

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**
 - Produced as the needle is introduced into the muscle
 - Result of a relative change in the electrical field surrounding the muscle membrane
 - Prolonged during early nerve and muscle injuries
 - 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

- To assess degree of RLN palsy
- 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
- Electro myographic studies can also differentiate between
 - (a) Old nerve injury with recovery
 - (b) Ongoing active denervation
- 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 suprahyoid 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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