

# Precising the different types of vocal fold immobility

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# Laryngeal examination



Laryngeal immobility/Laryngeal hypomobility

- First step: observation
- No etiological interpretation

# How to diagnose laryngeal immobility/hypomobility?

- Laryngeal examination:
  - Voluntary tasks of adduction (phonation, cough)
  - Voluntary tasks of abduction (sniff)
  - Alternative voluntary adduction/abduction (/i/-sniff)
  - Vegetative/unvoluntary tasks: laugh, swallow, reflexive cough
  - Voluntary tasks of elongation (singing voice)
- Nasal flexible endoscopy > oral approaches
  - Awake , relaxed patient,
  - Natural and comfortable position

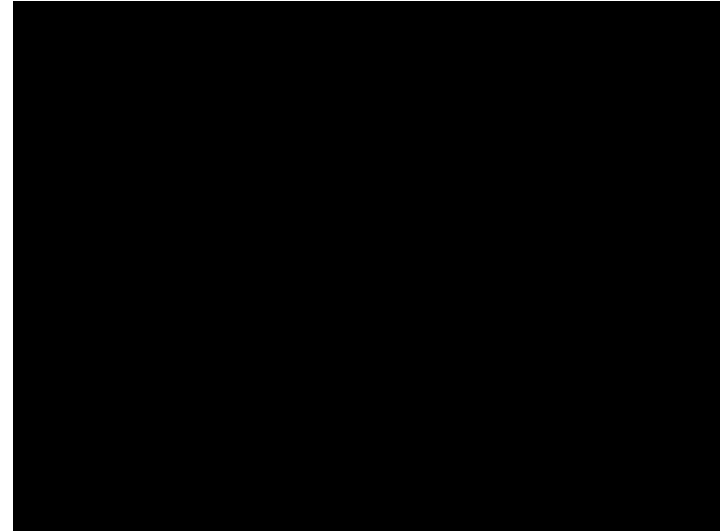
# Laryngeal immobility

- Laryngeal immobility:
  - Absence of gross adduction/abduction motion in the full vocal fold (cartilaginous and membranous)
  - Focus on the vocal process
  - Or posterior part of membranous part when non visible (anterior tilt of the arytenoid)
- Precisions
  - Median, paramedian, lateral,
  - Foreshortened vocal fold
  - Sub-vertical drop
  - Position of the arytenoid



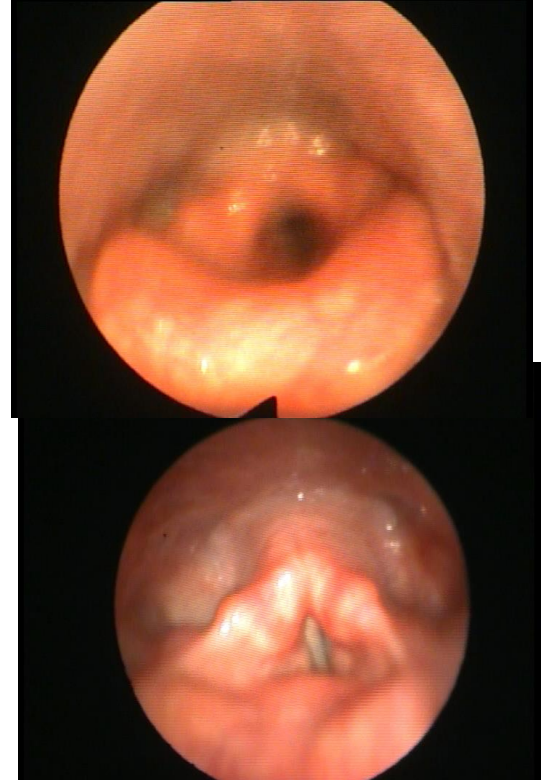
# Laryngeal immobility/laryngeal hypomobility

- Laryngeal hypomobility:
  - Reduced range and/or speed of adduction/abduction
  - Reduced rest tension
  - Lack of elongation, anterior commissure rotation
- Compared with the contralateral vocal fold when unilateral disturbance
  - Degree of hypomobility can be precised
  - Stroboscopic finding (debated)
- Diagnosis quite uneasy
  - Excellent inter-rater reliability for the diagnosis when definition is clear (Madden I, Rosen CA)
  - Almost 40% errors in the designation of the pathologic side in trainees, <10% in expert (Isseroff et al.)



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Laryngeal examination

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graph TD; A([Laryngeal examination]) --> B[Laryngeal immobility/Laryngeal hypomobility]; B --> C([2nd step: interpretation  
Medical history, ad hoc investigation]); C --> D[Etiological orientation  
Paralysis/paresis vs Mechanical immobility/hypomobility];
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Laryngeal immobility/Laryngeal hypomobility

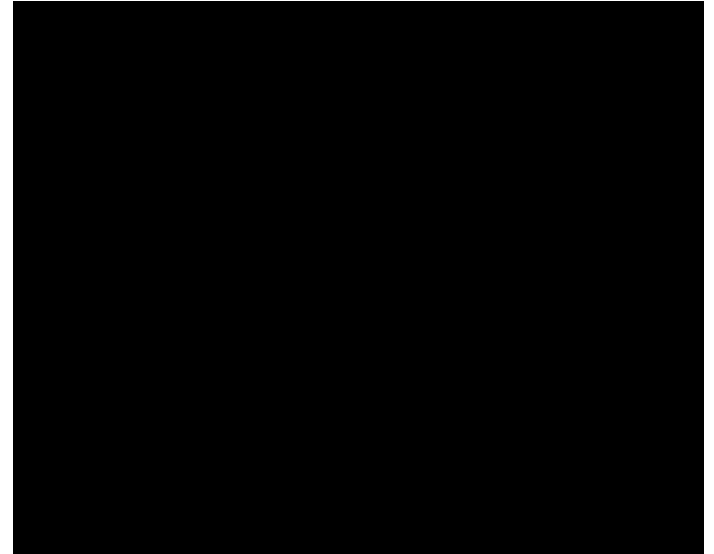
2<sup>nd</sup> step: interpretation  
Medical history, ad hoc investigation

Etiological orientation

Paralysis/paresis vs Mechanical immobility/hypomobility

# Neurogenic laryngeal immobility/hypomobility

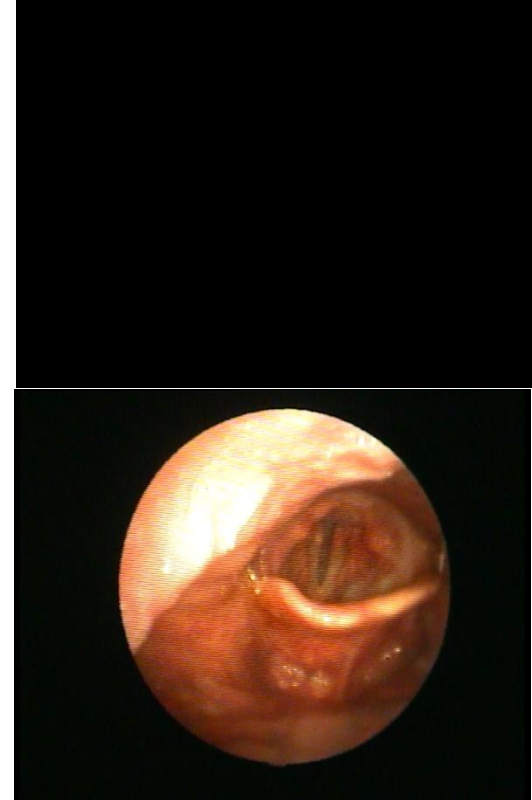
- Neurogenic impairment
  - Strongly suspected in the medical history
  - Confirmed with LEMG
- Laryngeal paralysis = Neurogenic laryngeal immobility
  - Absence of gross motion
  - Small degree of arytenoid movement with contraction of the IA muscle
- Laryngeal paresis = Neurogenic laryngeal hypomobility
  - Impaired range or speed of VF adduction and/or abduction and/or elongation





# Neurogenic laryngeal immobility/hypomobility

- Localization of the nervous lesion
  - Vagus nerve
    - Pharynx paresis
    - VF ab/ad-duction impairment, VF tension impairment
    - Loss of sensibility in pharynx and larynx
  - Recurrent laryngeal nerve
    - Ab/adduction impairment
  - Superior laryngeal nerve
    - VF tension impairment, ie. loss of high pitch voice (falsetto)
    - Asymetry of tension at rest or during phonation
    - Rotation of larynx axis in phonation
- Etiologic investigations mandatory
  - Imaging, neurological examination

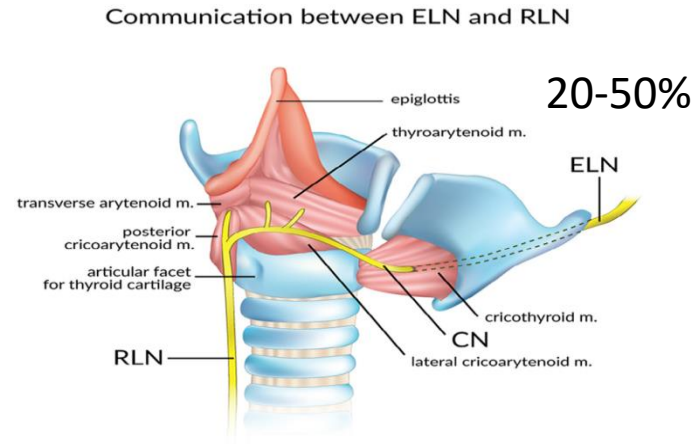
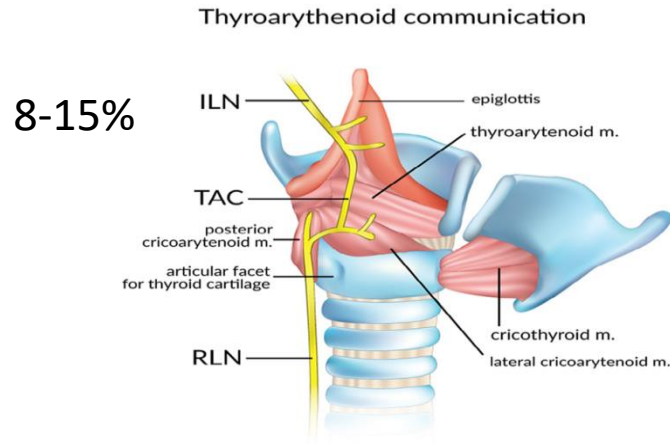


# Paralysis/paresis: LEMG interest

- Diagnostic interest (AANEM Practice topic, 2016)
  - In clinically suspected RLP, 48% of other diagnosis with LEMG
    - Another or additional diagnosis
      - Superior laryngeal neuropathy (anormal EMG in CT muscle)
      - Crico-arytenoid joint fixation (normal EMG in RLN and SLN territories)
      - Myopathy (myogenic pattern)
      - Stroke
  - Importance of multi-muscle LEMG (Foerster G & Mueller AH, Volk et al.)

# Paralysis/paresis: LEMG interest

- Diagnostic interest (Henry M et al. 2017)
  - Limitation of EMG lesional localization due to anatomical variations in the RLN and SLN motor territories

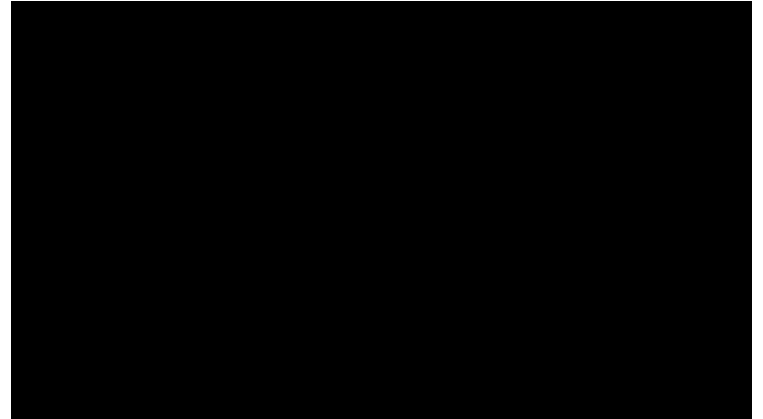


# Paralysis/paresis: LEMG interest

- Pronostic interest (AANEM Practice topic, 2016)
  - After 4 weeks
  - Before 6 months
    - Spontaneous recovery after 6 months is quite rare
    - Synkinetic reinnervation can lead to normal Motor Unit Potential recruitment without any VF motion
  - Pronostic for recovery
    - Presence of MUP, presence of polyphasic MUPs
    - Insufficient evidence for fibrillation potentials and/or positive sharp waves for predicting the recovery
    - Electrical synkinesis may decrease the likelihood of recovery

# Mechanical immobility/hypomobility

- Diagnosis:
  - LEMG: normal (if isolated)
  - Direct laryngoscopy with palpation of the passive mobility of vocal folds
    - Under general anaesthesia +/- curare
    - Without oro-tracheal tube

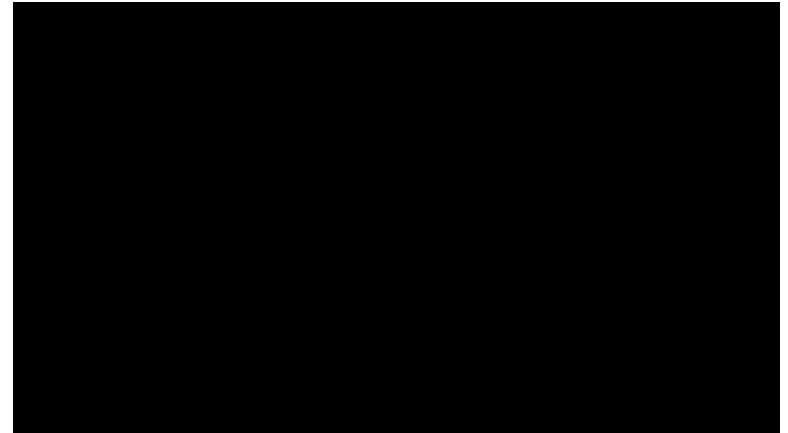
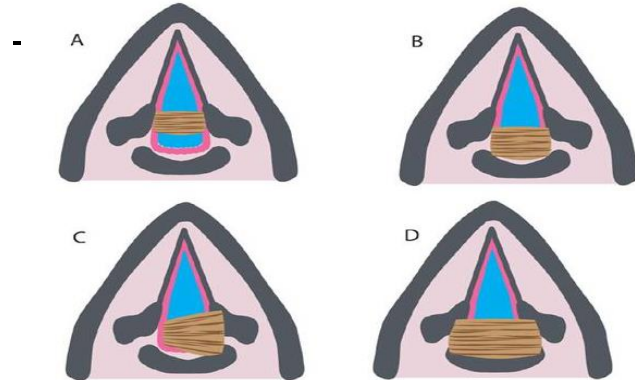


# Mechanical immobility/hypomobility

- Pathology of the crico-arytenoid joint (CAJ)
  - Dislocation/subluxation (uni or bi-lateral)
    - Trauma
  - Ankylosis (uni or bi-lateral)
    - Trauma
    - Arthritis/synovitis (Rheumatoid polyarthritis, psoriasis...)

# Mechanical immobility/hypomobility

- Posterior glottic stenosis
  - +/- inter-arytenoid scar
  - +/- CAJ ankylosis
  - Frequently post-intubation



# Laryngeal examination

Laryngeal immobility/Laryngeal hypomobility

2<sup>nd</sup> step: interpretation  
Medical history, LEMG, CAJ palpation

Etiological orientation

Paralysis/paresis

- Muscles involved/
- Uni- or bilateral
- Causal lesion

Mechanical immobility/hypomobility

- Pathology of CAJ
- Uni- or bilateral
- Local or general pathology

- Posterior glottis stenosis
- +/- CAJ involvement
- Always bilateral



# Laryngeal examination

Laryngeal immobility/Laryngeal hypomobility

Etiological orientation

Paralysis/paresis

Mechanical immobility/hypomobility

- Muscles involved/
- Uni- or bilateral
- Localization of the Causal lesion

- Pathology of CAJ
- Uni- or bilateral
- Local or general pathology

- Posterior glottis stenosis
- +/- CAJ involvement
- Always bilateral

Spontaneous recovery potential

Cause, time between onset and management

Treatment

# Cancer of the larynx and laryngeal immobility/hypomobility

- Pronostic value of the vocal fold fixation (TNM, AJCC 2017)
  - Definition of T3 in non-glottic larynx cancers
  - More subtle analysis of the vocal fold movement for the glottic cancer.
    - Physiopathology non precised (neurogenic or mechanical motion impairment)

<b>GLOTTIS</b>		
( ) T1	Tumor limited to the vocal cord(s) (may involve anterior or posterior commissure) with normal mobility	( ) T1
( ) T1a	Tumor limited to one vocal cord	( ) T1a
( ) T1b	Tumor involves both vocal cords	( ) T1b
( ) T2	Tumor extends to supraglottis and/or subglottis, and/or with impaired vocal cord mobility	( ) T2
( ) T3	Tumor limited to the larynx with vocal cord fixation and/or invasion of paraglottic space, and/or inner cortex of thyroid cartilage	( ) T3
( ) T4	Moderately advanced or very advanced	( ) T4
( ) T4a	<u>Moderately advanced local disease.</u> Tumor invades through the outer cortex of the thyroid cartilage and/or invades tissues beyond the larynx (e.g., trachea, soft tissues of neck including deep extrinsic muscle of the tongue, strap muscles, thyroid or esophagus)	( ) T4a
( ) T4b	<u>Very advanced local disease.</u> Tumor invades prevertebral space, encases carotid artery, or invades mediastinal structures	( ) T4b

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# Thanks for attention!

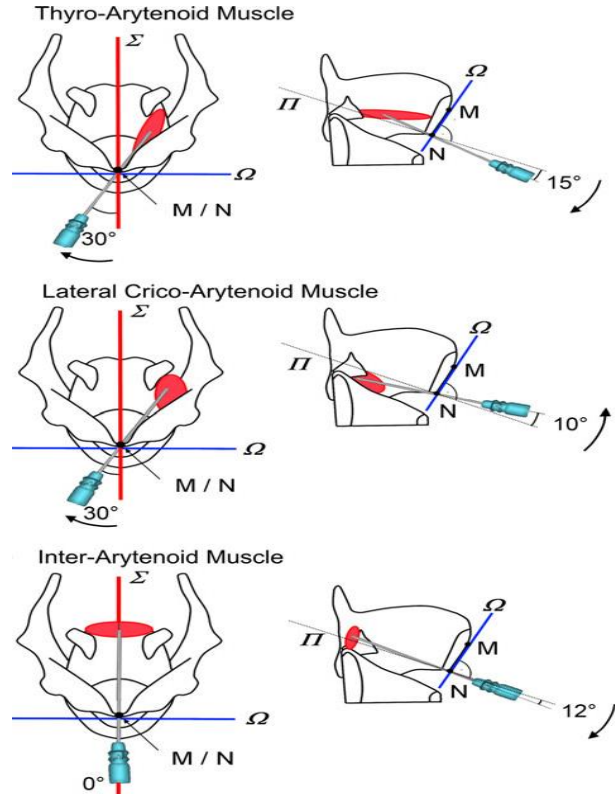
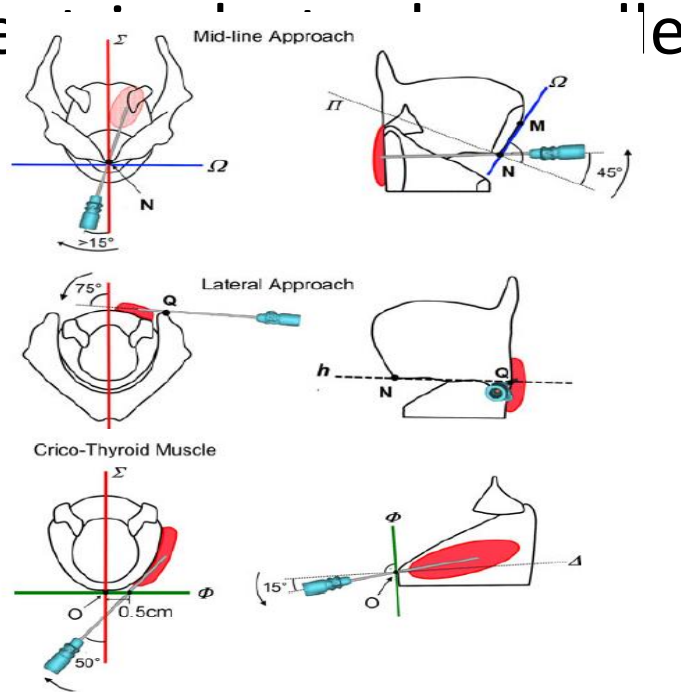




# Paralysis/paresis: LEMG interest

- Technique (Volk et al.):

- Conce



# Paralysis/paresis: LEMG interest

- **Technique (Volk et al.)**

Table 4 Documentation of LEMG

		TA		PCA		CT	
		Right	Left	Right	Left	Right	Left
	<b>Insertion activity</b>						
1.	No activity						
2.	Normal activity (<300 ms)						
3.	Increased activity						
4.	Highly increased activity						
	<b>Spontaneous activity</b>						
1.	No reproducible pathologic spontaneous activity						
2.	Little pathologic spontaneous activity						
3.	Moderate pathologic spontaneous activity						
4.	Dense pathologic spontaneous activity						
	<b>Volitional activity</b>						
1.	No activity						
2.	Single fiber pattern						
3.	Moderately decreased recruitment pattern						
4.	Mildly decreased recruitment pattern						
5.	Normal/dense recruitment pattern						
	<b>Morphology of waveform</b>						
1.	Normal biphasic motor unit potential						
2.	Early polyphasic reinnervation potentials with low amplitude and long duration						
3.	Giant polyphasic reinnervation potentials with high amplitude and long duration						
4.	Myogenic polyphasic potentials with low amplitude but normal duration						

# Paralysis/paresis: LEMG interest

- Diagnostic interest
  - Technique (Blitzer et al., 2010)
    - Insertional activity: burst of activity, <300ms, normal/reduced/increased
    - Rest activity: spontaneous activity
      - Fibrillation potentials (<5ms muscle fiber action potential)
      - Positive sharp waves (idem always in the positive direction)
      - Complex repetitive discharges (chronic myopathies and neuropathies: abrupt beginning and stop, harsh machinery-like sound)
      - Fasciculations (spontaneous discharges of entire motor unit)
      - Polyphasic potentials
    - Motor unit recruitment patterns



# Paralysis/paresis: LEMG interest

- Results (Blitzer et al., 2010)
  - Motor unit recruitment patterns
    - With increasing force contraction, MUAPs firing rates increase and additional MUAP are recruited
    - No, poor, moderate, slightly reduced voluntary recruitment of laryngeal motor unit firing
  - Synkinesis
    - Anormal patterning of activation after reinnervation