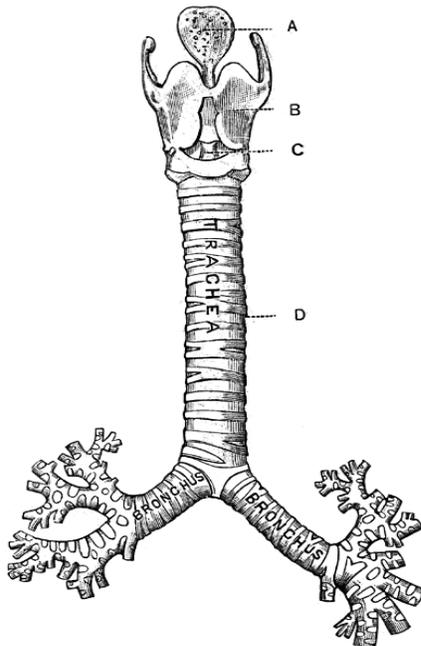


## Quick Review: Surgical Anatomy of Trachea



"Larynx, Trachea, and the Bronchi. (Front view.)

A, epiglottis; B, thyroid cartilage; C, cricothyroid membrane, connecting with the cricoid cartilage below, all forming the larynx; D, rings of the trachea." — Blaisedell, 1904. Source: [http://etc.usf.edu/clipart/15400/15499/trachea\\_15499\\_lg.gif](http://etc.usf.edu/clipart/15400/15499/trachea_15499_lg.gif)

The trachea connects the larynx with main bronchi. It is located on the midline of the body, with its distal part usually displaced to the right side. The upper border of trachea is placed higher in children as compared to adults. In a newborn it lies at the level of second cervical vertebra. As the descent of the larynx occurs its upper border reaches fifth cervical vertebra in a five year old child and finally comes to lie at the level of sixth vertebra in fifteenth year of life. Similarly the tracheal bifurcation is situated at the level of third or fourth cervical vertebra in new-born infants and at the fifth thoracic vertebra in adults. In an individual with a narrow thoracic cage the tracheal bifurcation may be situated at a higher level.

The cranial end of trachea is attached to the lower border of cricoid with the help of crico-

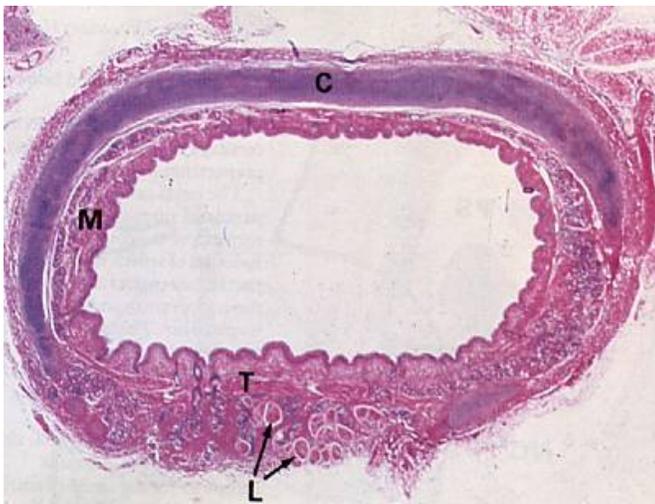
tracheal ligament. This attachment makes the larynx move up and down along with the larynx during respiration and swallowing.

The length of trachea can be correctly gauged by measuring the exact distance between lower border of cricoid cartilage and apex of the bifurcation angle (Perelman 1972). It varies with age (Allen, M S 2003). Langova (1946) measured the length of the trachea in 390 cadavers ranging in age from six months of intra-uterine life to twenty years and found that it was 3.1 cm on an average in the newborn, 6 cm in a five year old child, 7 cm at the age of ten and 8.5 cm at the age of 15 years. In adults the length of trachea varies widely from 8.5 to 15 cm. Tehmina Begum et al (2009) measured the length of trachea in adult males in the age range of 20 to 58 years. The mean lengths of the trachea were  $8.73 \pm 0.21$  cm in 20-29 years age Group,  $9.53 \pm 0.46$  cm in 30-39 years age Group,  $9.63 \pm 0.23$  cm in 40 - 49 years age group &  $9.79 \pm 0.39$  cm in 50-59 years age group. On an average the length of trachea in an adult male is 11 cm and 10 cm in female. The length of the trachea increases when head is thrown back and turned to the side. The length of trachea also increases with inspiration and decreases on expiration. The trachea is usually flattened in the ventro-dorsal direction.

The trachea is divided into cervical and mediastinal parts, by a line along the superior thoracic aperture when the neck is held in vertical position. In children the thoracic part is a little shorter than the cervical part, while in adults the thoracic part constitutes two-third of its entire length. From the operative surgical considerations it is expedient to divide the thoracic portion of trachea into three approximately equal parts, superior, mid and inferior. (Perelman 1972)

The total number of tracheal cartilages does not change with the age; there are usually 15-20 of them, but some times as many as 26 (Abrikosov, 1947). In adults the cartilages are 3 to 5 mm wide and up to 2mm thick. The first tracheal cartilage is wider than the others. During surgery the tracheal cartilages appear whitish and shine. The annular ligaments are light grey in color and are usually half the width of tracheal rings. The membranous part of trachea is reddish in appearance and becomes wider in its caudal part.

The mucous membrane of trachea is continuous with that of larynx and usually is pinkish in color. It is stratified ciliated columnar in character. The functioning of mucous glands, ciliary epithelium and muscle fibers promotes moistening of the trachea, cleansing of the contaminated air of dust particles and micro-organisms and liquefaction and expectoration of the sputum. (Parelman 1972)



**Trachea (transverse section) H&E/Alcian blue. 9x**  
 C=hyaline cartilage; M=tracheal mucosa; T=trachealis muscle; L=longitudinal muscle (behind the trachealis)  
 Burkitt, Young, Heath (1993) Wheater's Functional Histology 3rd Ed. Fig. 12.4, p. 224

Source:  
[http://download.videohelp.com/vitualis/med/his\\_pic\\_respsys2.htm](http://download.videohelp.com/vitualis/med/his_pic_respsys2.htm)

The arterial blood supply to the cranial half of the trachea comes mainly from inferior thyroid arteries while that of caudal half comes from the bronchial branches of the descending aorta. In most cases the inferior thyroid artery gives rise to common oesophageal-tracheal branches which later divide into tracheal and oesophageal branches. There are usually three tracheal branches with lower one being the largest. (Perelman 1972). The venous blood drains into venous networks located mainly in mucous membrane, submucous membrane and tunica adventitia. The venous plexuses situated around trachea and oesophagus ultimately drain into inferior thyroid venous plexus. The draining lymphatics pass on to lymph nodes located around trachea, the brachio-cephalic and right common carotid arteries. The trachea is mainly innervated by recurrent laryngeal nerves.

The depth at which the trachea is situated in relation to the skin increases in caudal direction. The upper tracheal cartilages are nearest to the surface- at a distance of 1 or 2 cm, 3-4 cm at the level of thoracic inlet and 6-12 cm at the level of bifurcation. The distance between the trachea and the skin surface depends on the thyroid gland and thickness of the fat tissue layer.

The cervical part of the trachea is covered by paired sternohyoid and sternothyroid muscles, which themselves are enveloped in pre-tracheal layer of the cervical fascia. These membranes blend with superficial fascia in midline of the neck and form cervical linea alba. A significant part of trachea is covered by the thyroid gland. Small depressions formed by the thyroid lobes may be seen on trachea. The lateral aspects of cervical trachea adjoin the major neuro-vascular bundles with the common carotid artery being closest to trachea.

The ventral aspect of thoracic part of trachea is covered by thymus gland in children. The left brachiocephalic vein extends on a level with the first rib from left to right, where as the brachiocephalic artery adjoins directly the tracheal wall in line with 8<sup>th</sup> to 13<sup>th</sup> tracheal cartilage. The brachiocephalic vessels, the artery in first place may quite frequently be situated very high and even protrude above the manubrium, particularly in children and in individual with narrow superior thoracic aperture (Dvuzhlnaya and Deinka, 1936).

The sides of the trachea are closely related to the pleural sacs. The superior vena cava along with arch of azygos vein draining into it above the right main bronchus is located on the right between the intrathoracic part of the trachea and pleura, while the arch of the aorta, the left common carotid artery and a little further the left subclavian artery are on the left. (Perelman 1972)

The posterior wall of the trachea is connected for its whole length with the oesophagus which is located somewhat to the left of midline. Oesophageal –tracheal sulci form on both sides between trachea and oesophagus in which recurrent laryngeal nerves are conveyed, the right nerve being situated more on the posterior surface of the trachea.

The main fascia –cellular spaces along the trachea are the substernal interaponeurotic, the pretracheal, and the paratracheal.

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