Intraoperative Facial Nerve Monitoring

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Indications

- CP angle tumor surgery
- Microvascular Decompression
- Parotid surgery
- Other otologic surgeries
  - Congenital aural atresia
  - Chronic otitis media and Cholesteatoma
  - Revision tympanomastoidectomy
Intraoperative Facial Nerve Monitoring

Techniques

• Video analysis of facial movement
• Electromyography (CMAP)
• Nasal muscle F-wave
• Sensitive detectors on face (facial nerve activity)
• Compound facial nerve action potential (CNAP)
Electromyography

• Equipments
  – Stimulator
  – Detector (& amplifier)
  – Monitor
    • Video
    • Audio

Monopolar
• connected to cathode
   (anodal return in the periphery of wound)

Bipolar
• Several types including “stimulus dissectors”
Electromyography

- Equipments
  - Stimulator
  - Detector (& amplifier)
  - Monitor
    - Video
    - Audio

- Video
- Audio

- Intraoperative Facial Nerve Monitoring

- Subdermal
  - Bipolar (Larger uninsulated surface)
  - Monopolar

- Hypodermal (hook wire)
  - higher impedance -> Not routine use
  - Useful when electrodes cannot be easily fastened with tape
Electromyography

- Equipments
  - Stimulator
  - Detector ( & amplifier)
- Monitor
  - Video
  - Audio
Electromyography

• Setting
  – Anesthesia
    • No paralytic agents should be used
    • No injection near the stylomastoid foramen
  – Correct functioning of system
    • Checking other nerves or muscles
    • Stimulus artifact
      – Absence of any artifact → open circuit
  – Locate & Stimulate facial nerve
Electromyography

- **Output:**
  - Spontaneous Activity
  - Mechanically evoked Activity
  - Electrically evoked Activity
Electrically Evoked Activity

- **Stimulation Criteria**
  - Constant voltage
  - Constant Current

**Ohm’s rule**

\[
\text{Voltage (Volt)} = \text{Current (Amp)} \times \text{Resistance (Ohm)}
\]

Intraoperative Facial Nerve Monitoring
Electrically Evoked Activity

• Electrical Stimulation
  – Mapping
    • Ruling out the presence of nerve in the field of dissection (1 Volt)
    • Map the precise location (0.05 – 0.3 Volt)
  – Functional Integrity after operation (0.05 – 0.3 Volt)
  – Nervus Intermedius
    • Important to prevent confusing it with facial nerve
    • Response only in orbicularis oris
    • long latency, low amplitude, higher in threshold
Electrically Evoked Activity

• Predictor of post operative function
  ➢ Response with Low threshold stimulation at brainstem
    good
    but not infallible (because of transient or delayed onset)

  ➢ No response with Suprathreshold stimulation
    post op. facial dysfunction (particularly short term)
Spontaneous Activity

• Ongoing EMG activity often is an indirect indicator of depth of anesthesia

• Spontaneous EMG activity may not be a reliable warning sign in large tumors
Mechanically Evoked Activity

• Burst activity
  • Direct mechanical nerve trauma
  • Free irrigation
  • Application of pledgets soaked with lactated Ringer’s
  • Electrocautery

– **Small amplitude** (less than 500 μV in amplitude) is not of major concern
– **Large amplitude**: a degree of facial nerve injury
Mechanically Evoked Activity

- **Train (tonic) activity** (according to frequency)
  - **A.** High frequency (>50 Hz) (Bomber activity)
  - **B.** Low frequency (<50 Hz) (Popcorn activity)
  - **C.** Irregular (Overlapping)
Mechanically Evoked Activity

- **Train (tonic) activity** (according to response)
  - **Silent** (no response with irritation)
  - **Ordinary** (response but not with mild irritation)
  - **Irritable** (response with mild irritation)
  - **Stray** (continuation of response after stopping irritation)
Limitations of EMG monitoring

- Low specificity
  - artifact:
    - Crackly sound
    - Appear in multiple channels

- Useless during electrocautery
  - Improving with:
    - Video monitoring adjunct to EMG
    - Test with electrical stimulation before electrocautery

- Evaluating integrity only after access to it
Thanks for Your Attention