Laryngeal Electromyography
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Introduction
• An electrophysiological test used to evaluate the integrity of the laryngeal motor system
• By recording the bioelectrical potentials generated in intrinsic laryngeal muscles, viz. thyroarytenoids, cricothyroid, posterior cricoarytenoids, lateral cricoarytenoids and interarytenoids; and at times, the crico-pharyngeus.

EMG apparatus
• An active recording electrode
• Reference electrode
• Amplifier (to amplify signals)
• Signal is displayed on a cathode ray oscilloscope
• Can be heard through a loudspeaker
• Thus, amplified signal can be monitored visually and acoustically

Electrodes
The choice of electrode depends on the examination required.
• Surface electrodes → sum of all the individual potentials of muscles → can be placed in skin or ETT
• Intramuscular electrodes → needle or wire-based
• Implantable electrodes → For intra-operative monitoring of the RLN.

Basic components of LEMG
LEMG is conducted and evaluated in 4 parts, viz.:-
1. During insertion
2. At rest
3. During minimal voluntary activity
4. During maximal voluntary activity

• The normal laryngeal motor unit potential is biphasic with an upward positive spike and a downward negative spike. It has an amplitude of 200 to 500 microvolts and a duration of approximately 5 to 6 milliseconds.

• Insertional activity
  o Produced as the needle is introduced into the muscle
  o Result of a relative change in the electrical field surrounding the muscle membrane
  o Prolonged during early nerve and muscle injuries
  o Shortened → Late injury with scar tissue or fat, which insulates the remaining muscle fibers

• Spontaneous electrical activity
Normally absent in a resting muscle
- Occurs in denervated muscle with unstable electrical charges
  - **Fibrillation**
    - Biphasic or triphasic appearance with an initial positive deflection.
    - “Machine gun firing” noises on the loudspeaker
    - 2-3 wks after denervation
  - **Complex repetitive discharges**
    - Bizarre configuration
    - Abrupt onset and cessation
    - Seen in chronic neuropathic and myopathic processes
  - **Myotonic potentials**
    - Repetitive discharges
    - Amplitude and frequency wax and wane
    - Producing “dive bomber” sound on the loudspeaker
    - Seen in myotonic dystrophy
  - **Polyphasic**
    - As regeneration proceeds
    - Have greater amplitudes than normal
  - **Recruitment**
    - Observed as an increase in the number and density of motor unit potentials
    - Reflects the degree of innervation of a given muscle.

- Morphology of the motor unit potential is evaluated during minimal voluntary muscle contraction
- Interference pattern and recruitment are evaluated during maximal muscle contraction.

### Current uses of Laryngeal Electromyography

**A. As a diagnostic / prognostic tool:**
1. Immobile vocal cord
   - Vocal cord palsy
   - Posterior glottic stenosis
   - Crico-arytenoid ankylosis
   - Crico-arytenoid joint arthritis
   - Arytenoid dislocation
2. Site of lesion testing and prognosis
   - To differentiate between
     - High vagal nerve palsy
     - Superior laryngeal nerve paresis
     - Recurrent laryngeal nerve paresis
3. Work up in Vocal fold paresis
   (a) Sulcus vocalis and atrophy
   (b) Superior laryngeal nerve paralysis or paresis
   (c) Recurrent laryngeal nerve paralysis or paresis
   (d) Cricoarytenoid joint arthrodesis

4. Evaluation of Spasmodic dysphonias, tremors and laryngeal movement disorders
5. Evaluation of Synkinesis and aberrant reinnervation
6. Swallow biofeedback
   - Single – surface EMG recordings
   - Audiofeedback of hyoid and suprahoid muscle contractions during swallow
   - To monitor the biomechanic and kinetic movements of the larynx and pharynx during swallow and speech.

B. For treatment purposes
1. Intraoperative nerve monitoring
   - Thyroidectomy
   - Skull base surgery eg. glomus jugulare
   - Parapharyngeal space tumour resections
   - Laryngeal surgery.
2. Treatment of aberrant reinnervation → LEMG guided chemodenervation.
3. Treatment of spasmodic dysphonias → LEMG guided botulinum toxin injections

Other uses of EMG in ENT

- Diagnostic
  - FN palsy assessment → EMG, EEMG, MNST, MST
  - VEMP
  - Electronystagmography
  - All diagnostic indications of LEMG
  - In OSA polysomnography (electro oculpgraphy + shin electrodes)

- Therapeutic
  - Parotidectomy → FN
  - Submandibular gland excision → hypoglossal, lingual
  - All of LEMG

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