have very slight synkinesis</td>
</tr>
<tr>
<td>III</td>
<td>Moderate dysfunction</td>
<td>Obvious, but not disfiguring, difference between 2 sides; noticeable, but not severe, synkinesis, contracture, or hemifacial spasm; complete eye closure with effort</td>
</tr>
<tr>
<td>IV</td>
<td>Moderately severe dysfunction</td>
<td>Obvious weakness or disfiguring asymmetry; normal symmetry and tone at rest; incomplete eye closure</td>
</tr>
<tr>
<td>V</td>
<td>Severe dysfunction</td>
<td>Only barely perceptible motion; asymmetry at rest</td>
</tr>
<tr>
<td>VI</td>
<td>Total paralysis</td>
<td>No movement</td>
</tr>
</tbody>
</table>
Evaluation of Facial Paralysis

- Laboratory/Blood Tests: Lyme, autoimmune disease
- Radiographic Tests: CT and MRI to identify skullbase tumors
- Hearing and Balance tests: Audiogram and Vestibular Lab for acoustic neuromas
- Electrophysiological Tests: ENoG, EMG

Diagnostic testing: Electrophysiology

- Electroneuronography (ENoG)
  - When greater than 90% degeneration of the nerve is present, the prognosis for return of function is quite poor
  - Must be done within 3-7 days
  - May be candidate for Facial Nerve Decompression
- Electromyogram (EMG)
  - Used to determine any residual function or prognosis. Fibrillations indicate poor prognosis and will not be observed before 2 weeks has elapsed from the time of the original insult
Impairments

Acute:
• Motor Loss of the facial muscles, unilateral/bilateral
• Impaired taste sensation (anterior 2/3 of tongue)
• Hypo lacrimation
• Hyperacusis
• Pre- or post- auricular pain

Chronic:
• Muscle atrophy: hypotonic
• Muscle stiffness: hypertonic
• Synkinesis
• Pain

Functional Limitations

• Incomplete eye closure: dry or teary, corneal abrasion
• Inability to move the corner of mouth: smile, laugh
• Inability to pucker lips: drink, blow out candles, brush teeth/spit, whistle, kiss
• Articulation difficulties: bilabial sounds –m, b, p, w
• Expression of emotions
Disability

- Social isolation/Depression
- Avoid being in photos
- Unable to eat in public/restaurants
- Unable to work due to articulation difficulties, visual dysfunction, pain, cosmesis