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LARYNX

- LARYNX
  - Synonyms
    - Voice box , upper windpipe ,
  - Function
    - Voice , phonation , vowels , consonants , speech , word ,
    - Language is called as index of intellect
  - Situation and extent
    - From root of tongue to trachea
    - Lies from C3 to C6 vertebra
  - Size
    - 44mm in males , 36 mm in females
  - Constitution of larynx
    - Laryngeal walls
      - Cartilages
        - Unpaired
          - Thyroid (shield like)
          - Cricoid (ring like)
          - Epiglottis (leaf like)
        - Paired
          - Arytenoid (cup shaped)
          - Corniculate (horn shaped)
          - Cuneiform(wedge shaped)
  - Laryngeal cartilages and joints
  - Thyroid cartilage
    - Laryngeal prominence
    - Lamina
    - Superior thyroid notch
    - Inferior thyroid notch
    - Superior thyroid tubercle
    - Inferior thyroid tubercle
    - Oblique line
    - Superior horn
    - Inferior horn
    - (Thyroid foramen)
    - Thyrohyoid membrane
      - Median thyrohyoid ligament
      - Retrohyoid bursa
      - Infrahyoid bursa
      - Lateral thyrohyoid ligament
      - Triticeal cartilage
  - Cricoid cartilage
    - Arch of cricoid cartilage
    - Lamina of cricoid cartilage
      - Arytenoid articular surface
      - Thyroid articular surface
    - Cricothyroid joint
      - Capsule of cricothyroid joint

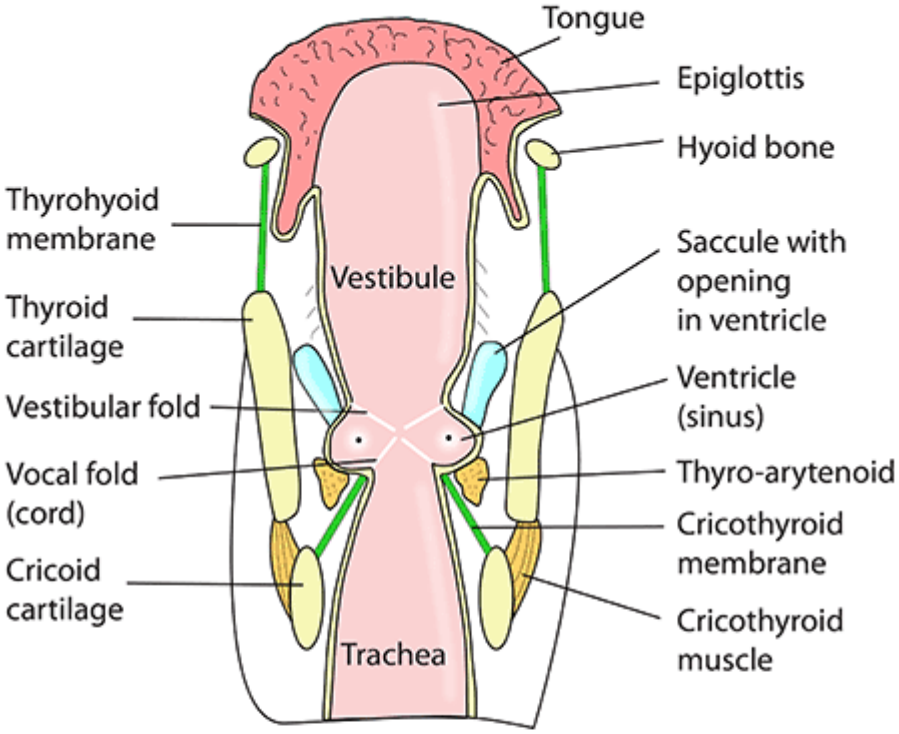
        - Ceratocricoid ligament
        - Median cricothyroid ligament
        - Cricotracheal ligament
    - Arytenoid cartilage
        - Articular surface
        - Base of arytenoid cartilage
        - Anterolateral surface
        - Vocal process
            - Arcuate crest
            - Colliculus
            - Oblong fovea
            - Triangular fovea
        - Medial surface
        - Posterior surface
            - Apex of arytenoid cartilage
            - Muscular process
        - Crico-arytenoid joint
            - Capsule of crico-arytenoid joint
            - Crico-arytenoid ligament
            - Cricopharyngeal ligament
    - (Sesamoid cartilage)
    - Corniculate cartilage Santorini
    - Corniculate tubercle
    - Cuneiform cartilage Wrisbergi
        - Cuneiform tubercle
    - Epiglottis
        - Epiglottic cartilage
        - Stalk of epiglottis
        - Epiglottic tubercle
        - Thyro-epiglottic ligament
        - Hyo-epiglottic ligament
        - Pre-epiglottic fat body
    - Laryngeal muscles
        - Cricothyroid
            - Straight part
            - Oblique part
        - Posterior crico-arytenoid
        - (Ceratocricoid)
        - Lateral crico-arytenoid
        - Vocalis
        - Thyro-arytenoid
            - Thyro-epiglottic part
        - Oblique arytenoid
            - Ary-epiglottic part
        - Transverse arytenoid
    - Laryngeal cavity
        - Laryngeal inlet
            - Ary-epiglottic fold
                - Corniculate tubercle
                - Cuneiform tubercle
            - Interarytenoid notch

- Laryngeal vestibule
- Vestibular fold
- Rima vestibuli
- Laryngeal ventricle Morgagni
    - Laryngeal saccule
- Glottis
- Vocal fold
- Rima glottidis
    - Intermembranous part
    - Intercartilaginous part
    - Interarytenoid part
- Infraglottic cavity
- Mucosa; mucous membrane
    - Laryngeal glands
- Fibro-elastic membrane of larynx
    - Quadrangular membrane
        - Vestibular ligament
    - Conus elasticus; cricovocal membrane
    - Vocal ligament

STRUCTURE

LARYNX - CORONAL SECTION

Viewed from behind so looking anteriorly



Blood supply: Superior & inferior laryngeal arteries
Mucosa: Pseudostratified ciliated columnar. Mucous glands in sinus
(cords & top of epiglottis - stratified squamous)
Nerve supply:

- Sensory above cords - Internal branch of superior laryngeal n
- Sensory below cords - Recurrent laryngeal n
- Motor to muscles - From nucleus ambiguus via cranial accessory
  - to: Cricothyroid - External branch of superior laryngeal n
  - to: All other laryngeal muscles, including upper oesophagus & cricopharyngeus - recurrent laryngeal nerve

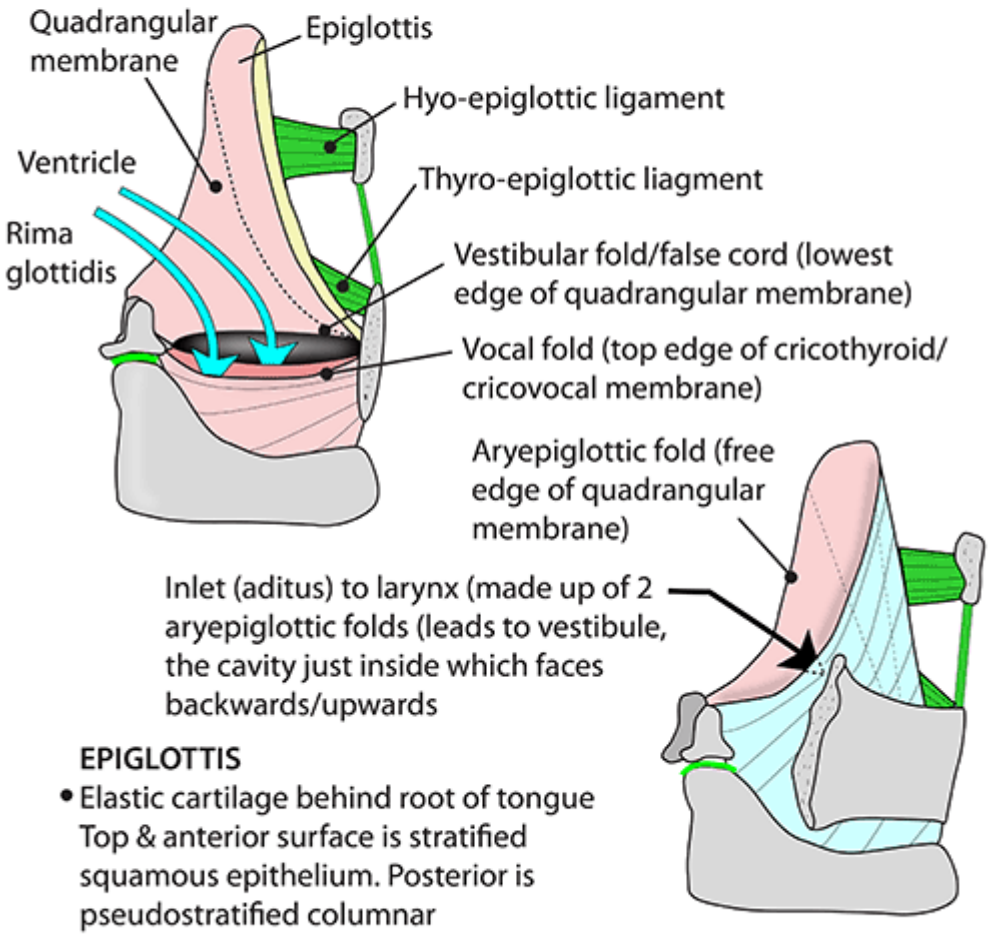
Lymphatic drainage:
Above cords - upper deep cervical nodes
Below cords - lower deep cervical nodes

INLET

LARYNX - INLET & EPIGLOTTIS

Inlet:

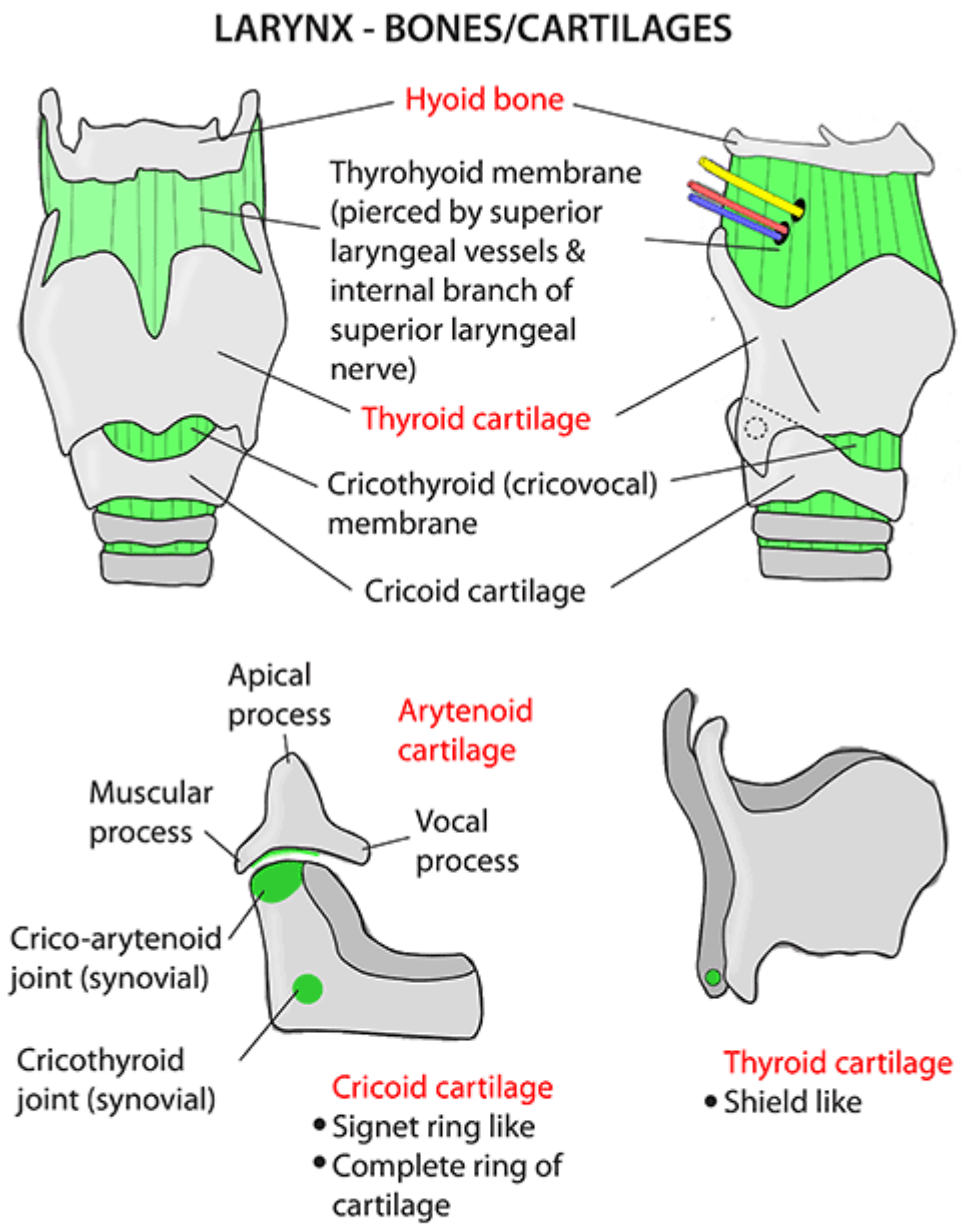
- Extends from tip of epiglottis to C6
- Open for respiration, partially closed for speaking, closed for coughing, straining and swallowing
- Hangs from hyoid bone via tongue/mandible (hyoglossus, mylohyoid geniohyoid, digastrics, middle constrictor). Some effect on it by 3 of 4 strap muscles (omohyoid, sternohyoid & thyrohyoid)



EPIGLOTTIS

- Elastic cartilage behind root of tongue Top & anterior surface is stratified squamous epithelium. Posterior is pseudostratified columnar
- Held by: hyo-epiglottic, thyro-epiglottic & aryepiglottic ligaments & median & lateral glosso-epiglottic folds

CARTILAGES


LARYNX - BONES/CARTILAGES
Hyoid bone
Thyrohyoid membrane (pierced by superior laryngeal vessels & internal branch of superior laryngeal nerve)
Thyroid cartilage
Cricothyroid (cricovocal) membrane
Cricoid cartilage
Apical process
Arytenoid cartilage
Muscular process
Vocal process
Crico-arytenoid joint (synovial)
Cricothyroid joint (synovial)
Cricoid cartilage
• Signet ring like
• Complete ring of cartilage
Thyroid cartilage
• Shield like
Larynx elevated by: Mylohyoid, digastric, stylohyoid, geniohyoid, thyrohyoid, stylopharyngeus, palatopharyngeus, salpingopharyngeus, inferior constrictor

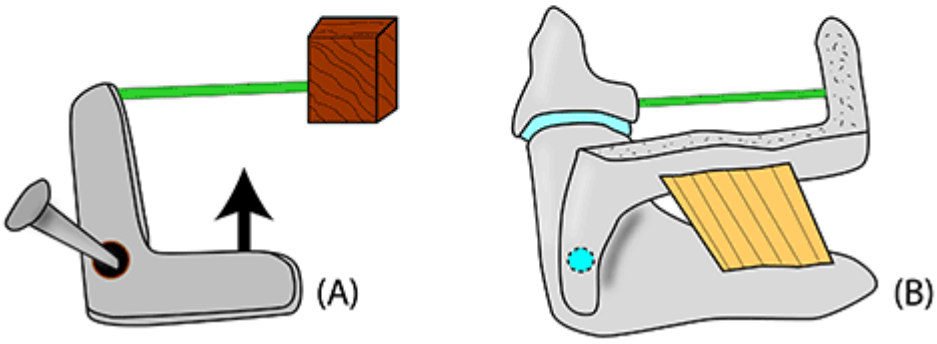
MUSCLES

LARYNX - CRICOTHYROID MUSCLE

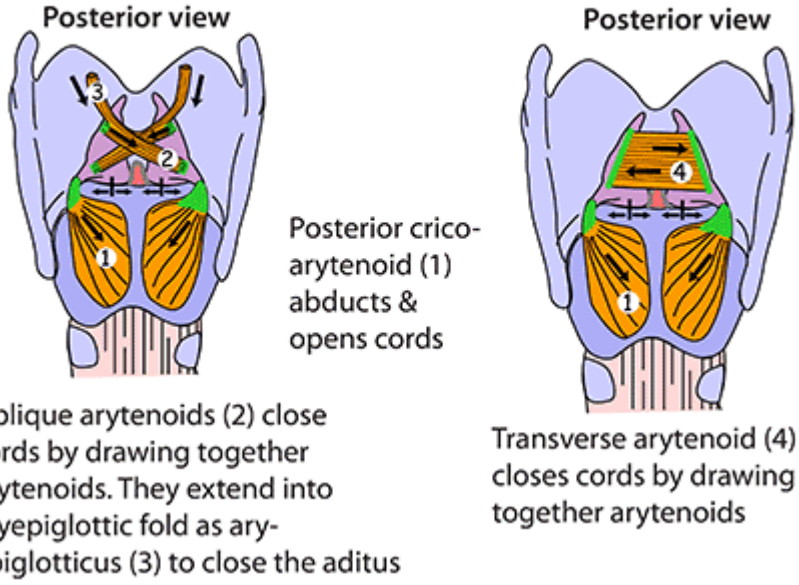
CRICOTHYROID has 3 special features that makes it different from other laryngeal muscles. These are:

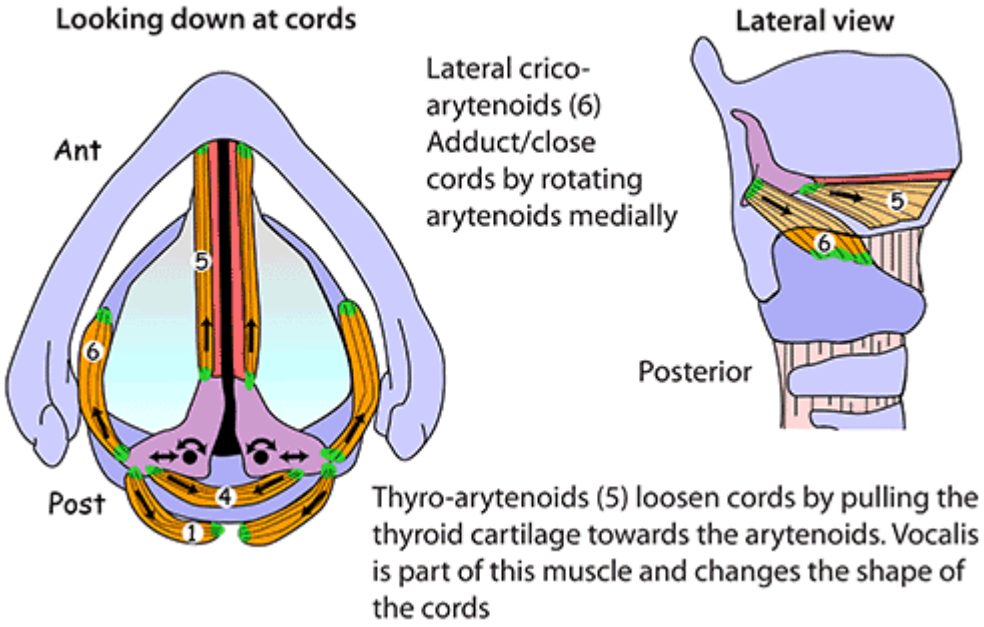
- It is the only muscle that tightens the cords
- It is supplied the external branch of the superior laryngeal nerve and not the recurrent laryngeal
- It is the only intrinsic muscle of the larynx which on the outside of larynx

It is not initially obvious how this muscle tighens the cords but the illustration below helps with the understanding. If you can imagine a block of wood attached to the wall (A) with a strong piece of very slightly elastic string joining the block to the top of an angle-iron. The angle-iron can rotate on a nail in such a way that lifting the other end of it will tighten the string. The equivalent situation in the larynx (B) is that the cricothyroid muscle does the lifting of the angle-iron (cricoid) to tighten the cords. The thyroid cartilage is not fixed as is the block of wood in (A) so that both cartilages are tilted when the cords are tightened. Note that the cords are attached to the back of the thyroid cartilage and the vocal processes of the arytenoids



LARYNX - INTRINSIC MUSCLES



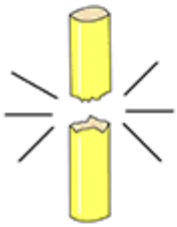


SEMON'S LAW
FOR DAMAGE OF NERVES TO LARYNX

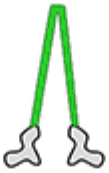
Semon's Law indicates the different effect between damage & transection of the recurrent laryngeal nerve as applicable to surgery in the region of this nerve (eg thyroidectomy or parathyroidectomy). It is probably more of a guide than a rule

Transection of recurrent laryngeal nerve

RLN



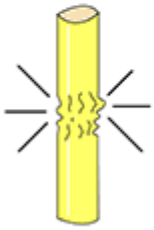
CORDS



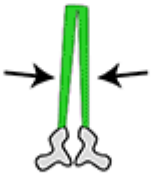
- Complete paralysis
- 1/2 ab(ad)ducted
- Cannot cough or speak

Trauma but no transection

RLN



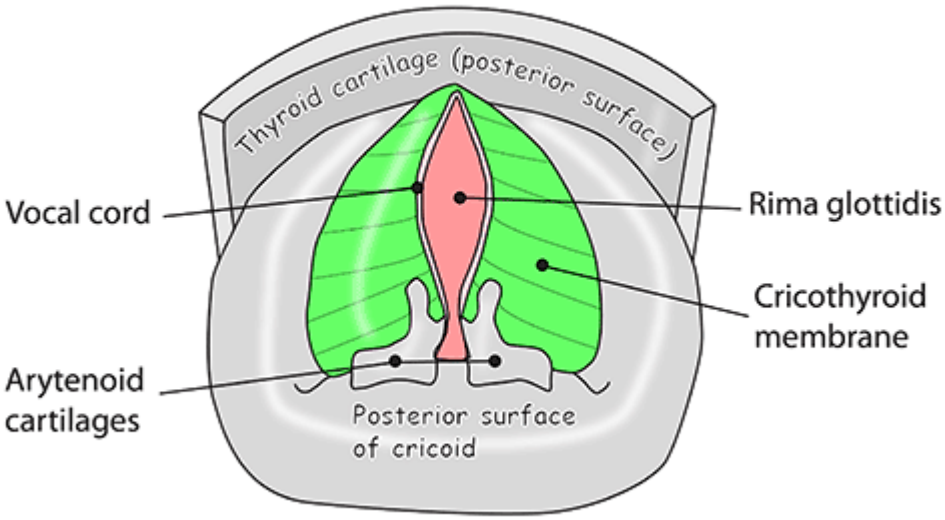
CORDS



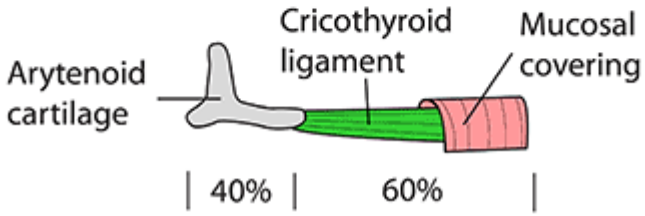
- Partial paralysis
- Adducted cords
- Posterior crico-arytenoids most vulnerable
- Cannot breath

BILATERAL → DISASTER
UNILATERAL → CAN COMPENSATE

VOCAL CORDS/CRICOTHYROID MEMBRANE



TRUE VOCAL CORDS are the free upper edges of the crico-thyroid membrane (conus elasticus) where it is thickened to become the cricovocal liagment and covered with mucosa. The mucosa is pearly white and has no submucosa and thus cannot become oedematous
40% of the vocal cord is arytenoid cartilage
60% is membrane
The cricothyroid membrane is attached around the inside of the ring of cricoid cartilage and has a free upper margin that is attached to the arytenoid cartilages posteriorly and to the back of the thyroid cartilage anteriorly



NERVES

VESSELS

DEVELOPMENT

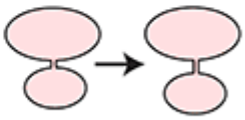
LARYNX - FUNCTION AND DEVELOPMENT

DURING SWALLOWING

- Closure of aditus by aryepiglotticus acting like a purse-sting on the aryepiglottic folds
- Closure of rima glottidis/cords (lateral crico-arytenoids & transverse arytenoids)
- Epiglottis flips backwards/downwards with solid food
- Larynx/pharynx hauled up under the tongue (suprahyoid muscles)

DURING PHONATION

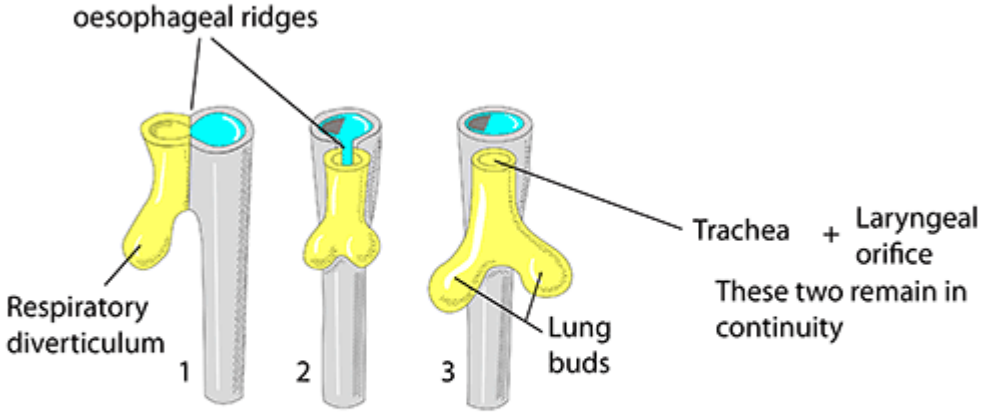
- Cords held together for up to 3mm
- Vocalis helps to change the amount of cord that approximates
- Series of jets of air
- Resonance produced by structures above larynx (pharynx/sinuses)
- Whispering is very wasteful of air as it is a constant stream



DURING COUGHING AND STRAINING

- Explosion of compressed air via closed cords

DEVELOPMENT



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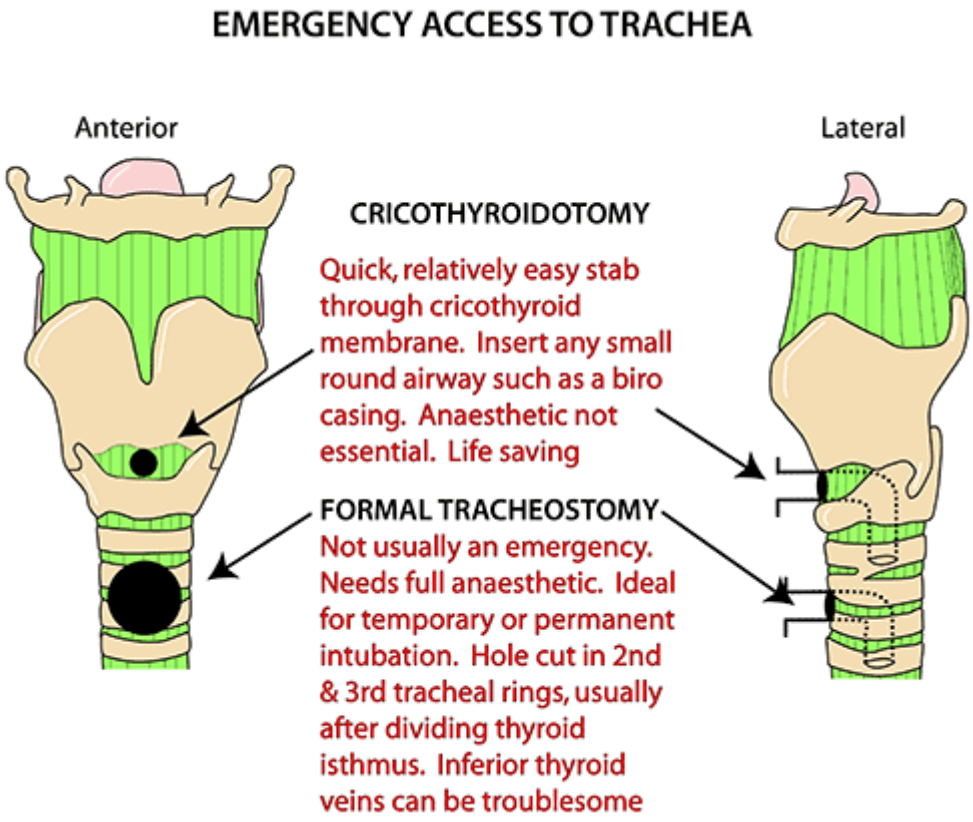
At 4 weeks, there is an endodermally lined outgrowth from the ventral wall of the foregut - the respiratory diverticulum. Initially it is wide open into the oesophagus then the oesophageal ridges fuse to give an oesophago-tracheal septum. Cartilage and muscle of the respiratory tract form from the splanchnic mesoderm.

CLINICAL ANATONY



terminology

LARYNX	LARYNX
Cartilagines et articulationes laryngis	Laryngeal cartilages and joints
Cartilago thyroidea	Thyroid cartilage
Prominentia laryngea	Laryngeal prominence
Lamina	Lamina
Incisura thyroidea superior	Superior thyroid notch
Incisura thyroidea inferior	Inferior thyroid notch
Tuberculum thyroideum superius	Superior thyroid tubercle
Tuberculum thyroideum inferius	Inferior thyroid tubercle
Linea obliqua	Oblique line
Cornu superius	Superior horn
Cornu inferius	Inferior horn
(Foramen thyroideum)	(Thyroid foramen)
Membrana thyrohyoidea	Thyrohyoid membrane
Lig. thyrohyoideum medianum	Median thyrohyoid ligament
Bursa retrohyoidea	Retrohyoid bursa
Bursa infrahyoidea	Infrahyoid bursa
Lig. thyrohyoideum laterale	Lateral thyrohyoid ligament
Cartilago triticea	Triticeal cartilage
Cartilago cricoidea	Cricoid cartilage
Arcus cartilaginis cricoideae	Arch of cricoid cartilage
Lamina cartilaginis cricoideae	Lamina of cricoid cartilage
Facies articularis arytenoidea	Arytenoid articular surface

Facies articularis thyroidea	Thyroid articular surface
Articulatio cricothyroidea	Cricothyroid joint
Capsula articularis cricothyroidea	Capsule of cricothyroid joint
Lig. ceratocricoideum	Ceratocricoid ligament
Lig. cricothyroideum medianum	Median cricothyroid ligament
Lig. cricotracheale	Cricotracheal ligament
Cartilago arytenoidea	Arytenoid cartilage
Facies articularis	Articular surface
Basis cartilaginis arytenoideae	Base of arytenoid cartilage
Facies anterolateralis	Anterolateral surface
Processus vocalis	Vocal process
Crista arcuata	Arcuate crest
Colliculus	Colliculus
Fovea oblonga	Oblong fovea
Fovea triangularis	Triangular fovea
Facies medialis	Medial surface
Facies posterior	Posterior surface
Apex cartilaginis arytenoideae	Apex of arytenoid cartilage
Processus muscularis	Muscular process
Articulatio cricoarytenoidea	Crico-arytenoid joint
Capsula articularis cricoarytenoidea	Capsule of crico-arytenoid joint
Lig. cricoarytenoideum	Crico-arytenoid ligament
Lig. cricopharyngeum	Cricopharyngeal ligament
(Cartilago sesamoidea)	(Sesamoid cartilage)
Cartilago corniculata Santorini	Corniculate cartilage Santorini
Tuberculum corniculatum	Corniculate tubercle
Cartilago cuneiformis Wrisbergi	Cuneiform cartilage Wrisbergi
Tuberculum cuneiforme	Cuneiform tubercle
Epiglottis	Epiglottis
Cartilago epiglottica	Epiglottic cartilage
Petiolus epiglottidis	Stalk of epiglottis
Tuberculum epiglotticum	Epiglottic tubercle
Lig. thyroepiglotticum	Thyro-epiglottic ligament
Lig. hyoepiglotticum	Hyo-epiglottic ligament
Corpus adiposum preepiglotticum	Pre-epiglottic fat body
Musculi laryngis	Laryngeal muscles
M. cricothyroideus	Cricothyroid
Pars recta	Straight part
Pars obliqua	Oblique part
M. cricoarytenoideus posterior	Posterior crico-arytenoid
(M. ceratocricoideus)	(Ceratocricoid)
M. cricoarytenoideus lateralis	Lateral crico-arytenoid
M. vocalis	Vocalis
M. thyroarytenoideus	Thyro-arytenoid
Pars thyroepiglottica	Thyro-epiglottic part
M. arytenoideus obliquus	Oblique arytenoid

Pars aryepiglottica	Ary-epiglottic part
M. arytenoideus transversus	Transverse arytenoid
Cavitas laryngis	Laryngeal cavity
Aditus laryngis	Laryngeal inlet
Plica aryepiglottica	Ary-epiglottic fold
Tuberculum corniculatum	Corniculate tubercle
Tuberculum cuneiforme	Cuneiform tubercle
Incisura interarytenoidea	Interarytenoid notch
Vestibulum laryngis	Laryngeal vestibule
Plica vestibularis	Vestibular fold
Rima vestibuli	Rima vestibuli
Ventriculus laryngis Morgagni	Laryngeal ventricle Morgagni
Sacculus laryngis	Laryngeal saccule
Glottis	Glottis
Plica vocalis	Vocal fold
Rima glottidis; rima vocalis	Rima glottidis
Pars intermembranacea	Intermembranous part
Pars intercartilaginea	Intercartilaginous part
Plica interarytenoidea	Interarytenoid part
Cavitas infraglottica	Infraglottic cavity
Tunica mucosa	Mucosa; mucous membrane
Glandulae laryngeales	Laryngeal glands
Membrana fibroelastica laryngis	Fibro-elastic membrane of larynx
Membrana quadrangularis	Quadrangular membrane
Lig. vestibulare	Vestibular ligament
Conus elasticus	Conus elasticus; cricovocal membrane
Lig. vocale	Vocal ligament