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Laryngeal Electromyography

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Functional Anatomy of Laryngeal Muscles

1. Histochemical Characteristics of Laryngeal Muscles

Types of muscle fiber

	Type I	Type IIA	Type IIB
	Slow	Fast	Fast
	Fatigue-resistant	Fatigue-resistant	Fatigue-susceptible
Energy metabolism	Oxidative	Oxidative Glycolytic	Glycolytic
Myofibrillar ATPase	Low	High	High
Oxidative enzyme	High	High	Low
Glycolytic enzyme	Low	High	High
Color	Red		White
Diameter of muscle fiber	Small		Large
Size of Motor Unit	Small		Large

Thyroarytenoid ; higher proportion of Type II fiber

Post.cricothytenoid

Higher proportion of Type I fiber ; 52-67%

Type II fiber ; IIA dominant

Rapid contraction & fatigue resistant

; appropriate for enduring action of respiration

Muscle fiber type grouping (Teig E et al, 1978)

2. Motor Unit

Composed of extrafusal fibers and innervating motor neuron

Lower innervation ratio than limb skeletal muscle ; suitable for delicate action

3. Motor End Plate

Multiple end plate at various unfixed sites

; reliable neuromuscular transmission than single end plate architecturally comp-

lex system for tension generative & fine motor control(Gambino et al, 1985)

Apparatus

1. Electrode

Surface electrode

Needle electrode

Monopolar

; stainless steel insulated with teflon except distal tip

Unipolar concentric

; 1 wire in stainless steel cannula registration of potential difference between the wire & shaft "cross talk" potentials from nearby muscles(Dedo, 1969)

Bipolar concentric

; 2 wires in stainless steel cannula registration of potential between the 2 wires no interfering signals from adjacent muscles reliably record the activity of specific intrinsic laryngeal muscles(Dedo, 1969)

Hooked-wire(Hirano, 1969)

Advantage ; longterm stability

flexibility & lightness

Disadvantage ; cannot be repositioned

no reliability in results

2. Amplifier

3. Visual displays

4. Loudspeaker

5. Write-out system

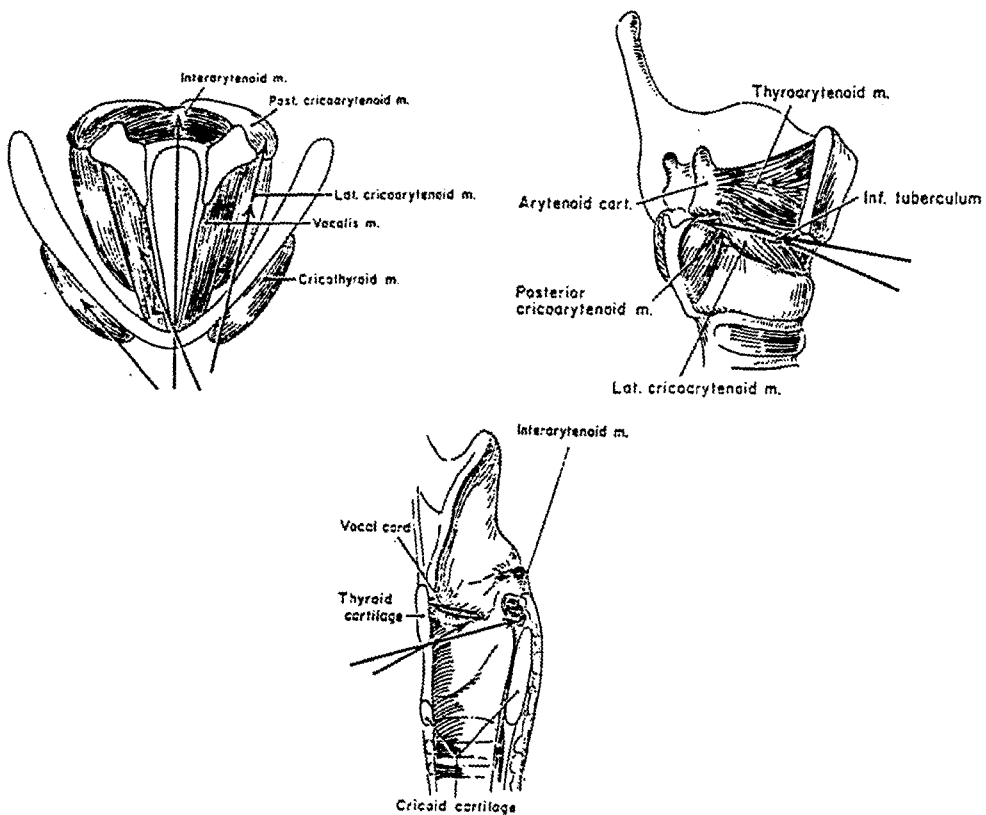
6. Stimulators

Approach

1. Open Surgical Approach ; through pharyngostoma and laryngofissure used for research purpose

2. Peroral Approach ; direct, indirect laryngoscopy

3. Percutaneous Approach ; minimal discomfort to the patient not interfere with natural phonation & articulation



Needle EMG

1. Settings for Needle EMG

	At rest	Maximal contraction
Sweep velocity (msec/division)	10	500-1,000
Sensitivity(μ V)	100	500
Filter		
High(KHz)	20	20
Low(Hz)	20	20

2. 4 Steps of Examination

1) Insertional Activity

2) Spontaneous Activity in relaxed muscle

Positive sharp wave ; Initial deep positivity and subsequent slow negativity

Fibrillation potential ; Biphasic or triphasic potential with initial positivity

Fasciculation potential ; Spontaneously discharged motor unit potentials from ant.horn cell & peripheral nerve

3) **Motor Unit Potentials** at mild voluntary contraction

Amplitude, Rise time, Duration

Phase : Biphasic or triphasic in normal

Polyphasic potential

4) **Recruitment & Interference Pattern** at maximal voluntary contraction

Nerve Conduction Study

1. Settings for Nerve Conduction Study

Swee velocity	2- 5msec/division
Sensitivity	2- 5mV
Filter	2Hz~5KHz
Stimulation	
Intensity	Supramaximal
Frequency	1/sec
Duration	0.1msec

2. Types of Stimulation

Electrical Stimulation

Magnetic Stimulation

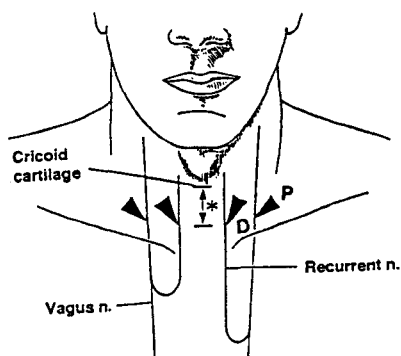
3. Sites of Stimulation

Sup. laryngeal nerve ; 1.5cm blow greater horn of hyoid bone, 1cm deep

Recurrent layngeal nerve ;

Distal stimulation ; paratracheally 2.5cm below the lower margin of cricoid cartilage, 25cm deep

Proximal stimulation ; post. edge of SCM muscle at the same level of distal stimulation

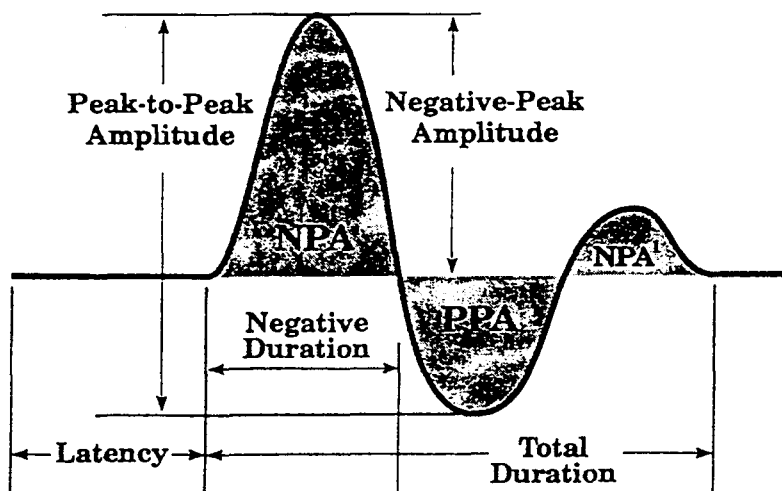


Sites of Stimulation of Recurrent Laryngeal nerve

D : distal P : proximal * : 2.5cm

Components of Compound Muscle Action Potential

Latency, Amplitude, Duration



Conduction Velocity

Recurrent laryngeal nerve (Atkins, 1973)

distal ; 29 ± 3 M/sec

proximal ; Rt. 63 ± 5 M/sec

Lt. 65 M/sec

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