

The Aging Voice

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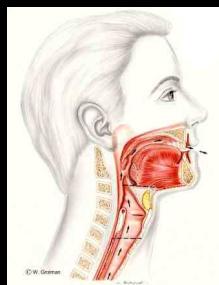


Lecture Goals

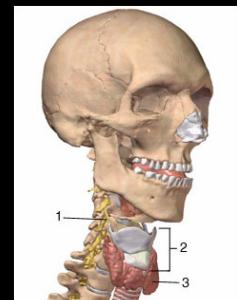
- Understand the anatomy of the voice box (larynx)
- Understand the development of the human larynx
- Understand several basic concepts in the production of the human voice
- Describe the changes that occur to the aging larynx
- Understand the impact of neurological disease on the aging larynx

The Throat: Basic Anatomy

- Throat contains one common chamber that divides into two
 - Larynx (voice box)
 - Pharynx (food passage)
- Air moves through the larynx
- Food and liquid move through the pharynx into the esophagus

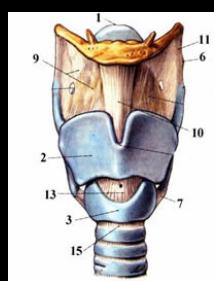


The Larynx: The Voice Box



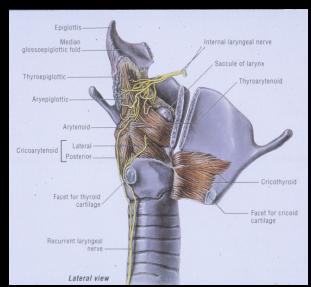
The Voice Box: The Larynx

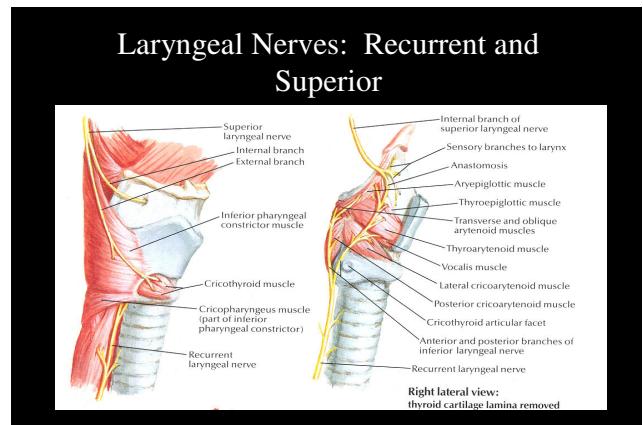
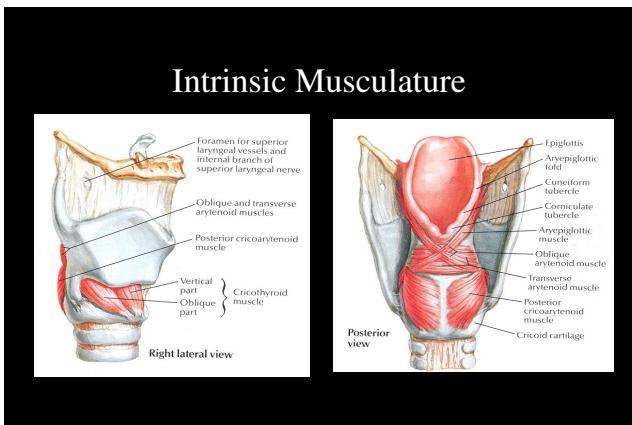
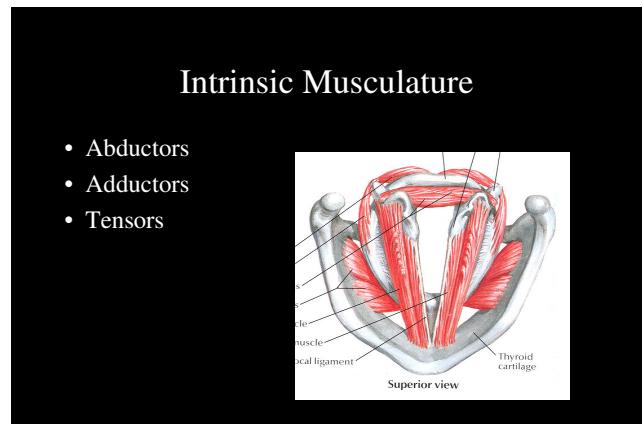
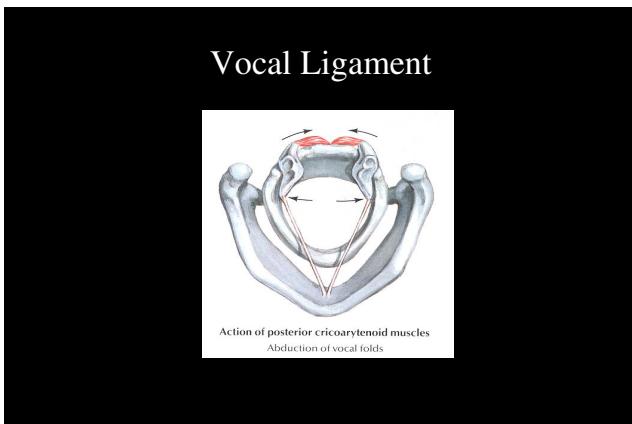
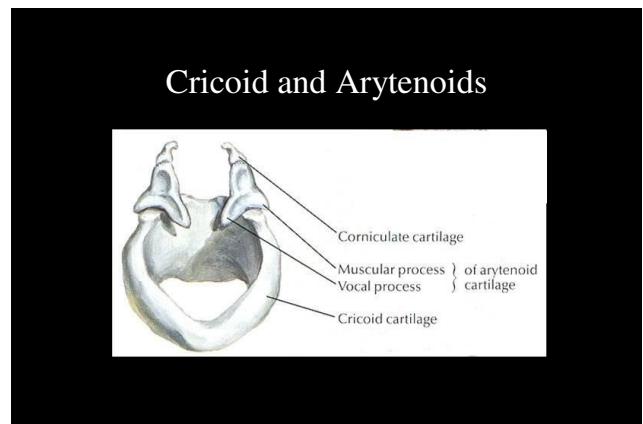
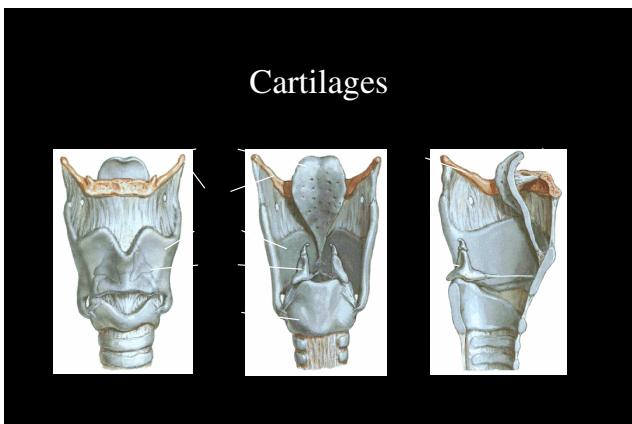
- Speech producing organ
- Swallowing
- Breathing
- Coughing
- Lifting
- Quality of Life



The Complex Larynx

- 8 cartilages
- 9 muscles
- 2 true vocal cords
- 2 false (extra) vocal cords
- 2 major motor nerves
- 2 major sensory nerves



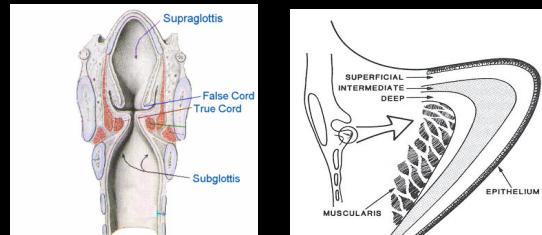


Normal Functions

- Closing (speaking)
 - Opening (breathing)
 - High pitch (falsetto)
 - Low pitch
 - Whisper
 - Cough



Vocal Cord = Vocal Fold



Mechanism of Phonation

- Inhalation of air
 - Glottic closure



Mechanism of Phonation

- Exhalation increases subglottic pressure until vocal folds displace laterally



Mechanism of Phonation

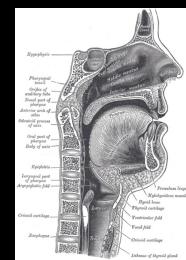
Vocal folds return to midline

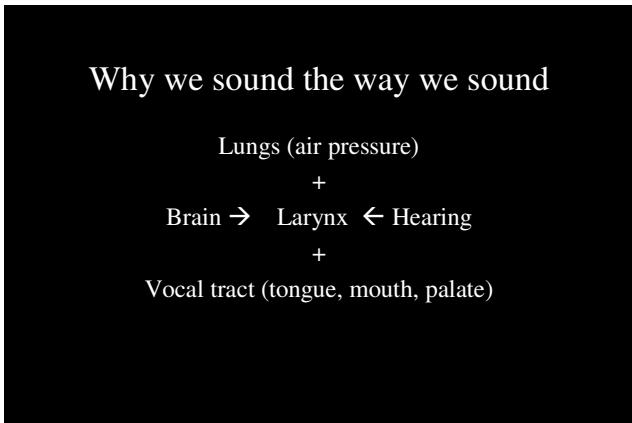
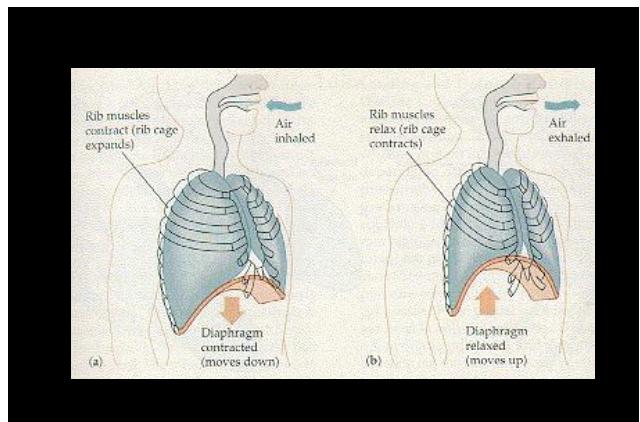
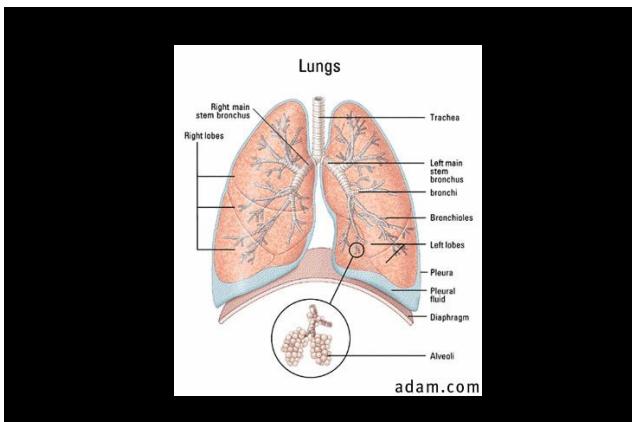
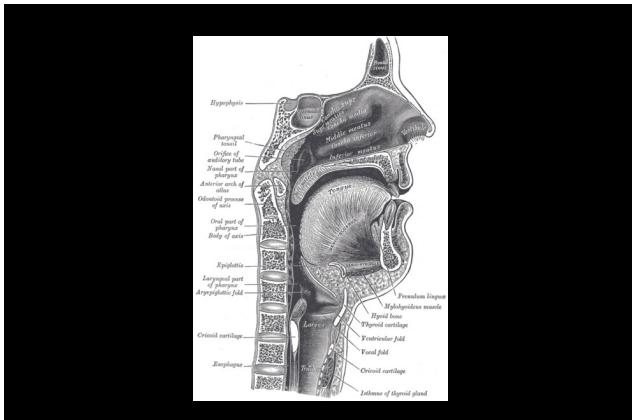
- Decrease in subglottic pressure
 - Elastic forces in vocal fold
 - Bernoulli effect of airflow



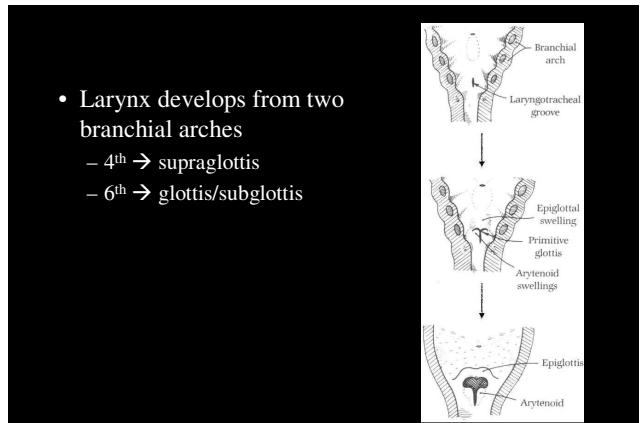
The Vocal Tract: Resonance

- Everything above the vocal cords to the lips
 - Concentrates harmonics
 - Resonance
 - Variable/adjustable





- Larynx develops from two branchial arches
 - 4th → supraglottis
 - 6th → glottis/subglottis



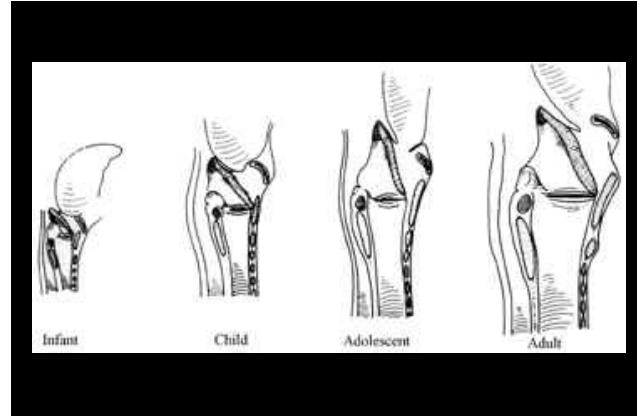
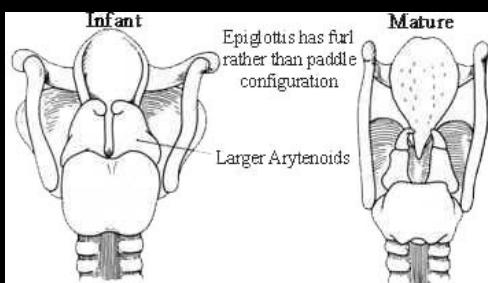
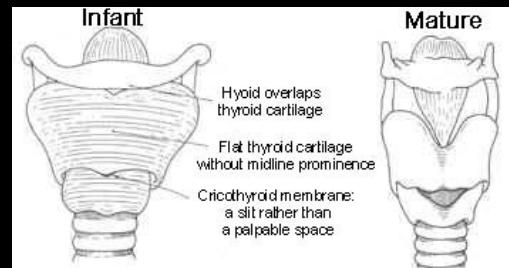
Differences between infants and adults

Infants

- Thyroid cartilage flat
- Arytenoids large
- CT membrane slit
- Epiglottis furled

Adults

- Pointed
- Proportionately smaller
- Space
- Paddle configuration

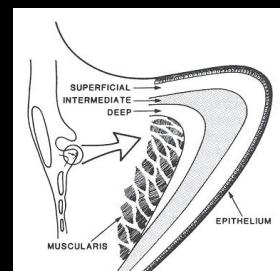


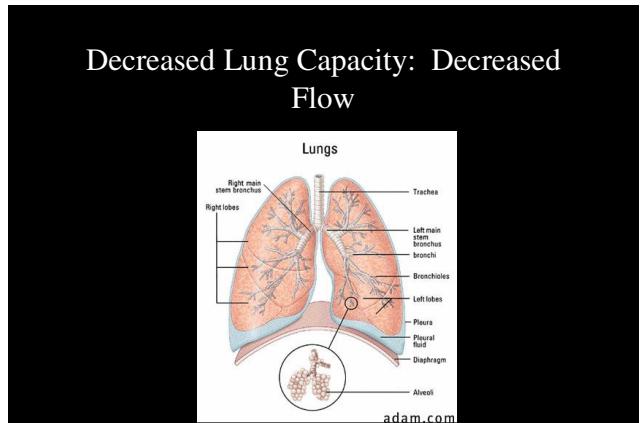
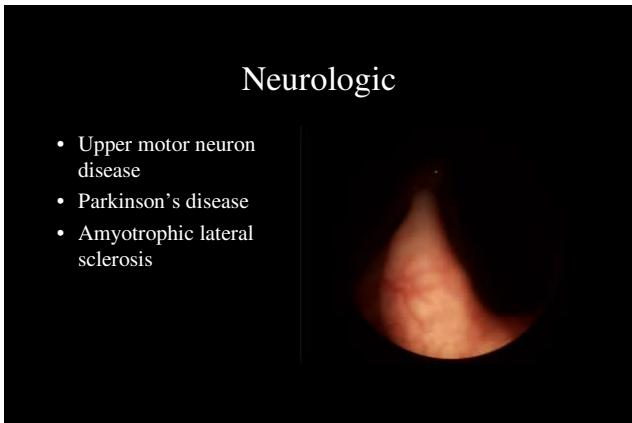
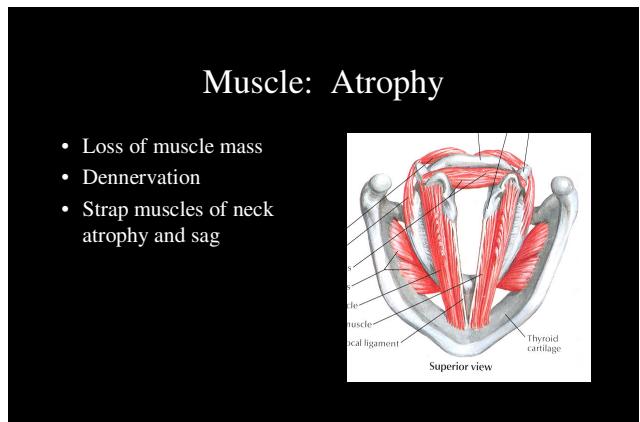
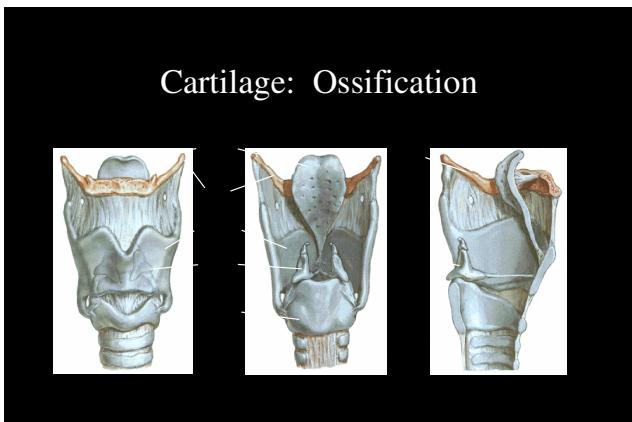
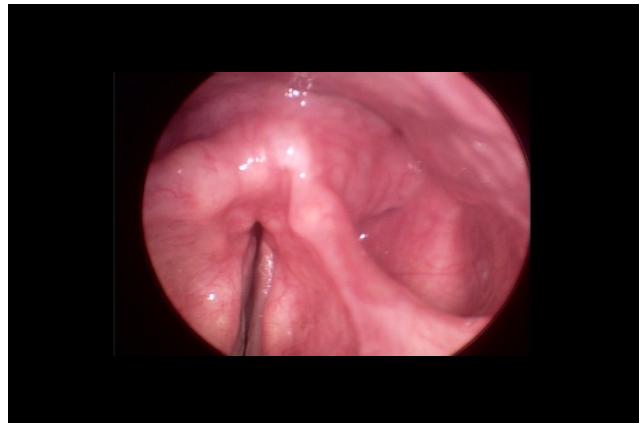
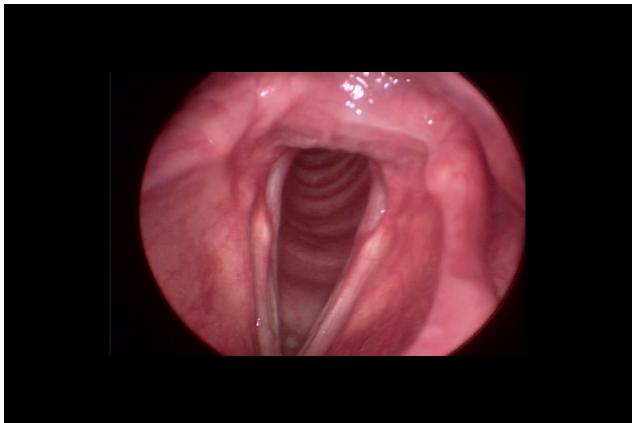
Presbyphonia: Stereotypic Aged Voice

- High pitched
- Breathy
- Hoarse
- Soft
- Tremulous

Vocal fold: Atrophy

- Mucosa thins
- Atrophy of the lamina propria
- Edema within the lamina propria in females





Secretions: Thicken

- Decreased mucous production
- Thickened mucous
- Decreased saliva
- Phlegm and globus



Overall Impression

- Larynx descends (neck looks sagged)
- Voice pitch higher in men
- Voice pitch lower in women
 - Breathy
 - Hoarse
- Vocal folds appear bowed

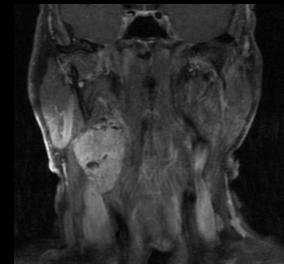
Vocal Cord Paralysis

- Injury to one or both of the vocal cord nerves
- Often following an infection
- Painless
- Symptoms vary



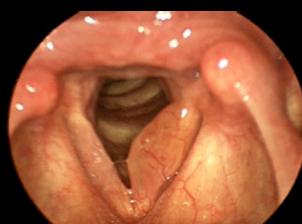
Vocal Cord Paralysis

- Occasionally caused by a tumor somewhere in the neck
- Patient may be unaware until the vocal cord becomes paralyzed
- Need to perform a scan in order to rule this out



Reinke's Edema

- Classically occurs in smokers
- Typically both sides but may be one-sided
- Looks like a polyp
- Benign
- Hoarse, husky voice
- Must stop smoking or will recur

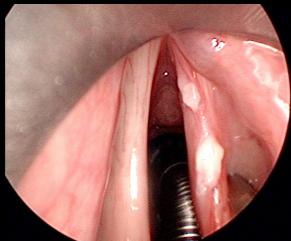


Reinke's Edema



Leukoplakia (White patch)

- May be precancerous
- Typically seen in smokers
- Can be mistaken for fungal infections
- Surgical removal is the treatment of choice
- Need to followup regularly and re-biopsy if it comes back

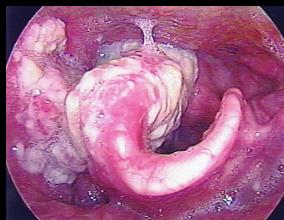


Cancer of the Larynx

- 10,000-12,000 new cases per year
- Most common site in head and neck cancer
- 4200 deaths per year from laryngeal cancer

Cancer

- Laryngeal cancer the most common cancer of the head and neck area
- Least common cause of hoarseness
- Difficulty swallowing
- Coughing up blood
- Sore throat
- Ear pain



Cancer

- Can occur on one vocal cord
- Can get a good estimate of the true extent in the operating room



Cancer

- Can involve both vocal cords



Treatment

- What components of speech mechanism are involved?
- Presbyphonia?
- Removal of part of tongue, palate?
- Stroke with neurological injury?
- Removal of lung or treatment for lung cancer?

Treatment

- Voice therapy
- Lee Silverman Voice Therapy (LSVT)
- Particularly helpful in Parkinson's disease
- Goal of therapy is to make the person loud
- Intense therapy given over several weeks

Hearing

- Assess hearing
- Patient may be embarrassed to discuss
- May be dismissed by patient as minor factor
- Consider audiogram/hearing aids

Therapy

- Growth factors?
- Estrogen?
- Testosterone?

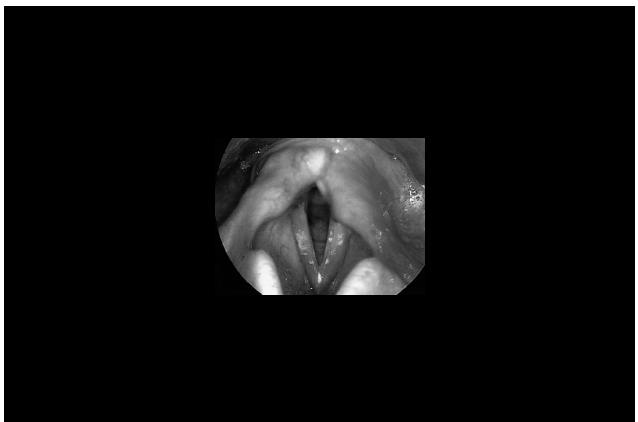
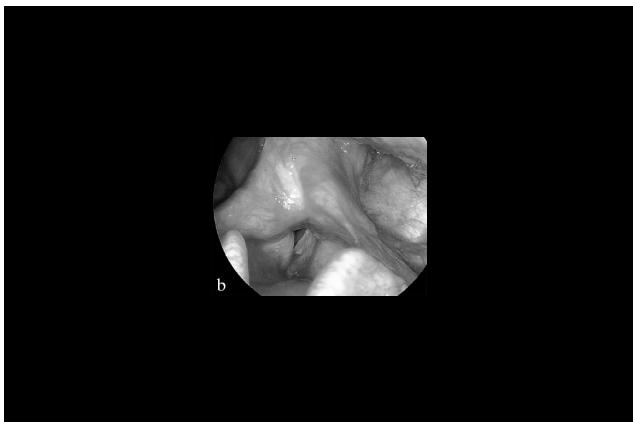
Surgery

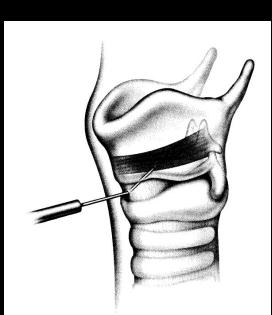
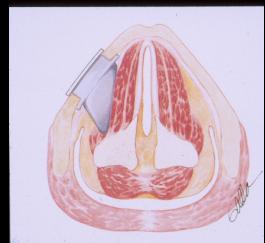
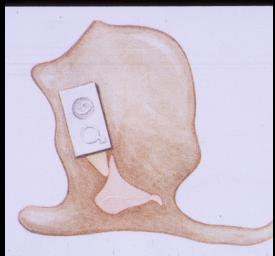
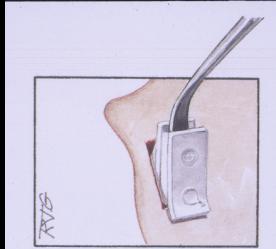
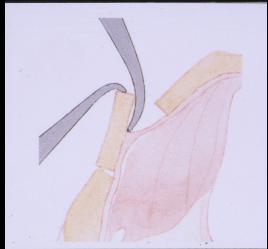
- Goal is the restoration of glottic competence
- Variety of methods
- Often voicing becomes easier, more efficient while the voice itself may not change very much

Surgery

- Preop
- Postop







Percutaneous Collagen Injection
For Glottic Insufficiency

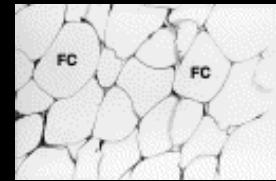
Direct Laryngoscopy

- General anesthesia
- Jet ventilation
- Spontaneous
- Microlaryngeal tube 5.0
- Paralysis
- Outpatient



Materials - Fat

- Fat
 - Excellent viscoelastic properties
 - Temporary vs. permanent
 - Injecting complete cells with attached fibrovascular support probably critical to survival



Collagen

- Collagen (Zyplast, Cosmoplast)
 - Recommendation for skin testing up to 4 weeks prior to injection
 - \$250.00 per cc
 - No skin testing required with Cosmoplast (\$350.00/cc)
 - Persists up to 3-6 months
 - Less endurance with each subsequent injection?



Acellular dermis

- Acellular human dermis (Cymetra)
 - Need to reconstitute in office
 - Requires 10-15 minutes
 - Reconstitution product "lumpy", increases difficulty of injection
 - Results last clinically 6 – 9 months
 - Long term effects of "biointegration" unknown
 - \$400.00 per cc



Calcium hydroxylapatite

- Calcium hydroxylapatite
 - White paste – easy to visualize
 - Particle size 75 to 125 microns vs. 25 to 45 microns
 - Calcium spherules may be replaced by fibrous tissue ingrowth, preserving augmentation



Calcium hydroxylapatite

- Calcium hydroxylapatite
 - Expensive - \$500.00/cc
 - Exact long term benefit remains to be seen
 - Extrusion of material at injection site
 - Degree of reabsorption undetermined



Summary

- Larynx is a complex organ, and the vocal fold itself is layered
- Voice is not a property of laryngeal function alone – much more goes into voice production than vocal fold vibration
- Consider the person as a whole when assessing a voice problem

Summary

- Presbyphonia due to many factors:
 - Calcification of cartilage
 - Muscle atrophy
 - Loss of lamina propria
 - Thinning of mucosa
 - Thickening/drying of secretions

Summary

- Treatment geared to situation at hand
 - Hearing aids
 - Voice therapy
 - Injection laryngoplasty
 - Thyroplasty