# The Hoarse Whisperer

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# Disclosures

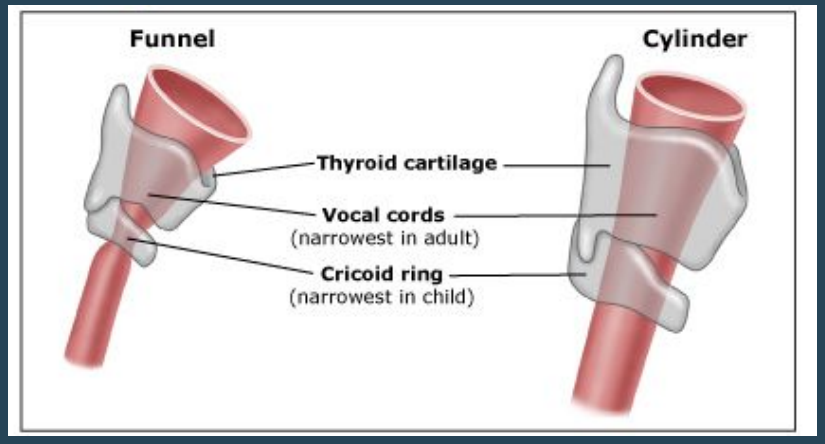
- I have no relevant relationships with ineligible companies to disclose within the past 24 months. *(Note: Ineligible companies are defined as those whose primary business is producing, marketing, selling, re-selling, or distributing healthcare products used by or on patients.)*

# Educational Objectives

- At the conclusion of this session, participants should be able to:
  - Describe laryngeal anatomy and how pathologic alterations in the anatomy or physiology of the larynx affect phonation
  - Discuss the appropriate history and physical examination of the hoarse patient and formulate a comprehensive differential diagnosis
  - Summarize treatment options for hoarseness including medications, speech therapy and procedural and surgical modalities

# Laryngeal Anatomy

- Located at the level of C3-C7
- Approximately 4-5cm long and wide with a slightly shorter anterior posterior diameter
- Funnel shaped as an infant, cylindrical as an adult

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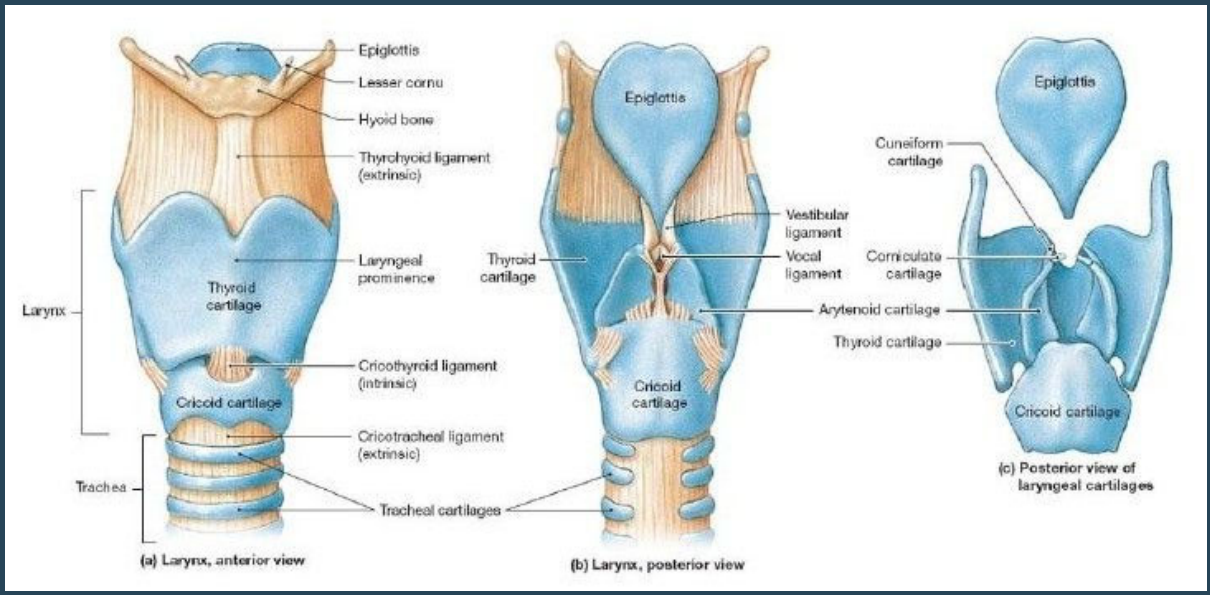
# Laryngeal Anatomy

- Cartilage
  - Cricoid
  - Thyroid
  - Epiglottis
  - Arytenoid
  - Corniculate
  - Cuneiform

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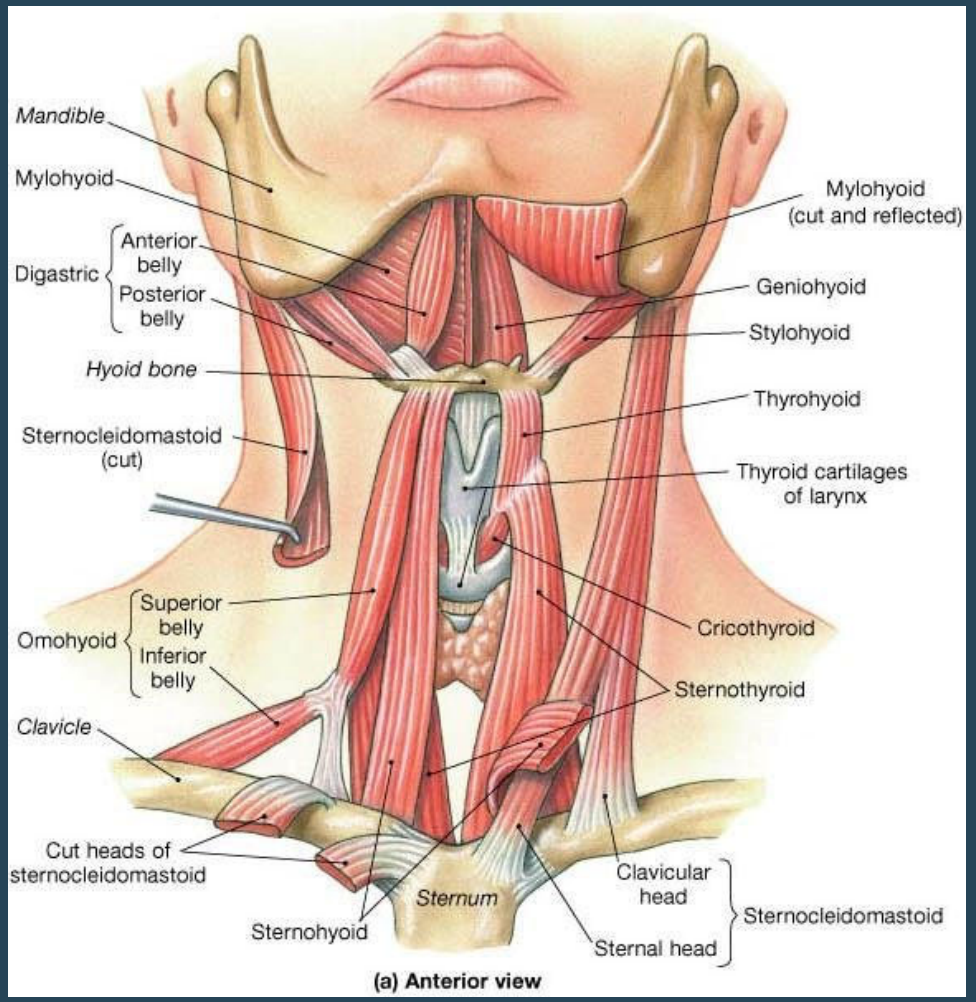
# Extrinsic Laryngeal Muscles

- Elevation of larynx
  - Superior aspect of the hyoid
    - Geniohyoid
    - Digastric
    - Mylohyoid
    - Thyrohyoid
    - Stylohyoid
  - Pharynx
    - Stylopharyngeus
    - Palatopharyngeus
    - Pharyngeal constrictor muscles
- Depression of larynx
  - Inferior surface of the hyoid
    - Sternohyoid
    - Omohyoid
  - Sternothyroid

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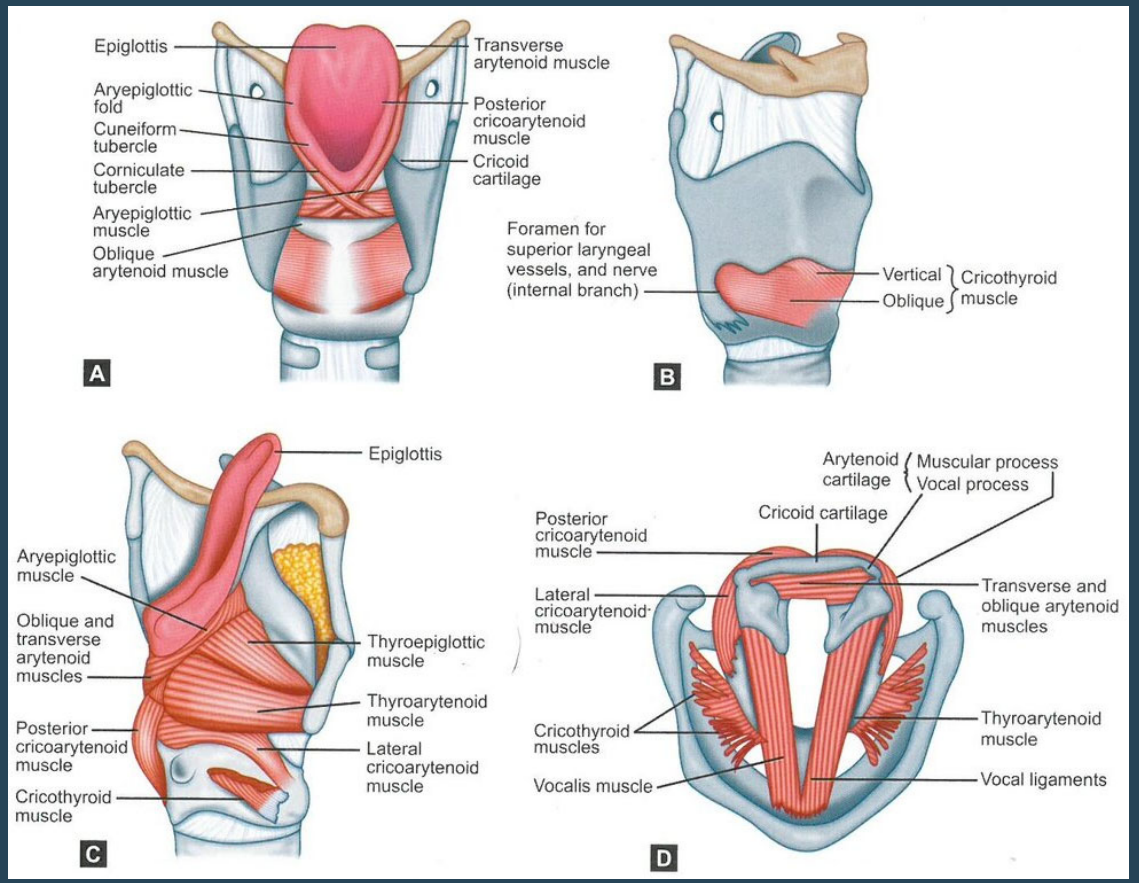
# Intrinsic Laryngeal Muscles

- Muscles of the inlet
  - Aryepiglottic
  - Oblique arytenoid
  - Thyroepiglottic
- Muscles of the vocal folds
  - Adductors
    - Lateral cricoarytenoid
    - Transverse and oblique arytenoid
  - Abductors
    - Posterior cricoarytenoid
  - Tensors
    - Cricothyroid
  - Relaxers
    - Thyroarytenoid
  - Fine adjustments
    - Vocalis

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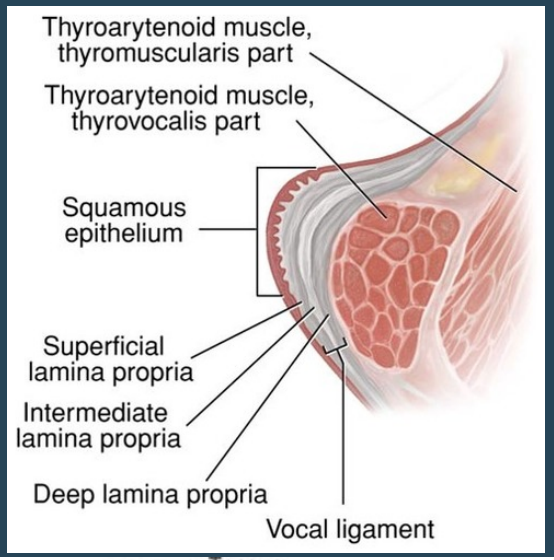
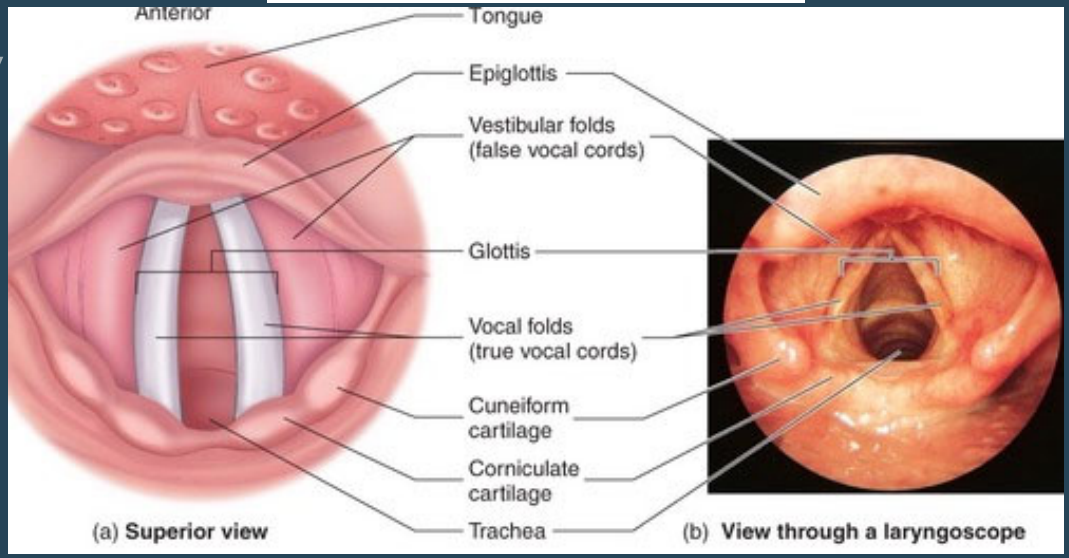
# Laryngeal Anatomy

- Vocal Folds
  - True
  - False
- Mucosal Lining
  - True folds and mechanically exposed areas lined with non-keratinizing squamous epithelium
  - Lumen of larynx lined with respiratory epithelium

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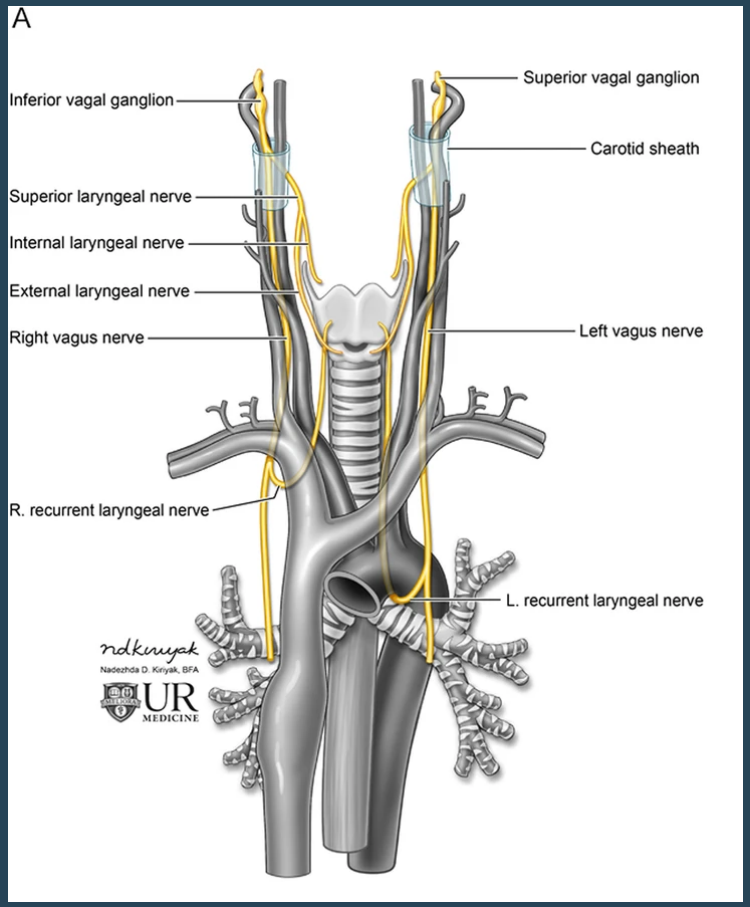
# Laryngeal Anatomy- Innervation

- Recurrent laryngeal
  - All intrinsic muscles of the larynx except cricothyroid (external branch of superior laryngeal)
  - Some motor function of the pharynx
- Superior laryngeal
  - Sensory function of the vocal cords
- Vagus Nerve
  - Motor function of the pharynx
  - Sensory function of the external auditory canal and hypopharynx

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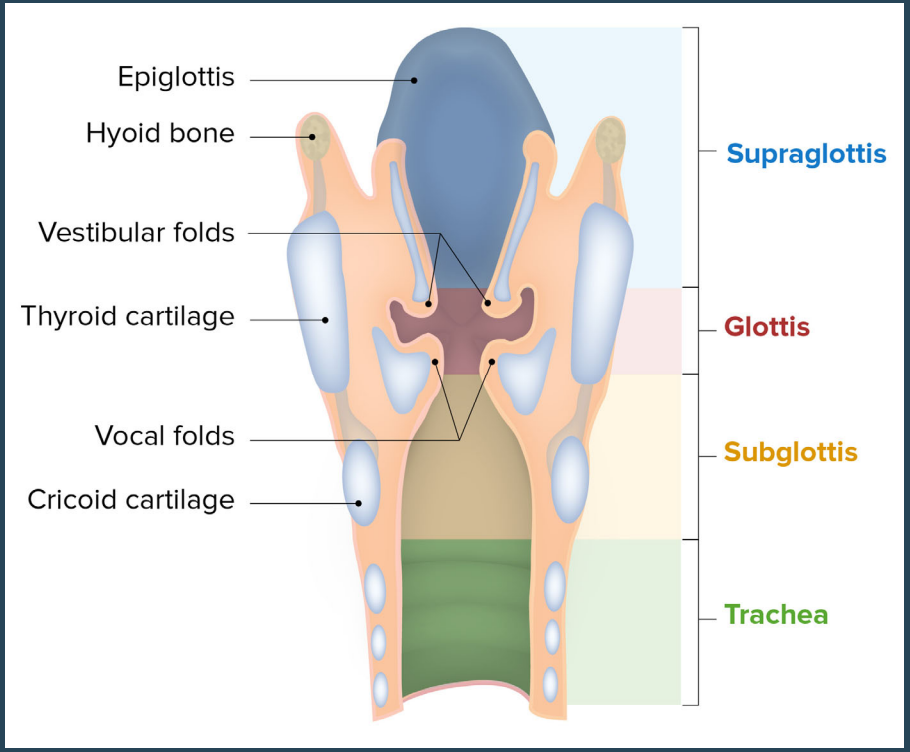
# Regions of the Larynx

- Supraglottis
  - All structures above the true folds
- Glottis
  - True folds and 1 cm below
- Subglottis
  - Area from the inferior boarder of the glottis to the boarder of the cricoid cartilage

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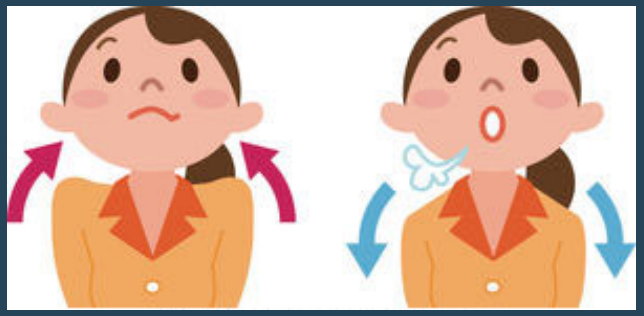
# Functions of the Larynx

- Phonation
- Airway patency
- Swallow
  - Larynx elevates
  - Epiglottis deflects posteriorly
  - Vocal cords close

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https://grid.gograph.com/deep-breathing-vector-clipart_gg66896024.jpg

# Phonation

- Voice is achieved when the vocal cords adduct and air passes through them causing a vibratory wave creating sound
- This sound resonates in the nose and pharynx
- Articulation of words is controlled by the tongue, palate and lips
- The pitch of voice is dependant on vocal fold length and tension

# Phonation


https://www.youtube.com/watch?v=GDzcLZDdxqs

# Evaluation of the Hoarse Patient

# Hoarseness

- Often used to describe any change in vocal quality including:
  - Change in pitch
  - Breathiness
  - Strain
  - Fatigue
  - Tremor
  - Loss of voice
  - Voice breaks

# History

- Duration of the change in voice
  - Recurrent?
- Gradual or sudden onset
- Speaking voice vs singing voice change
- Muscular neck pain with phonation
- Vocal fatigue
- Exacerbating or improving factors
- Triggers
  - Smoke exposure
  - Vocal abuse
  - Postnasal drip
  - Activities
    - Exercise
  - Scents
- Voice use
  - Hobbies
    - Coaching, singing
  - Work environment

# History

- Reflux symptoms or history
- Globus sensation
- Cough
- Throat clearing
- Smoking and alcohol history
- HPV exposure history
- Surgical history
  - Neck or thoracic surgery
- Injury to the vocal cords or neck
  - Trauma
  - Intubation
- Other head and neck symptoms
  - Dysphagia
  - Odynophagia
  - Otalgia
  - SOB
  - Weight loss
  - Neck mass

# Physical Exam

- Listen to the patient's voice
  - Scratchy or coarse
  - Breathy
  - Vocal fatigue
  - Tremulous
  - Wet or gurgling
  - Soft – unable to produce loud voice
  - Cracking
  - Stridorous
  - Halting
- Ear exam
  - Look for effusions
    - Unilateral
- Nasal exam
- Oral cavity exam
  - Palpation of base of tongue
- Neck exam
  - Lymphadenopathy
  - Thyroid

# Normal Strobe

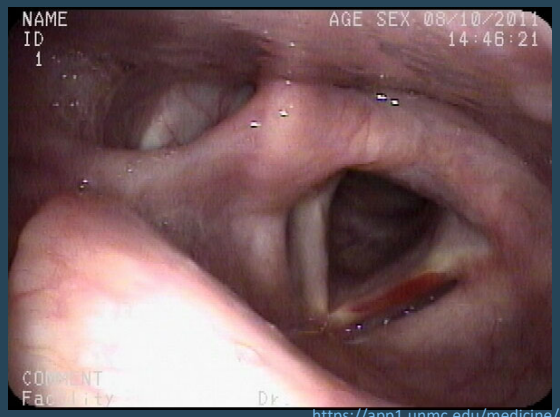
# Differential Diagnosis

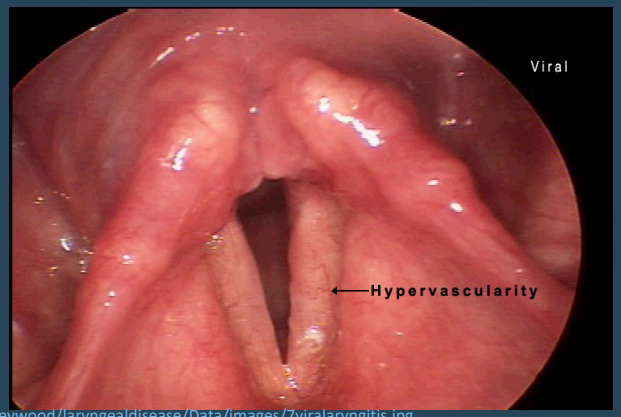
- Acute laryngitis
- Chronic laryngitis
- Benign lesions
- Malignant lesions
- Functional disorders
- Neurologic disorders
- Congenital abnormalities
- Systemic disorders

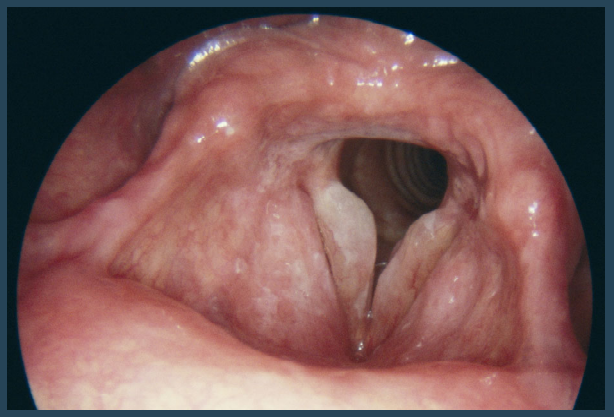
# Acute Laryngitis

# Causes

- Viral or bacterial infections that are short duration
- Cough related to illness can cause edema or injury to vocal folds resulting in hoarseness
- Vocal strain such as yelling can cause submucosal trauma with focal hemorrhage and edema



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# Treatment

- Symptomatic Relief
  - Cough reduction
  - Hydration
  - Cessation of vocal strain
- Antibiotics are not indicated
- Steroids have very limited use (if any)

# COVID-19

- One study found 5% of COVID-19 patients had hoarseness
- Another found hoarseness preceded hospitalization
- Causes
  - Vocal fold edema
  - Poor breath support due to lung involvement
  - Post viral vagal neuropathy
  - Psychogenic

# Chronic Laryngitis

# Irritants

- Potential irritants
  - Smoking
  - Postnasal drip
  - Chronic vocal strain (singers)
  - Chemicals
  - Inhaled steroids
- Treatment
  - Removal of offending agent
  - Treatment of postnasal drip

https://www.healio.com/~/media/slack-news/stock-images/pediatrics/s/smoking.jpg

# Treatment of Postnasal Drip

- Topical Nasal Steroids
  - Beclomethasone dipropionate (Beconase Aq, QNASL)
  - Budesonide (Rhinocort Aqua)
  - Ciclesonide (Omnaris)
  - Flunisolide (Nasarel)
  - Fluticasone (Flonase)
  - Fluticasone furoate (Veramyst)
  - Mometasone (Nasonex)
  - Triamcinolone acetonide (Nasacort AQ)
- Other Nasal Sprays
  - Azelastine (Astelin)
  - Ipratropium Bromide (Atrovent Nasal)
  - Azelastine and fluticasone (Dymista)
- Nasal Rinses
- Treatment of any underlying allergic component

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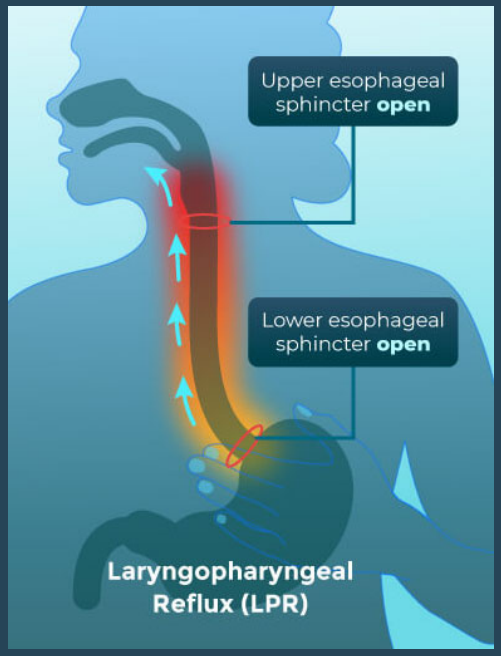
# Laryngeal Pharyngeal Reflux (LPR)

- Retrograde flow of stomach content to the larynx and pharynx whereby this material comes in contact with the upper aerodigestive tract
  - Globus
  - Throat clearing
  - Cough
  - Sore throat
  - Dysphagia
  - Laryngospasm
  - Choking

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# LPR Treatment

- Diet and lifestyle modification
  - No eating or drinking 2 hours prior bedtime
  - Elevate head of bed
  - Avoidance diet
  - Weight loss

| Group | Recommend | Avoid/Limit |
|---|---|---|
| Milk or milk products | Skim, 1% or 2% low-fat milk, low-fat or fat-free yogurt | Whole milk (4%), chocolate milk |
| Vegetables | All other vegetables | Fried or creamy style vegetables, tomatoes |
| Fruits | Apples, berries, melons, bananas, peaches, pears | Citrus fruits, pineapple, kiwi |
| Breads and grains | All those made with low-fat content | Any prepared with whole milk or high-fat |
| Meat and meat substitutes | Low-fat meat, chicken, fish, turkey | Spicy cold cuts, sausage, bacon, fatty meat, chicken fat/skin |
| Fats and oils | None or small amounts | Keep amount limited on a given day |
| Sweets and desserts | All items with no or low-fat (<3g/serving) | Chocolate, desserts made with high amounts of oils and/or fats |
| Beverages | Water, juices (except citrus), herbal tea (not peppermint) | Alcohol, coffee, carbonated beverages, tea |
| Spices | All other spices that do not appear to have a negative effect | Hot mustard, vinegar, hot peppers, curry |

# Medication for LPR

- PPI
  - Dexlansoprazole (Dexilant/ Kapidex)
  - Esomeprazole (Nexium)
  - Lansoprazole (Prevacid)
  - Omeprazole (Prilosec)
  - Omeprazole/sodium bicarbonate(Zegrid)
  - Pantoprazole (Protonix)
  - Rabeprazole sodium (Aciphex)
- Acid Reducers
  - Cimetadine (Tagamet)
  - Famotidine (Pepcid)
  - Nizatidine (Axid)
  - Ranitidine (Zantac)
- Antacids
  - Alka-Seltzer
  - Gaviscon
  - Mylanta
  - Maalox
  - Rolaids
  - Tums

# Muscle Tension Dysphonia

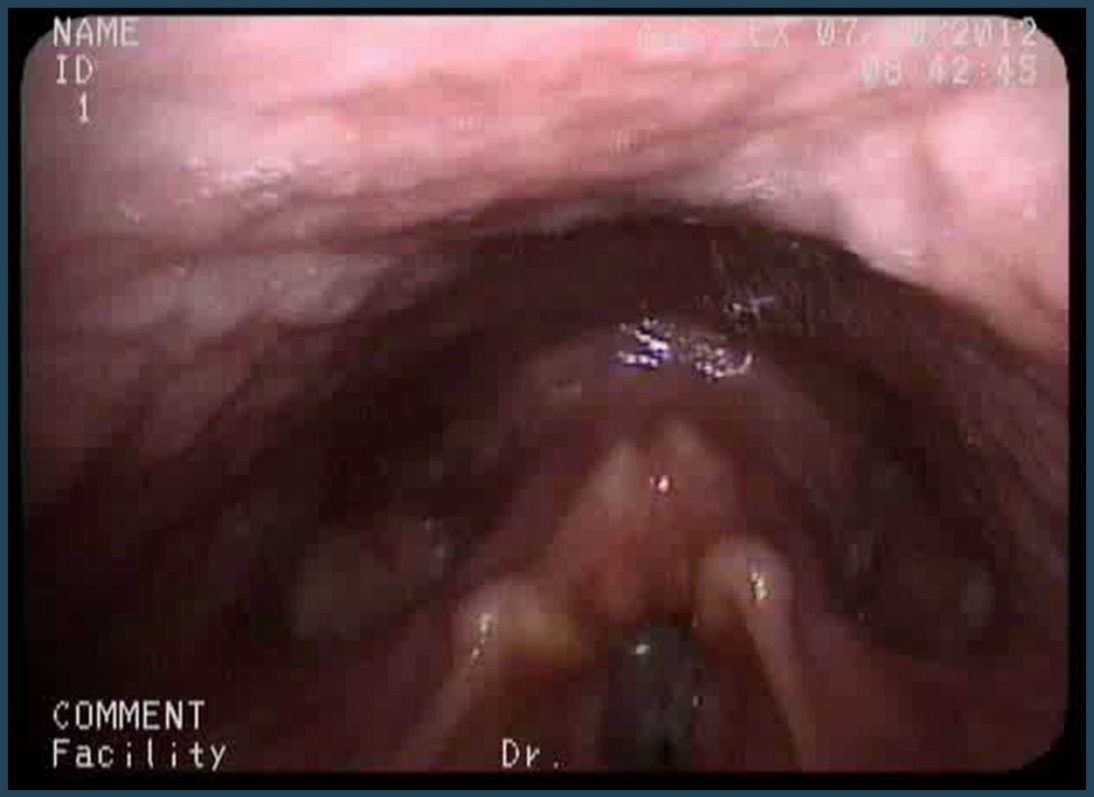
- Imbalance of muscles used for phonation
- Broad spectrum of causes
  - Psychological/personality, vocal misuse, compensation for disease
- Treatment
  - Vocal therapy
  - Vocal hygiene
  - Relative vocal rest
  - Treatment of underlying disease

# Benign Lesions

# Reinke's Edema (Polypoid Corditis)

- Viscous material collects in the lamina propria (Reinke's space) secondary to smoking
- Vocal folds appear floppy and swollen
- Occurs in smokers
- Treatment
  - Tobacco cessation
  - Surgery if does not resolve with tobacco cessation

# Reinke's Edema/Polypoid Changes



# Polyp

- Caused by chronic laryngitis
- Often unilateral but may have a contact lesion
- Most often in the anterior third of the vocal fold more frequently seen in men
- Treatment
  - If smoking, quit
  - Vocal therapy
  - Surgical removal
  - Less studied treatments
    - Green laser
    - Steroid injection
    - Acupuncture

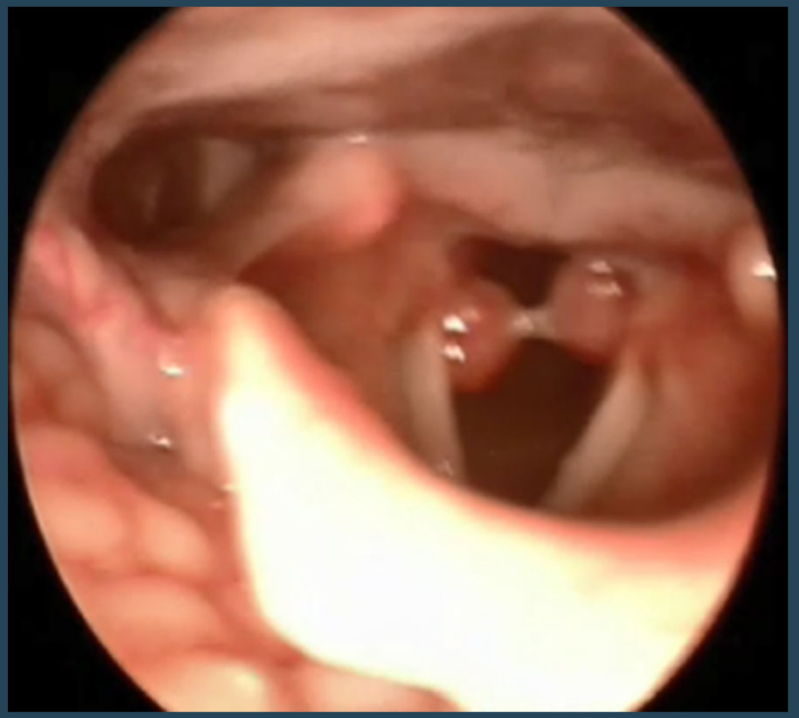
https://www.researchgate.net/profile/Daniela-Vasconcelos-4/publication/330668815/figure/fig1/AS:722581145526287@1549288178720/Angiomatous-polyp-in-the-right-vocal-fold.png
https://voicesurgeon.net/wp-content/uploads/2018/11/Polyp-about-translucent-OR.jpg

# Nodules

- Usually bilateral and relatively symmetric
- Occur in middle vocal fold most commonly
- More common in women and children
- Common in singers due to vocal abuse
- Most common cause of chronic hoarseness in children
- Treatment
  - Vocal therapy aimed at correcting vocal abuse
  - Surgical resection*

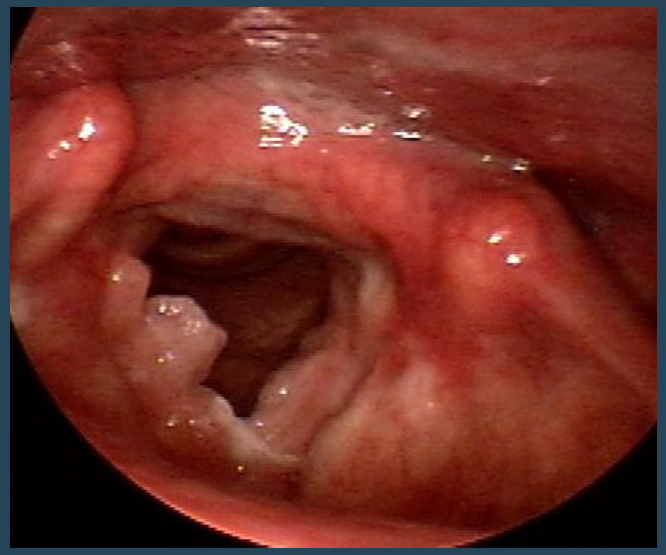
# Granuloma

- Pseudotumor of the lateral wall of the posterior glottis
- Most commonly located in the posterior glottis
- Commonly associated with intubation trauma
- Can be associated with reflux, chronic throat clearing, vocal misuse
- Treatment
  - Treat underlying cause
  - Surgical resection reserved for airway compromise or persistent granuloma despite adequate treatment



# Papillomatosis

- Warty growths caused by HPV 6 and 11
- Congenitally acquired at the time of birth from passing through the birth canal of a mother with HPV
- Can affect any portion of the larynx
- Rarely have malignant degeneration
- Treatment
  - Surgical resection
    - CO2 or KTP lasers
  - Prevention!



# Treatment

- Most types of benign vocal fold lesions may benefit from treatment for LPR if they have symptoms or exam is consistent

# Malignant Lesions

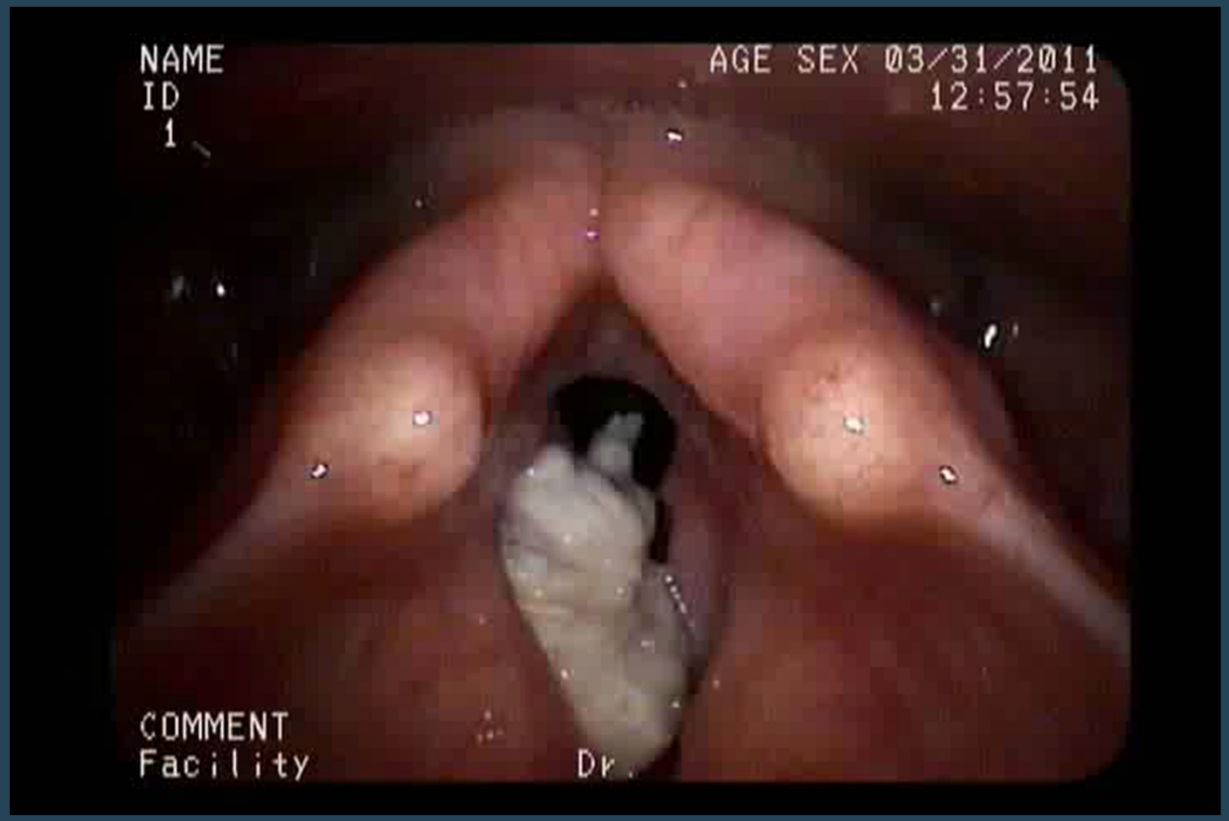
# Malignant Vocal Fold Lesions

- Overwhelming majority of malignancies are Squamous Cell Cancer
- Risk factors
  - Smoking
  - Drinking alcohol
  - Strong family history of head and neck cancer
  - Increased risk in those who smoke and drink
  - HPV 16 and 18

# Treatment

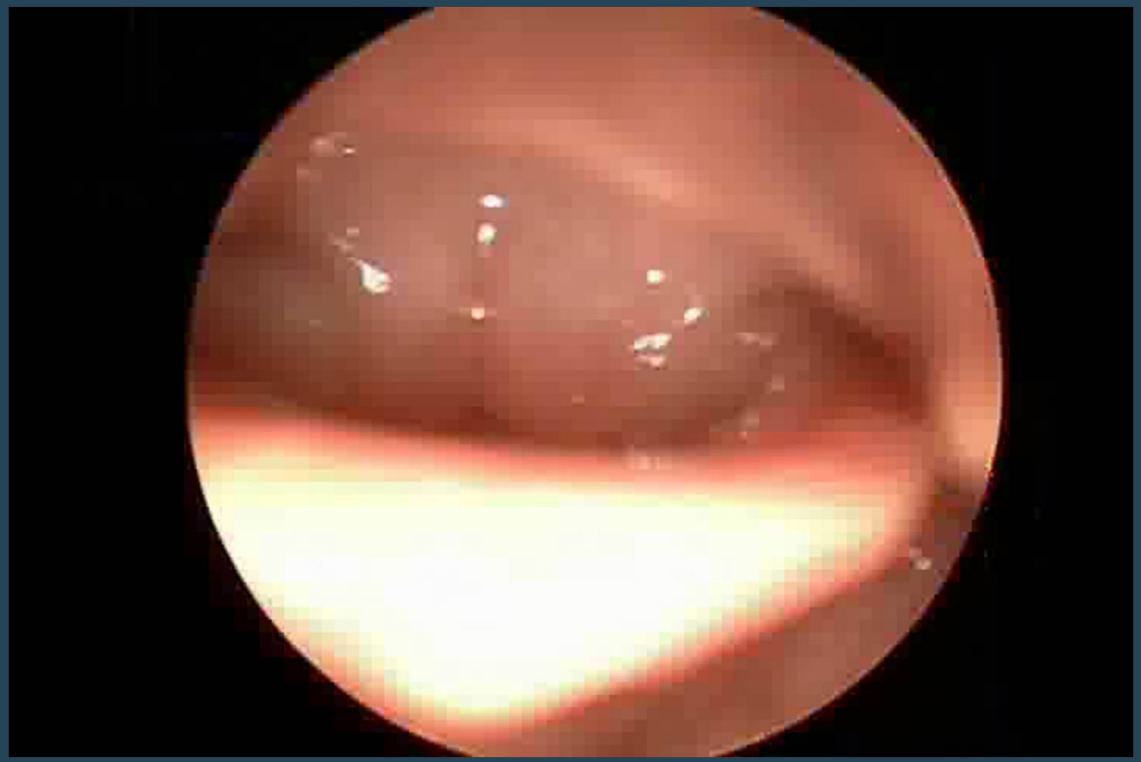
- Surgical
  - Local resection
    - Laser ablation
  - Partial laryngectomy
  - Total laryngectomy
  - May also need neck dissection for lymph node involvement or locally metastatic disease
- Chemotherapy
- Radiation Therapy
- Combination of the above

# Laryngeal Squamous Cell Cancer



# Laryngeal Squamous Cell Cancer- Unilateral Fixed Vocal Fold

# Laryngeal Squamous Cell Cancer- Fixed Vocal Folds



# Functional Causes

# Functional Vocal Fold Disorders

- Functional Dysphonia
  - Change in voice without organic lesion
  - Stress and/or anxiety related in some patients
- Paradoxical Vocal Fold Dysfunction
  - Vocal fold adduction with inspiration and abduction with expiration
  - May cause inspirational stridor
  - Commonly exacerbated by exercise
- Laryngeal Conversion Disorder
  - Somatization of psychological issues

# Treatment

- Vocal therapy and treatment of any underlying cause of irritation to the vocal folds is the primary treatment for all Functional Vocal Fold Disorders
- Reassurance that the patient is not “crazy”

# Paradoxical Vocal Fold Motion

# Glottal Fry

- Raspy, frog like, quality to the voice when used at the lowest register
- Caused by loose closure of the glottis allowing air to pop or rattle through the cords during phonation
- Often results in vocal fatigue and muscle discomfort
- Need to identify correct register for patient to speak in through speech therapy

# Neurologic Causes

# Unilateral Vocal Fold Paralysis

- Results from injury to recurrent laryngeal nerve(RLN)
- Often produces a breathy voice
- Can also cause aspiration
- Causes
  - Extra-laryngeal malignancy involving the RLN or vagal nerve in the head, neck or thorax
  - Injury during surgical procedures or intubation
  - Trauma
  - Degenerative neurological disorders
  - Idiopathic
- Treatment
  - Determine underlying cause and treat
  - Period of waiting to see if there is recovery of vocal fold paralysis unless severely symptomatic
    - 3-9 months on average
  - Speech therapy
  - Injection Laryngoplasty
  - Medialization thyroplasty

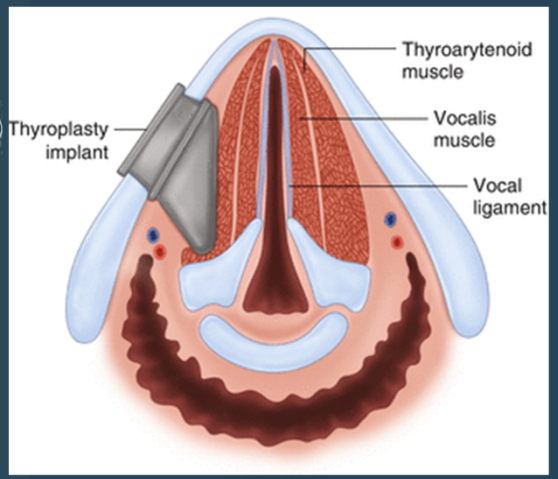
# Injection Laryngoplasty

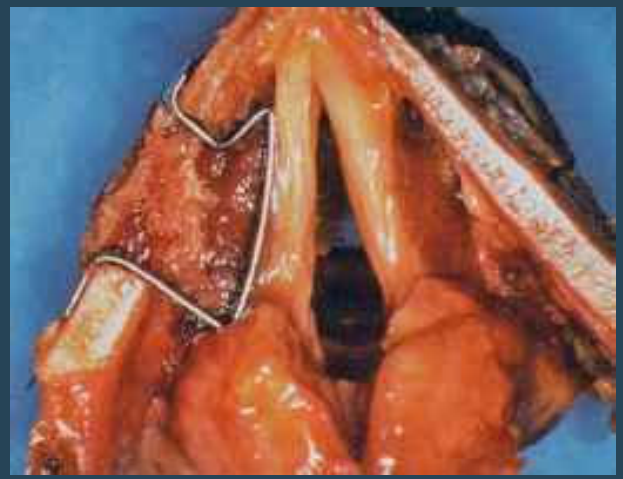
- Injection of an absorbable material to medialize the paralyzed vocal fold to restore more normal voice and swallow function
  - Improves function for 3+ months depending on the material used
- Approaches in the office with a flexible laryngoscope:
  - Percutaneous
    - Trans-cricothyroid membrane
    - Trans-thyroid cartilage
    - Trans-thyrohyoid membrane
  - Trans-nasal
  - Trans-oral

- Cymetra
- Juvederm
- Restylane/Perlane
- Radiesse
- RENÚ voice/ RENÚ gel
- Autologous fat/ fascia
- Gelfoam
- Teflon*
- Silicone*

# Medialization Thyroplasty

- Surgical implantation of non-absorbable prosthesis to medialize the affected vocal fold to improve voice and swallow function



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https://www.globehealth.net/vocal-fold/images/9595_86_64-thyroplasty-surgery.jpg

# Bilateral Vocal Fold Paralysis

- Can cause respiratory compromise if in the paramedian position
  - Stridor
- Causes
  - Iatrogenic
  - Surgical injury to RLN or vagus nerve
  - Intubation
  - Organophosphate pesticides
  - Stroke or head injury
  - Neurologic disorders
  - Arnold-Chiari malformation
- Treatment is dependent on position of folds, voice and swallow function
  - Medialized vocal folds bilaterally can cause airway compromise
    - Tracheotomy
    - Cordotomy
      - Will decrease or eliminate voice
  - Lateralized vocal folds can cause lack of voice or aspiration
    - Tracheotomy
    - Unilateral vocal fold injection
    - Medialization thyroplasty
  - Speech therapy
    - Useful for patients without airway compromise or aspiration

# Vocal Fold Paralysis in the Child

- Iatrogenic
  - Cardiothoracic surgery
  - Repair of tracheoesophageal fistula
  - Thyroidectomy
- Neurologic
  - Arnold Chiari malformation
  - Posterior fossa tumor
  - Hydrocephalus
- Injury to recurrent laryngeal nerve from delivery or intrathoracic lesions
- Idiopathic
- Treatment
  - Often spontaneously resolve
  - Speech therapy
  - Other interventions are the same as adults

# Vocal Fold Paralysis

# Spasmodic Dysphonia

- Intermittent focal laryngeal dystonia
- Halting strained and strangled voice quality
- Results from forceful adduction of vocal folds during phonation
- Most noticeable with vowels

- Treatment
  - Vocal therapy not usually effective
  - Injection of botulinum toxin into the laryngeal muscles reduces symptoms
    - Needed every 3-6 months

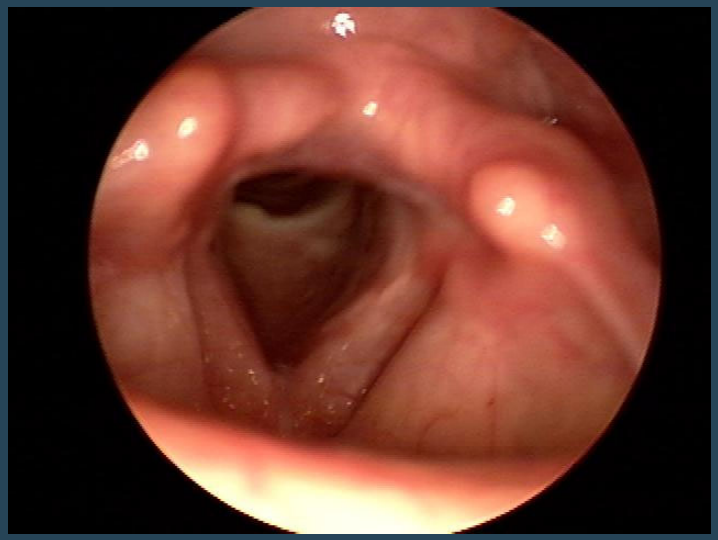
# Spasmodic Dysphonia

# Congenital Abnormalities

# Laryngeal Web

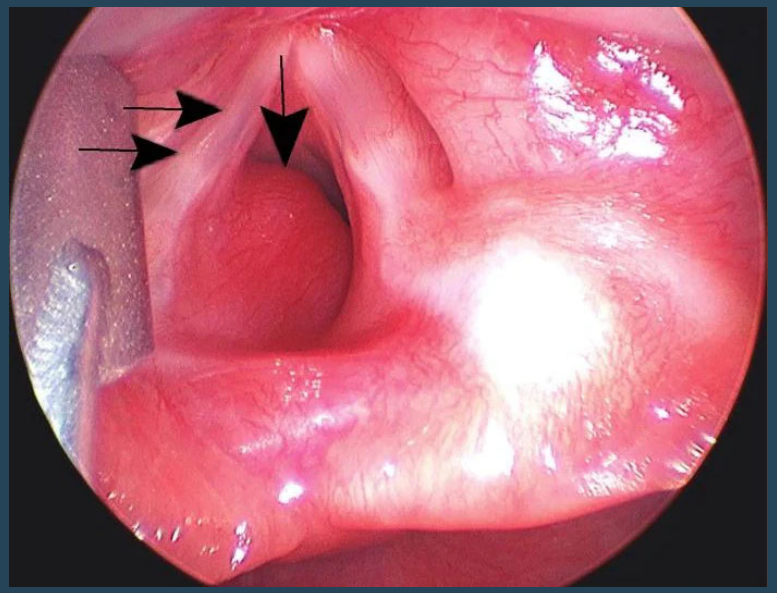
- Incomplete separation of the vocal folds
- Complete webbing is an emergency requiring immediate tracheotomy at birth
- Associated with cardiac and respiratory anomalies
- Present with weak or unusual cry
- If presents later in life may present with weak voice, breathiness, stridor

- Treatment
  - Depends on severity of webbing
    - Surgical lysis
    - Stenting
    - Laryngeal reconstruction



# Hemangioma

- Rare cause of hoarseness
- Associated with skin hemangiomas
- Treatment
  - Most do not require intervention
  - Ablation of hemangioma surgically



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# Systemic Disorders

# Systemic Disorders

- Amyloidosis
- Wegner’s Granulomatosis
- Post radiation changes
- Rheumatoid arthritis
- Parkinson's disease
- Motor Neuron Disorders
- Pregnancy

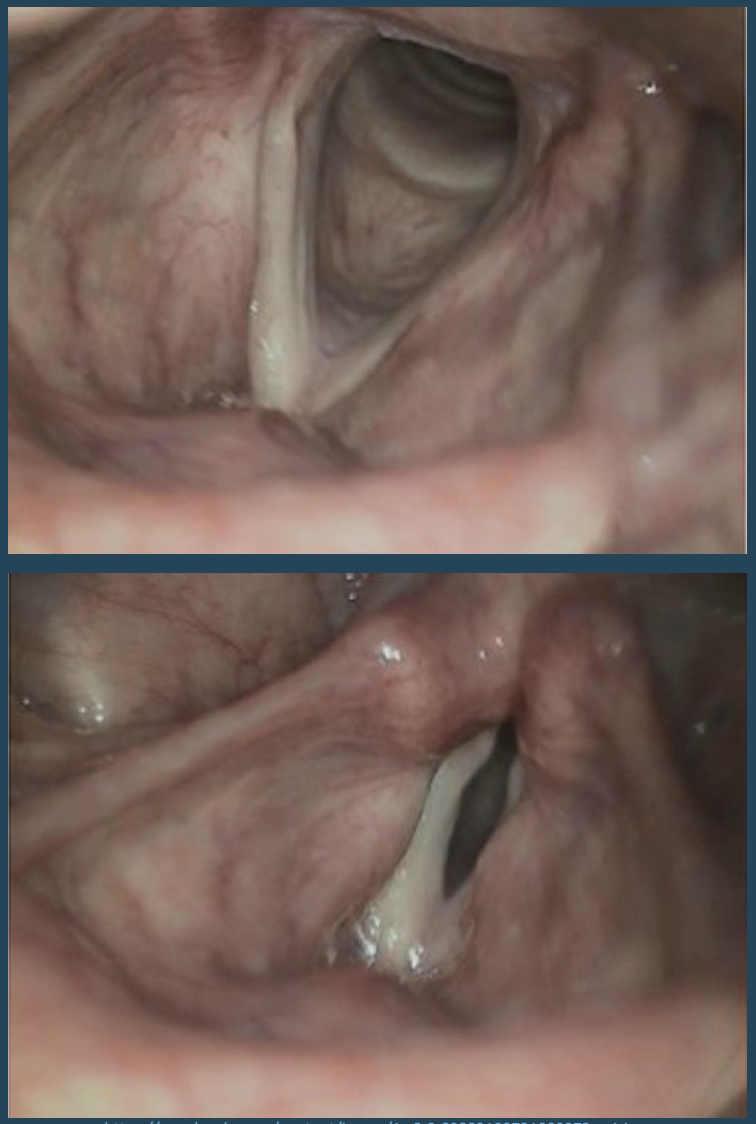
- Tremor
  - Stroke
  - Tumor
  - Multiple Sclerosis
- Motor Neuron Disorders
- Myasthenia Gravis
- Hypothyroid
- Hormonal therapy

# Tremor

# Amyloidosis

# Presbylarynx

- Aging causes
  - Ossification of the laryngeal skeleton
  - Arthritis of the cricoarytenoid and cricothyroid joints
  - Degeneration of the vocal fold layers
    - Results in bowing defect of the vocal folds
- Treatment with speech therapy



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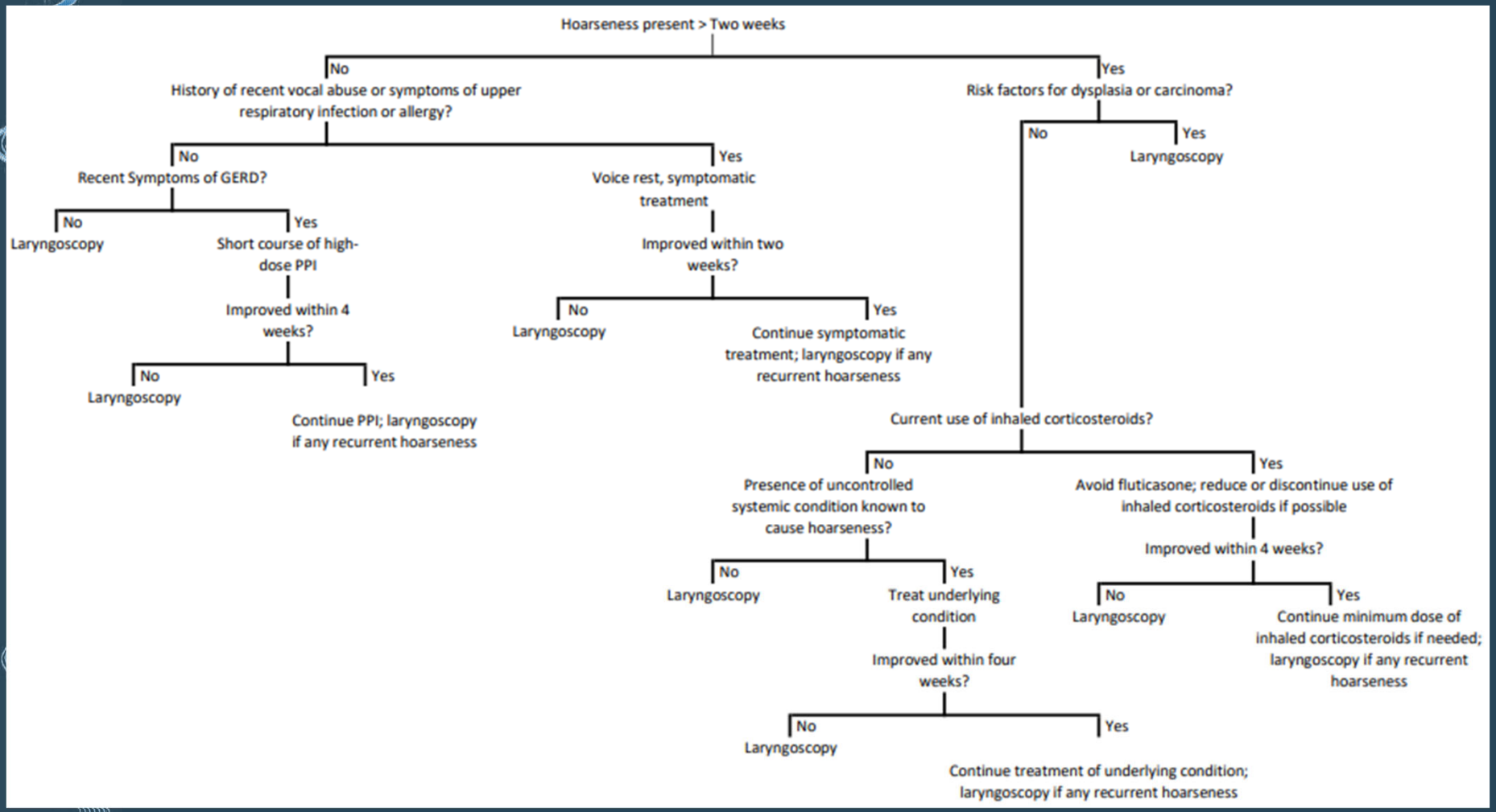
# Take Home Points

- Investigate further or refer to an otolaryngologist
  - If a patient has "acute" laryngitis that does not resolve within expected time period
  - If you have a strong level of suspicion that the patient has a malignancy
    - For example a smoker and drinker with new onset hoarseness who has no other viral symptoms
  - If the patient has hoarseness with neck mass and/or ear pain
  - If you have treated possible irritant causes and the hoarseness does not resolve
  - If the patient also has symptoms of aspiration or vocal fold paralysis

# Treatment and Referral Algorithm




Adapted from
http://www.aafp.org/afp/2009/0815/p363.html

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# Questions?

Feel free to email me with any further questions not answered today:

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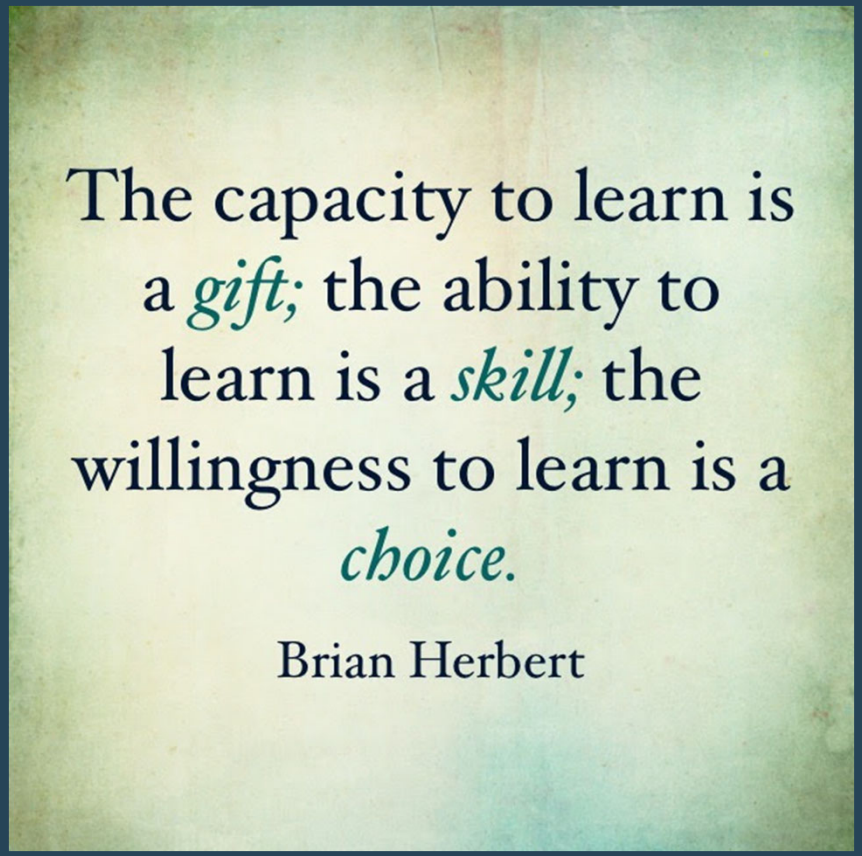


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