

2B: Normal Anatomy of The Trachea

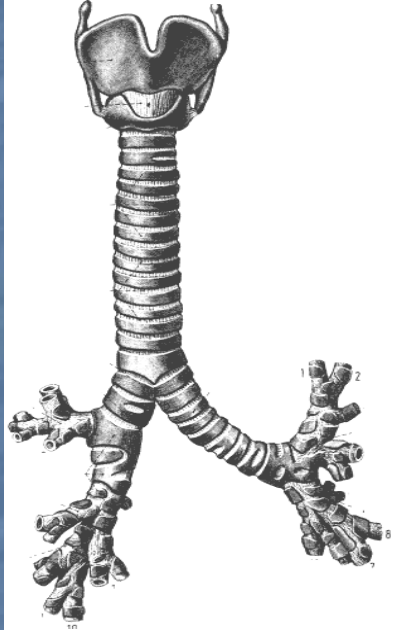
Series of Web-based Bronchoscopic Images



Prepared By
Bronchoscopy International

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Tracheal and subglottic anatomy



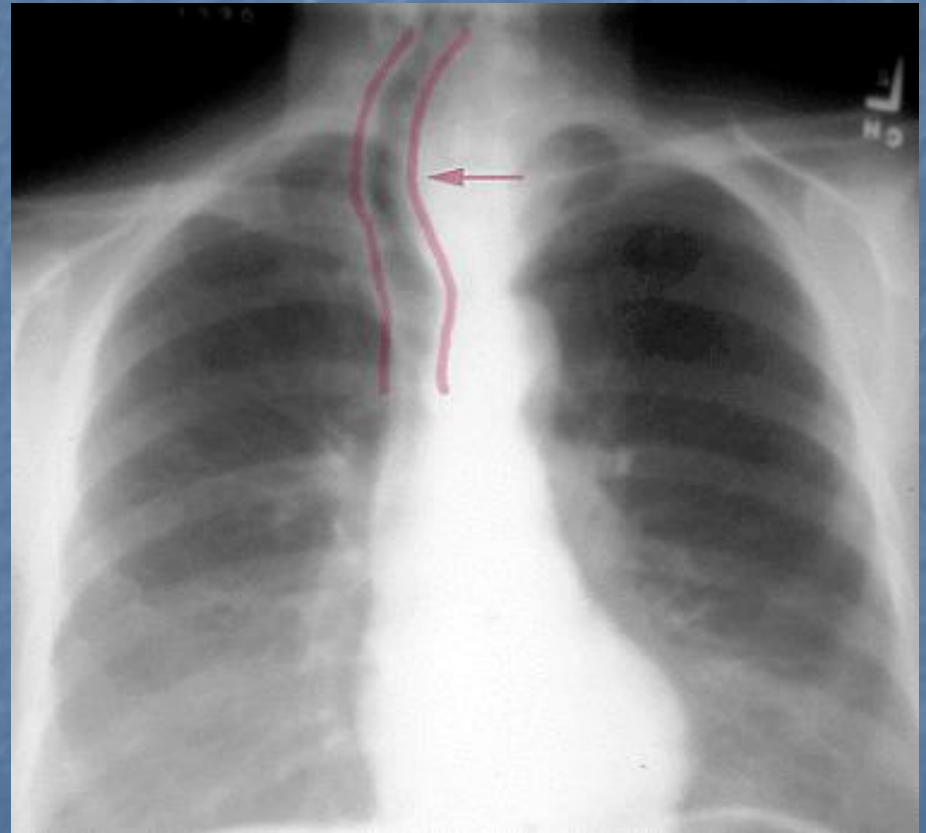
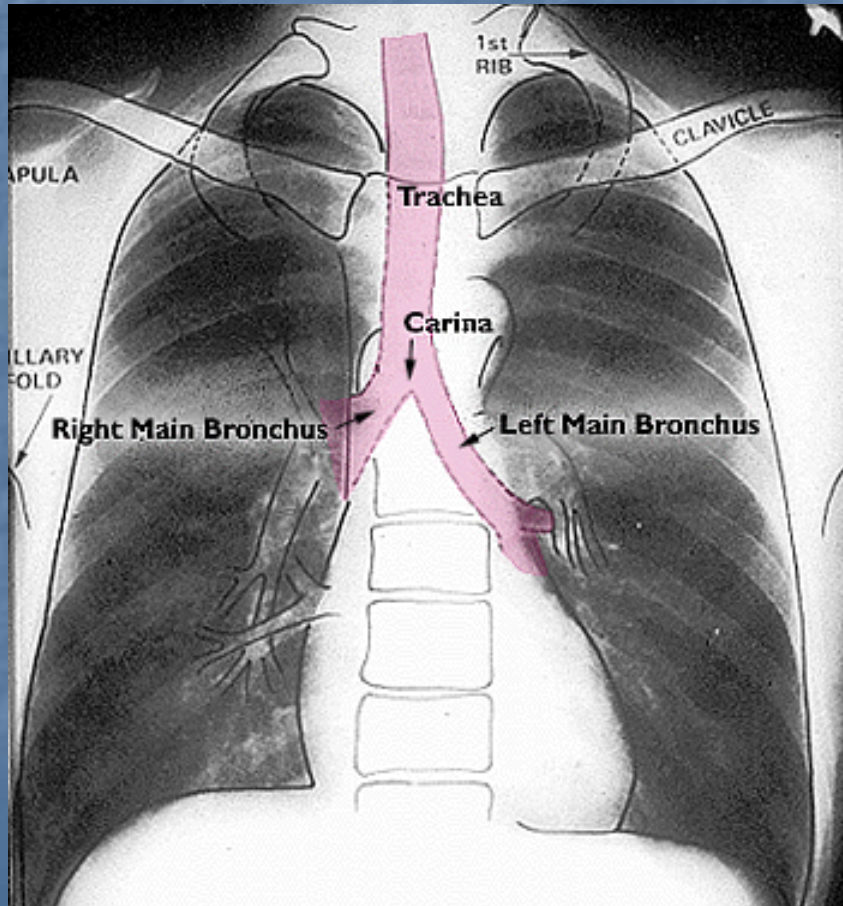
The trachea is a cylindrical tube that projects onto the spine from C6 to the level of T5. As it passes downwards, it follows the curvature of the spine, and courses slightly backward. Near the tracheal bifurcation, it deviates slightly to the right.



The subglottis ends 2 cm below the level of the vocal cords. This corresponds cranially to the inferior margin of the cricoid cartilage, which is the inferior margin of the larynx and forms the only complete cartilage ring in the airway.

Tracheobronchial anatomy

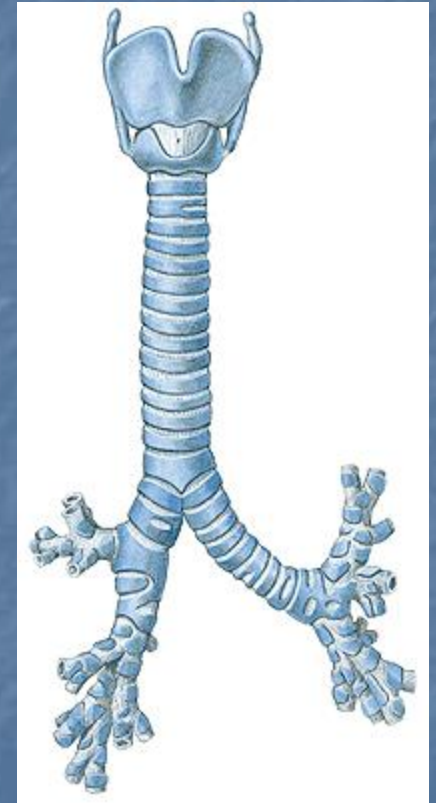
Images downloaded from From www.vh.org



Tracheal Displacement Due to Goiter

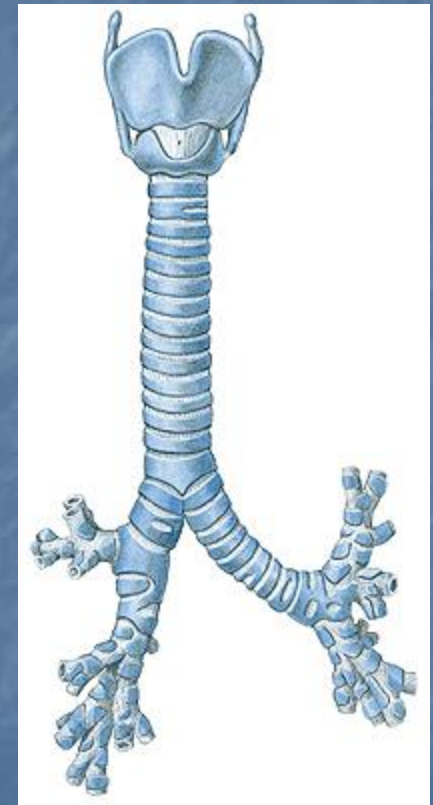
Anatomy of the trachea

- Length: 9-15 cm
- Outer diameter: 21-27 mm
- Internal diameter: 12-18 mm
- Distance infracricoid-carina about 11 cm



Anatomy of the trachea

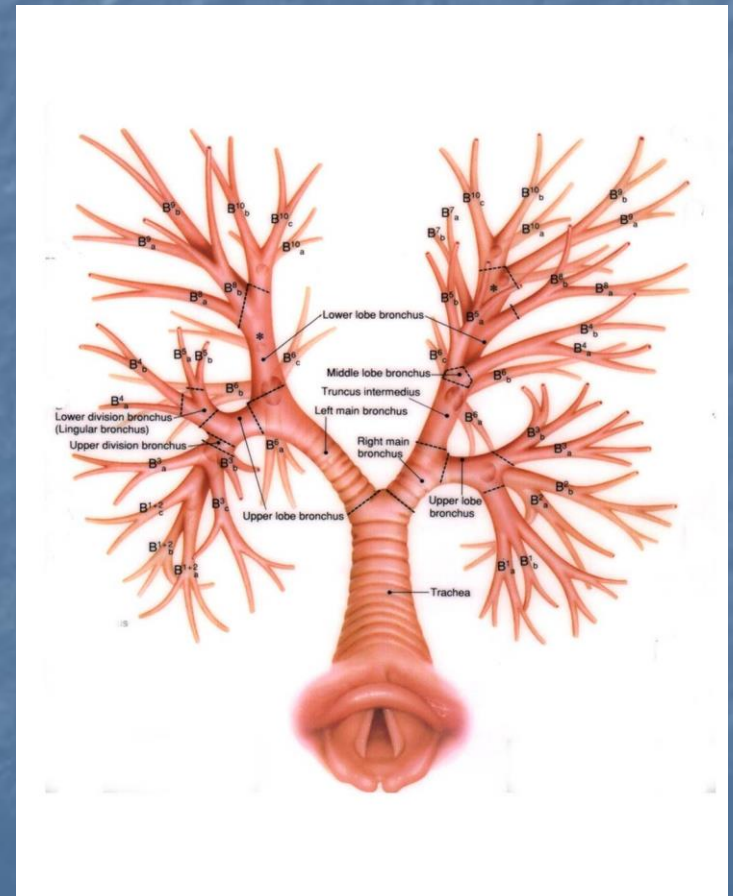
- 18-22 cartilaginous rings
- There are 2.1 rings/cm
- Becomes intrathoracic at 6th cartilaginous ring
- Intrathoracic portion: 6-15 cm



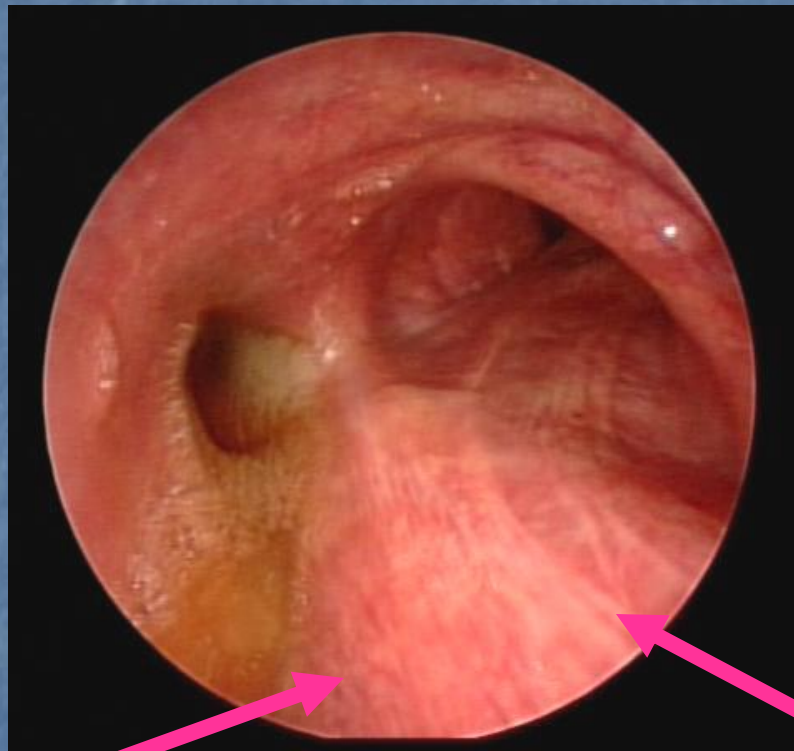
Anatomy of the trachea

- Cross-section area of women about 40% less than men.

From Oho and Matsukawa,
Olympus Co.



The membranous posterior membrane allows esophageal expansion during deglutition



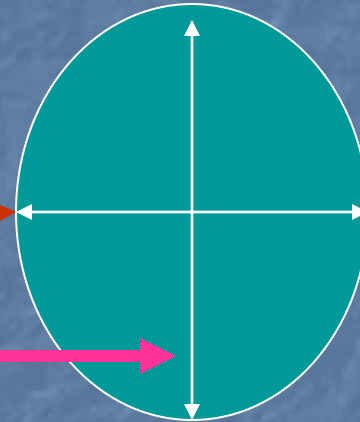
Contains glands, small arteries, nerves, lymph vessels and elastic fibers

Trachealis muscle overlies esophageal muscle and epithelium

Tracheal dimensions

Trachea

- Average cross-sectional area of the male adult trachea is approximately **2.8 cm²**
- Transverse (lateral) diameter of **25 mm** and sagittal (anteroposterior) diameter of **27 mm** are the upper limits of normal (males)
- The lower limit of normal for both transverse and sagittal diameters is about **13 mm in men** and **10 mm in women**



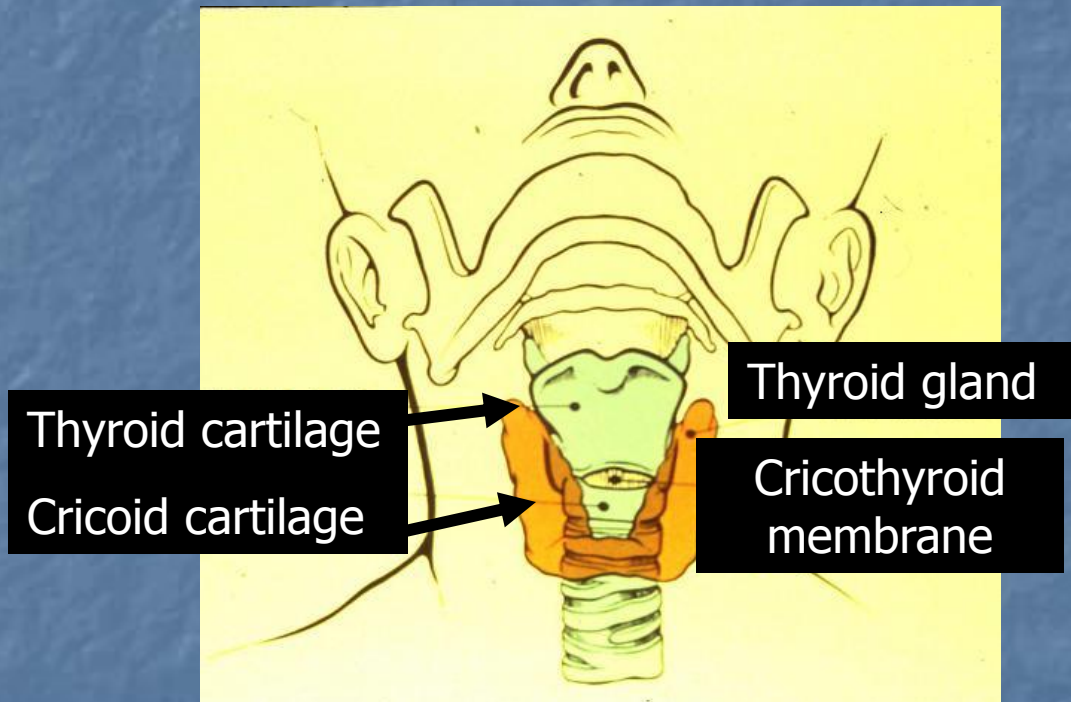


The average cross-sectional area of the trachea
in a 30-year-old male is

- A. 1.5 cm²
- B. 2.8 cm²
- C. 3.2 cm²
- D. 5.0 cm²

Click for correct answer: **B**

Cricoid



Cricoid Cartilage

The carina

Y this is Great



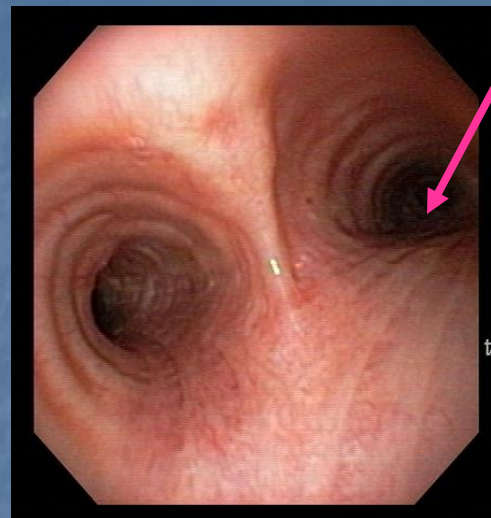
Courtesy Henri Colt MD,
Editor, *Journal of Intensive Care Medicine*, 2005

Inverted Y Simulating Main Carina



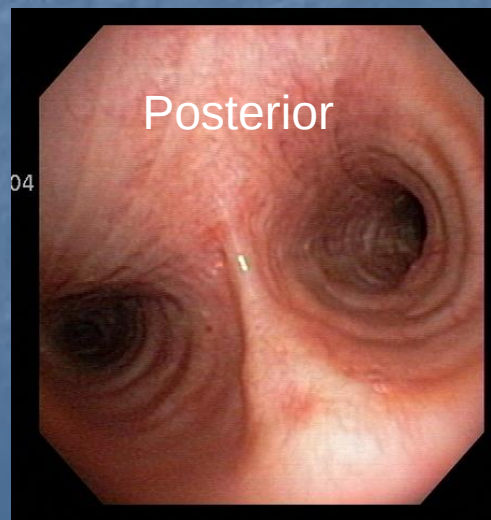
Courtesy Henri Colt MD,

Note vertical RMB



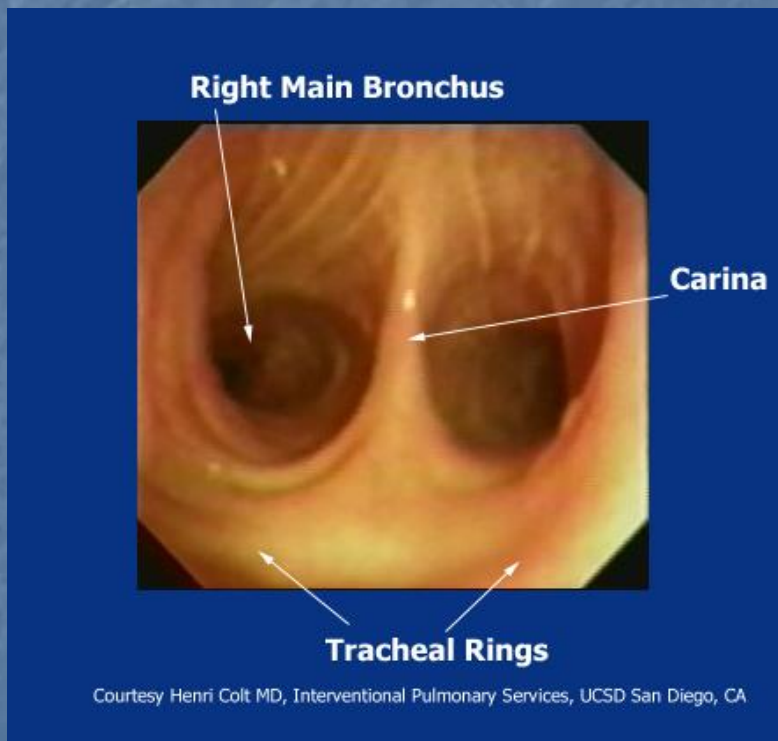
From the head

Posterior

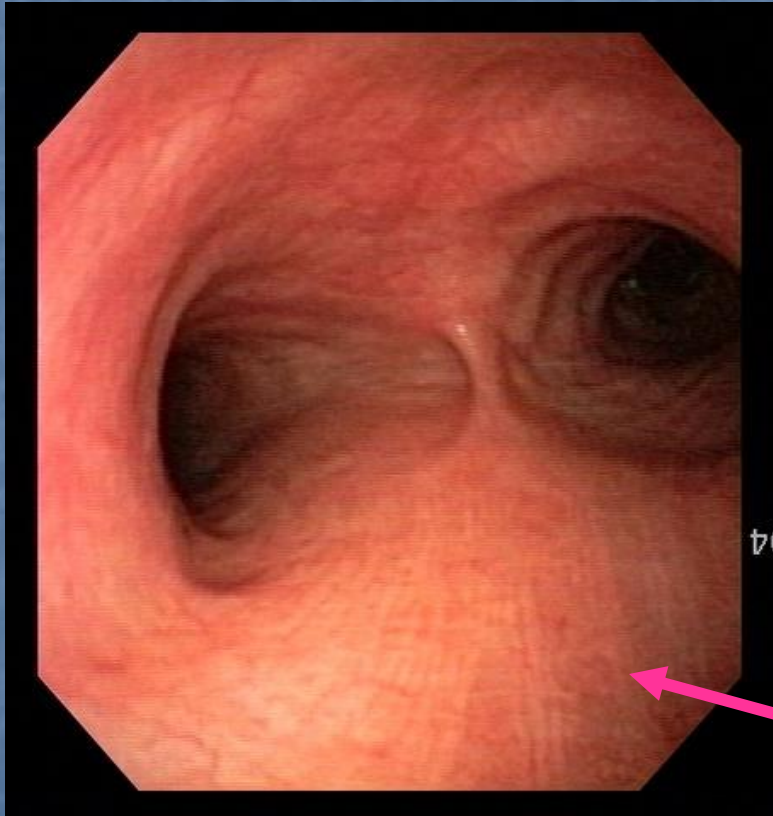


From the front

Main carina: Concepts of anterior and posterior



Widened main carina



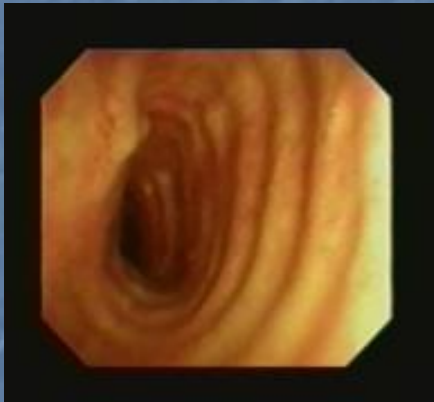
Large subcarinal
adenopathy present

Posterior membrane

Some facts about tracheal anatomy

- ✓ The cervical segment (extrathoracic) ends at the sternal manubrium and encompasses about the first six tracheal rings.
- ✓ The U-shaped trachea is probably the most frequent shape found.
- ✓ A man's cross sectional tracheal area is usually about 40 percent larger than a woman's.
- ✓ In women, the lower limit of normal for transverse and sagittal diameters is about 10 mm.

Tracheal morphologies



A saber-sheath or scabbard trachea is defined as a trachea with excessive transverse narrowing and widened sagittal diameter of the intrathoracic portion of the trachea. This is very different from the C-shaped trachea seen in about 49% of normal adults. The saber sheath trachea has been described in up to 5 % of elderly men.



Women tend to preserve a round configuration, while men tend to have some sagittal widening and transverse narrowing.

NORMAL Dynamic Airway Collapse

- During normal respiration, there is narrowing of the airway caliber due to bulging of the posterior membrane.
- The mean decrease in cross sectional area between inspiration and expiration is up to 40%.

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Morphologic normal variants

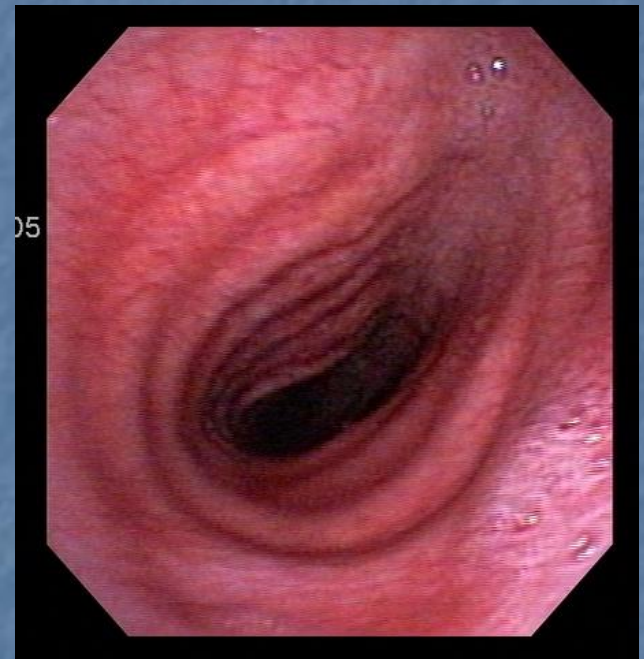
U-shaped trachea (27%)



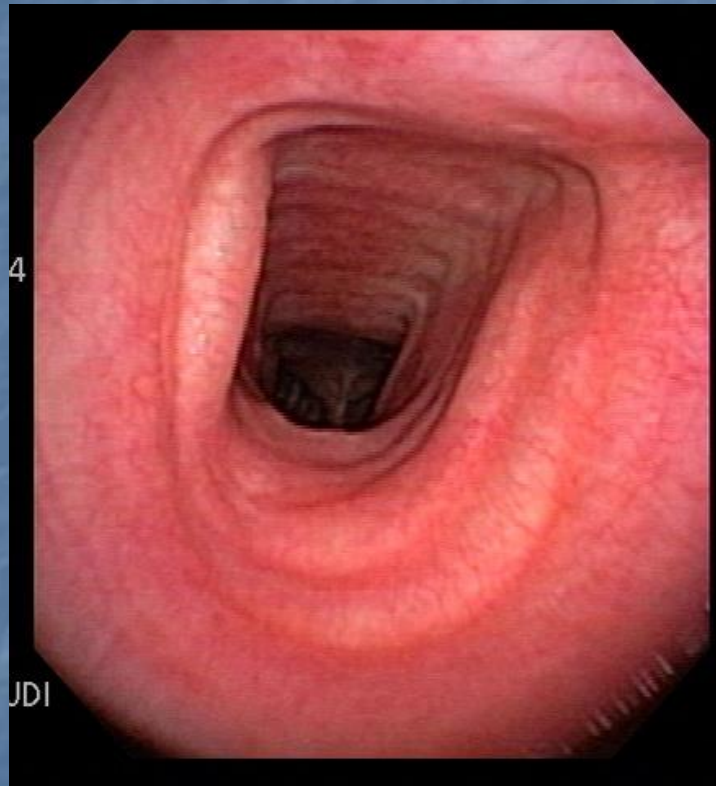
C-shaped trachea (49%)

Saber-sheath trachea

- Tracheal Index (TI) defined as (transverse/sagittal diameter) < 0.6
- 5% of elderly men with COPD



Horseshoe trachea

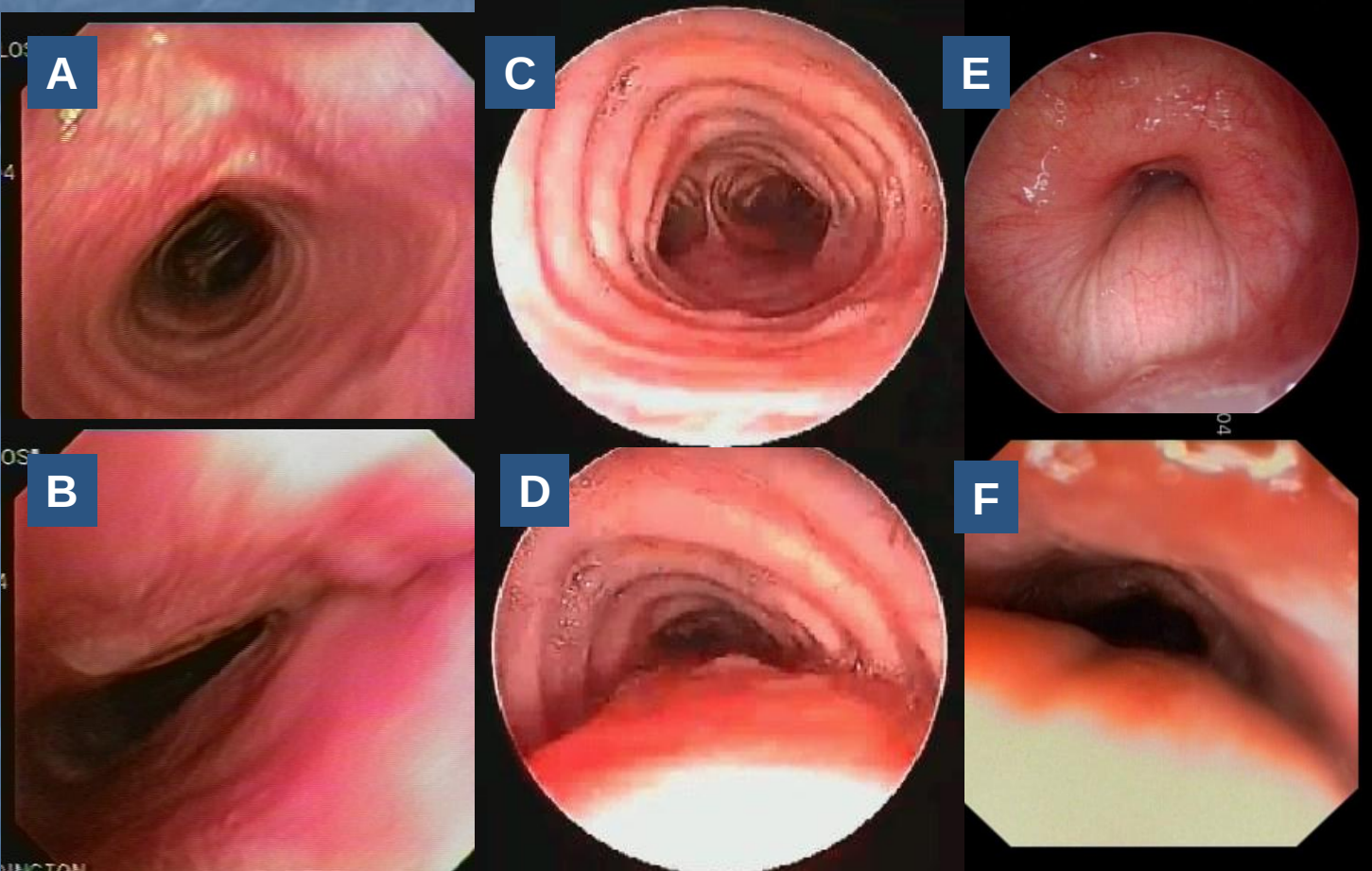


Tracheal appearances

Normal shape

expansion during inhalation

circumferential collapse



Saber sheath

Dynamic collapse

Crescent shape collapse

Dynamic abnormalities

Tracheobronchomalacia

- A condition that causes the airways to narrow during exhalation because of weakness of the cartilaginous structures.

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Crescent-Shaped Tracheomalacia

Excessive Dynamic Airway Collapse

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- Excessive bulging of the posterior membrane causing narrowing of the cross-sectional area to 50% or more.

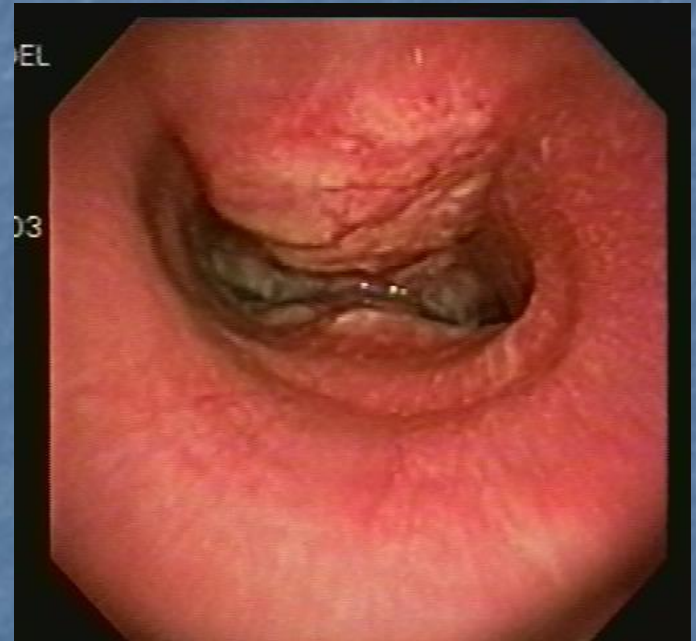
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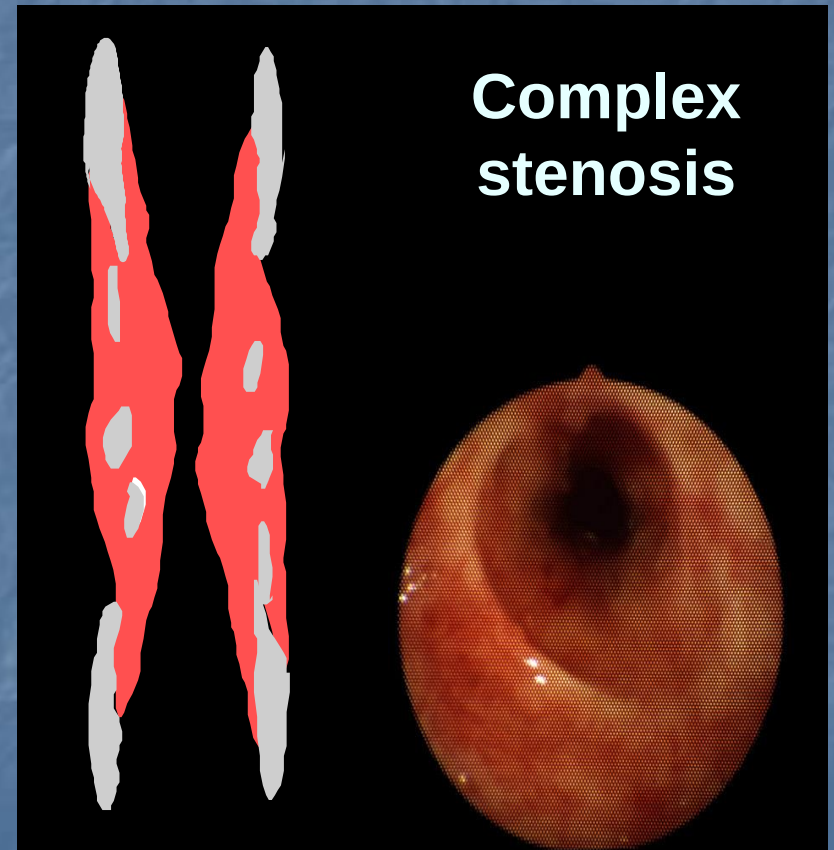
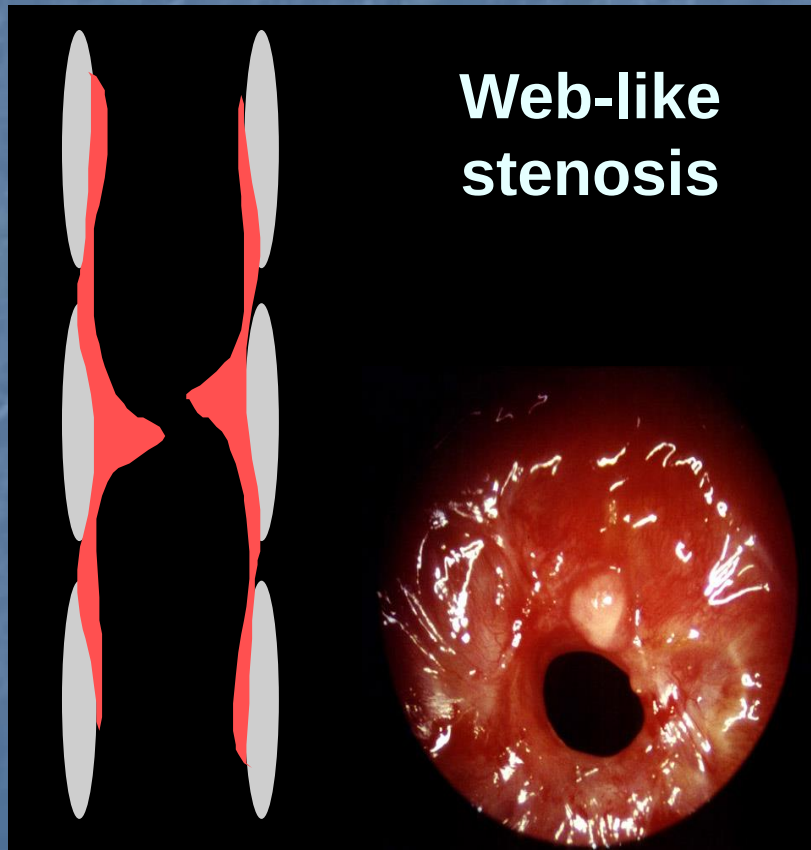
Fixed abnormalities

Intraluminal disease and extrinsic compression

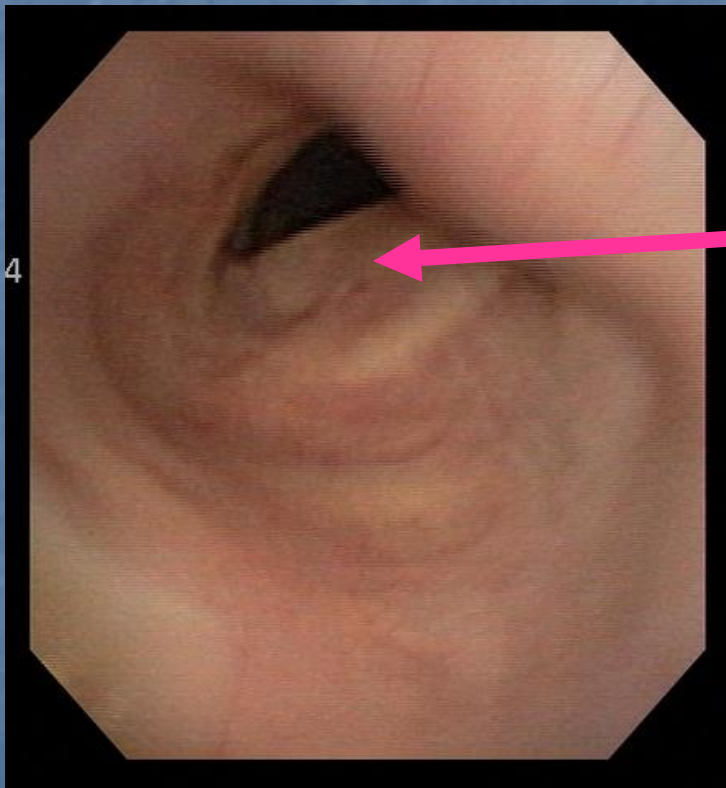
- Tumor invading through posterior wall.
- Tumor invading left and right main bronchi
- Narrowing of lower third of trachea



Simple and complex strictures



Example of fixed stricture at previous tracheostomy site



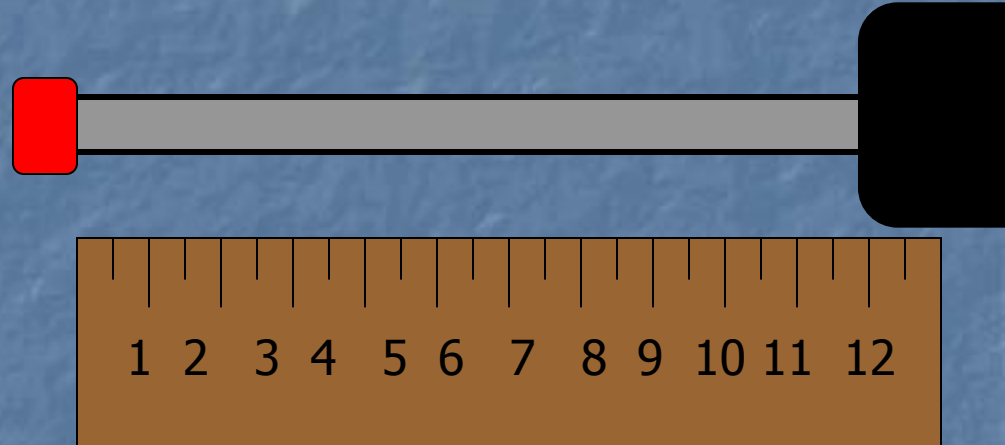
Note partial collapse of anterior-lateral tracheal wall

Classic triangular shape of stomal stricture

Measuring an abnormality

First we measure the distance from the inferior aspect of vocal cords to the abnormality.

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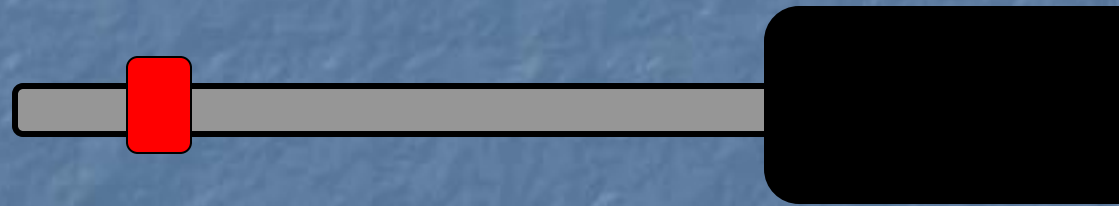
3.0 cm

Click to continue

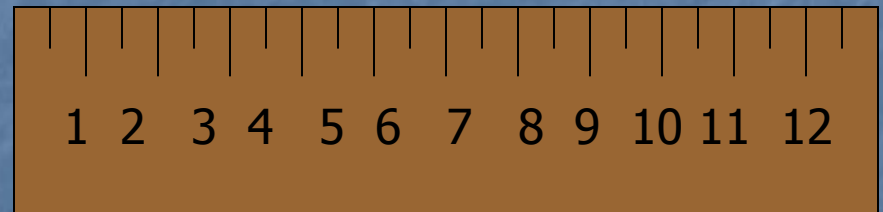


Measuring an abnormality

Next we measure the length of the abnormality itself



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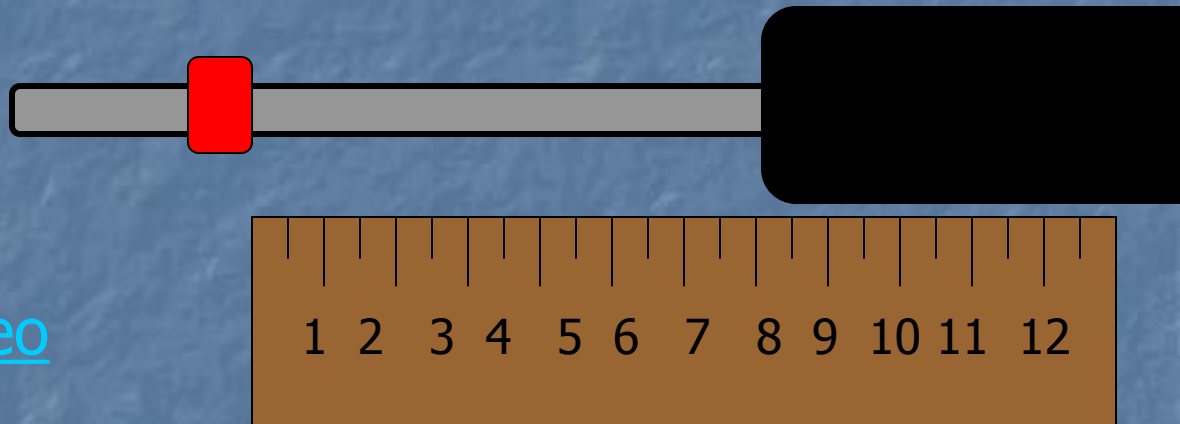
1.5 cm

Click to continue



Measuring an abnormality

Finally, we measure the distance from the distal extremity of the abnormality to the carina



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8.0 cm

Click to continue

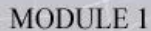


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The Essential Bronchoscopist

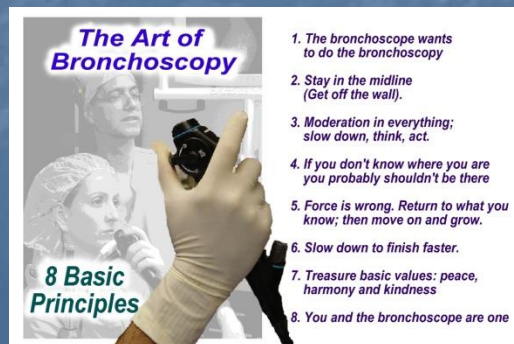
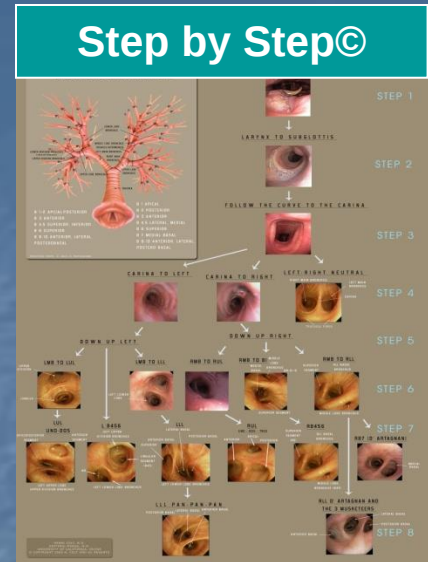


MODULE 1



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Thank you