CHAPTER 11

FACIAL PARALYSIS

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The facial nerve innervates a total of 23 paired muscles and the orbicularis oris muscle. The majority of muscles innervated by the facial nerve act in facial expression, and, thus, are critical structures for communication. As a result, facial paralysis can pose both social and physical consequences for the patient. While numerous procedures for facial reanimation exist, it is important to acknowledge that no reconstructive technique is able to reproduce the delicate balance between all mimetic muscles.

I. FACIAL NERVE ANATOMY (CRANIAL NERVE VII)

A. Exits skull base from the stylomastoid foramen
B. Derived from the 2nd branchial arch
C. Landmarks for identification
   1. Tympanomastoid suture – medial to the suture line
   2. Tragus – 1 cm inferior and deep to the tragal pointer
   3. Posterior belly of the digastric muscle – Found midway between muscle and styloid process
D. Travels within the substance of the parotid gland
E. Parasympathetic innervation – Lacrimal, submandibular, and sublingual glands
F. Sensory innervation – Tympanic membrane, external auditory canal, and auricular concha
G. Taste – Anterior 2/3 of the tongue
H. 5 motor branches which control facial mimetic muscles (Figure 1)
   1. Temporal branch
      a. Within the temporoparietal fascia (Figure 2, 3)
      b. Falls on a line from 0.5 cm below tragus to 1.5 cm above the lateral brow (Pitanguy’s line)
      c. Brow depression/elevation
   2. Zygomatic branch
      a. Eyelid closure
      b. Elevation of the oral commissure
   3. Buccal branch
      a. Elevation of the oral commissure
      b. Upper lip elevation
      c. Nostril flaring and compression
      d. Cheek compression
   4. Marginal mandibular nerve
      a. Superficial to the facial artery/vein
      b. Above the inferior border of the mandible when anterior to the facial vessels
      c. Oral commissure depression
d. Chin elevation/dimpling

5. Cervical branch
   a. Oral commissure depression


Figure 3. Anatomic course of the frontal (temporal) branch of the facial nerve. From Agarwal C, et al. The course of the frontal branch of the facial nerve in relation to fascial planes: An anatomic study. Plast Reconstr Surg 2010;125:532-7.

II. MIMETIC MUSCLES

A. Constrictors or expanders of sphincters
   1. Elevators or depressors expand
   2. Constrictors
      a. Orbicularis oculi
      b. Orbicularis oris
      c. Buccinator
      d. Nasalis

B. Innervation from deep surface for most mimetic muscles. Exceptions are buccinators, levator anguli oris, and mentalis which are innervated on superficial surface.

III. CAUSES OF FACIAL PARALYSIS

A. Idiopathic
   1. Bell’s palsy
      a. Most common cause of unilateral facial palsy in adults
      b. Not addressed surgically; managed with steroids and antivirals
      c. May take up to 6 months to resolve
B. Trauma
1. Neurotransmitter depletion within 72 hours after injury
2. Repair should be performed within 72 hours so that nerve stimulator can be used
3. Facial nerve arborizes anterior to the lateral canthus; repair in trauma anterior to lateral canthus is not generally performed. Redundancy exists among muscle innervation by multiple arborizing branches; Exception: temporal and marginal mandibular branches.
4. Frey syndrome – “gustatory sweating” – is a result of injury to the auriculotemporal nerve, a branch of the trigeminal nerve

C. Infectious
1. Herpes zoster (Ramsey-Hunt-Syndrome)
2. Lyme disease – may be bilateral

D. Tumors - Cholesteatoma, neurofibromas, meningioma

E. Congenital - Moebius syndrome
1. CN VI and VII
2. CN VI controls eye abduction

F. Iatrogenic – Tumor extirpation or traumatic delivery (facial nerve is more superficial in children)

IV. HISTORY AND PHYSICAL EXAM

A. History
1. What are the signs/symptoms concerning for the patient?
2. When did the signs/symptoms begin?
3. Any inciting factors related to causes (see above)

B. Physical Exam
1. Forehead/frontalis muscle function
   a. Eyebrow elevation
   b. Symmetric/asymmetric forehead rhytids
   c. Unilateral versus bilateral
2. Eyes and Eyelids/orbicularis oculi muscle function
   a. Facial nerve controls eyelid closure through the orbicularis oculi muscle
   b. Intact Bell’s phenomenon
   c. Dry eye
   d. Conjunctival injection
   e. Lagophthalmos
   f. Lower lid ectropion
   g. CN III controls levator palpebrae superioris muscle (eyelid elevation)
   h. Sympathetic nerves control Mueller muscle (eyelid elevation)
3. Ears – change in hearing (stapedius muscle)
4. Midface/nose
   a. Difficulty breathing through each nostril
   b. Asymmetry of nasolabial folds
5. Lower face and mouth
a. Asymmetric smile
b. Oral incompetence/drooling
c. Difficult with keeping cheeks puffed out with air
d. Inability to dimple the chin

6. Synkinesis (mass movement) occurs when two different groups of muscles are inappropriately innervated by the same branches of the facial nerve.
   a. The more proximal the injury, the greater the expected degree of mass movement.
   b. Example: Twitching of the upper lip with eyelid closure

V. MANAGEMENT

A. Testing
   1. Electromyography (EMG) – needle insertion into muscle groups.
      a. Fibrillations indicate denervation.
      b. Does not become positive until 2 – 3 weeks after onset of paralysis
         i. Should be considered after 3 weeks
   2. Electroneurography
      a. Evaluates the nerve/muscle unit
      b. Compound muscle action potentials (CMAPs) – summation of the action potentials from muscle fibers innervated by queried nerve. Compare normal side with the injured side.

B. Non-surgical management
   1. Determine symptoms which pose risk to patient or which bother the patient most
   2. Corneal dryness
      a. Risk of ulceration and blindness
      b. Night time lubricant and artificial tears
   3. Botulinum toxin
      a. Prevents acetylcholine release across neuromuscular junction
      b. Lasts 2-6 months
      c. Treat facial asymmetry by weakening the normal side
      d. Treat synkinesis by weakening the inappropriate motor function
   4. Physical therapy – biofeedback using mirror to rehabilitate during recovery

C. Surgical options
   1. Direct nerve repair or nerve grafting can be performed for immediately identified injuries
   2. Chronic paralysis
      a. Forehead/upper face
         i. Brow lift
            a) Improve brow asymmetry
            b) Reduce vision obstruction caused by brow ptosis
            c) Beware of causing corneal exposure
         ii. Botox to contralateral side
            a) Improve asymmetry with the paralyzed contralateral side
b) May cause ipsilateral brow ptosis

b. Eyes and eyelids
   i. Gold weight in upper lid to improve eyelid closure
   ii. Lower lid tightening to treat ectropion
      a) Lower lid canthoplasty
      b) Mid-face lift
   iii. Temporalis muscle transfer

c. Midface/Nose
   i. Spreader grafts to treat internal nasal valve collapse
   ii. Alar grafts to treat external nasal valve collapse
   iii. Filler or fat grafting to address nasolabial fold asymmetry
   iv. Unilateral facelift to address nasolabial fold asymmetry

d. Lower face and mouth
   i. Unilateral facelift to improve symmetry
   ii. Static sling using fascia lata, acellular dermal matrix, or other graft material
      a) Attach to the modiolus to raise the corner of the mouth
         i. Muscle transfers
      b) Temporalis muscle transfer procedure (McLaughlin procedure) (innervated by CN V)
      c) Temporalis turnover procedure (Rubin procedure) (innervated by CN V)
      d) Masseter transfer (innervated by CN V)
   iii. Nerve transfer
      a) Masseteric or hypoglossal nerve to facial nerve
      b) Requires training to coordinate use of the nerve
      c) Hypoglossal nerve transfer may result in partial tongue atrophy
   iv. Free functional muscle transfer
      a) Two-stage vs. single-stage
      b) Cross-facial nerve graft (CFNG)
         i) Two-stage repair
         ii) Sural nerve from contralateral facial nerve tunneled across
             the upper lip to the ipsilateral side
         iii) Allow 9-12 months for nerve to grow across
         iv) Observe Tinel sign to confirm nerve growth
         v) Free functional muscle transfer (most commonly gracilis muscle)
      c) Single-stage free functional muscle transfer uses the ipsilateral
         motor nerve to the masseter as a donor
      d) Gracilis muscle
         i) Perform 9-12 months after CFNG (two-stage reconstruction)
            vs. direct nerve coaptation to ipsilateral motor nerve to the
            masseter (single-stage reconstruction)
         ii) Innervated by the anterior branch of the obturator nerve
         iii) Blood supply from medial circumflex femoral artery
         iv) Set tension based on resting tension present at the donor site
VI. REFERENCES


