ANAESTHESIA FOR BRONCHOGRAPHY

THESIS

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By

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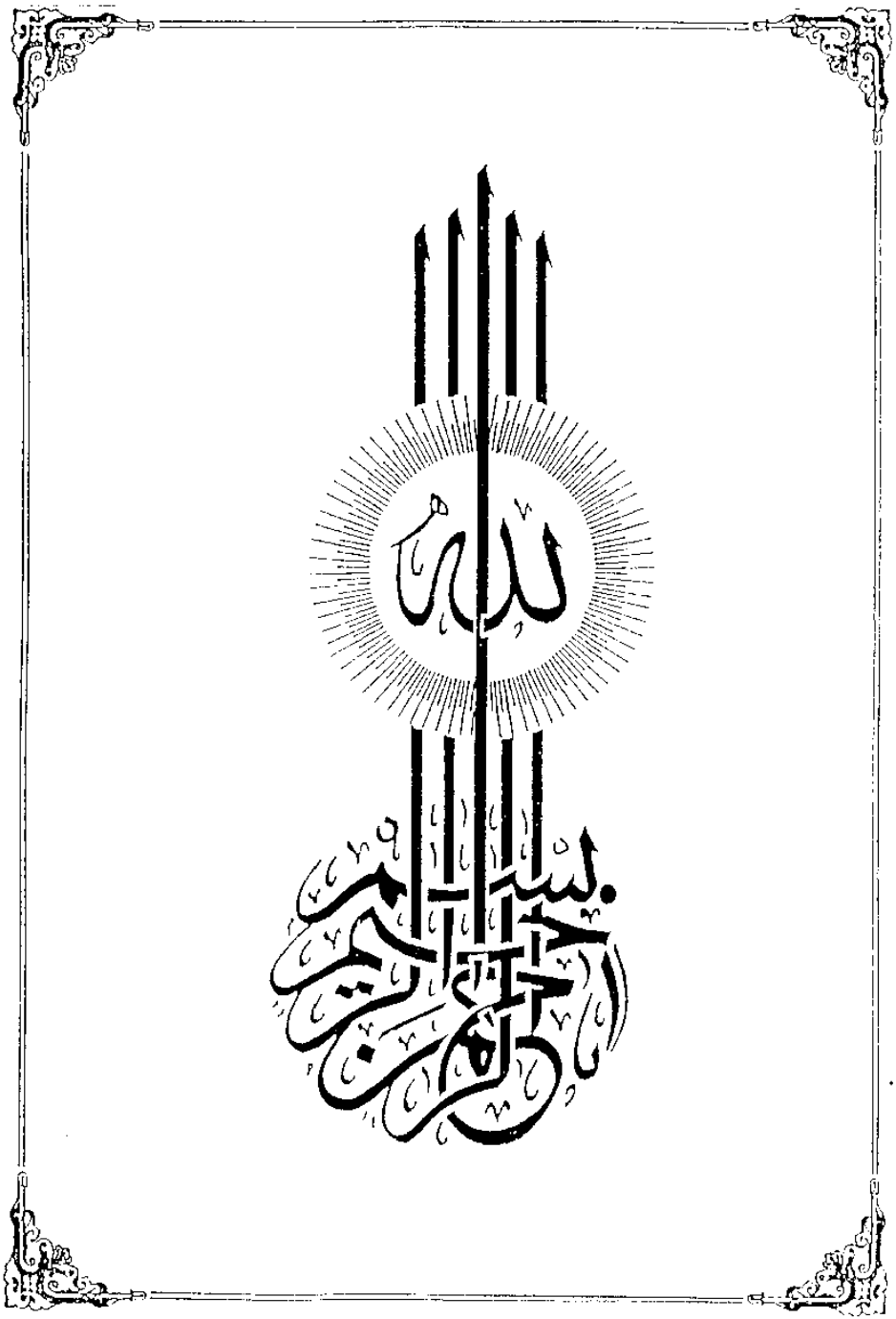


C O N T E N T S

INTRODUCTION AND AIM OF THE WORK

Bronchography,a method of delineating the bronchial tree with radio-opaque contrast medium, was first carried out in 1922 by Sicard and Forestier. It is a very usefule method of examination of the anatomy of the bronchial system. It is commonly done in patient with chest disease e.g. bronchiectasis, primary carcinoma, broncho-pleural and broncho-œsophageal fistulae etc. Their is a variety of other effective diagnostic techniques, including cytopathology, bronchoscopy, bronchial brushing, transbronchial or percutaneous lung biopsy and other radiographic methods. Bronchography provide informations that are not otherwise available concerning the size, shap, branching and spatial relationships of all but the smallest airways. Bronchography remains today the only certain method of diagnosing bronchiectasis.

Bronchography is an unpleasant experience for the patient and entails hazards. It is usually done in critical patient with depressed respiratory reserve and function, tendency to airway obstruction and bronchospasm and a considerable amounts of vescid and infected respiratory secretion. It may results in many complications related to anaesthesia and others related to contrast medium.

The aim from this study is to reach a decision of which method we can best deal with such a critical patient.

ANATOMY OF TRACHEA

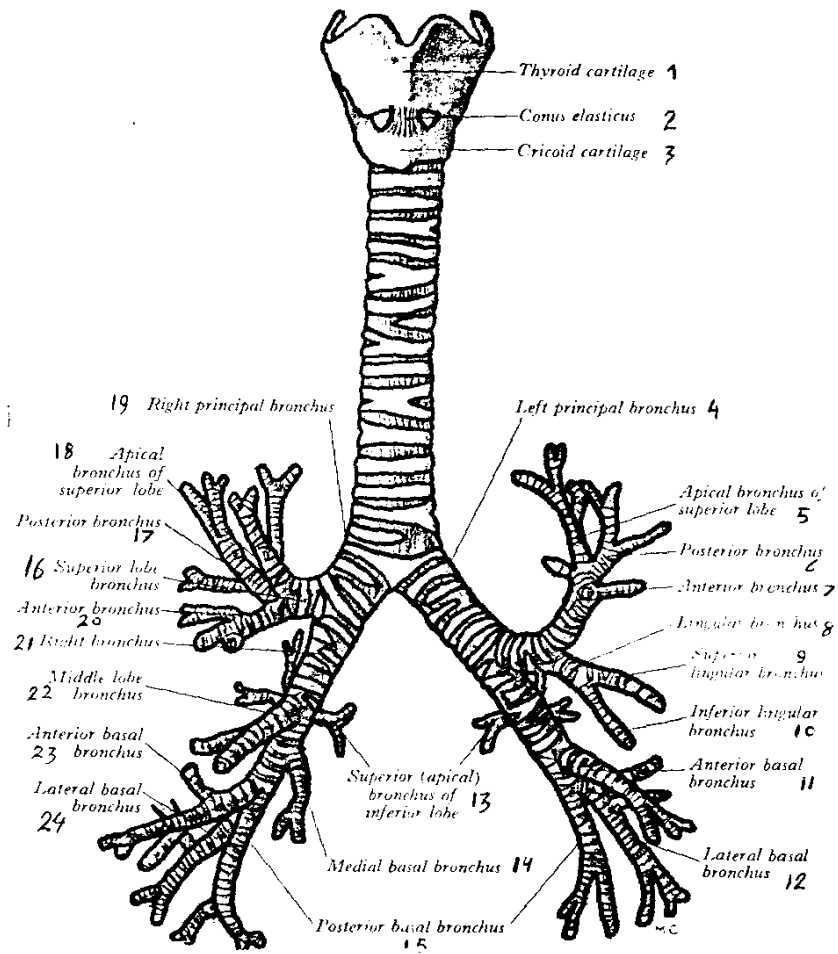
AND BRONCHIAL TREE

TRACHEA

The trachea is an extensile tube, being made of fibro-elastic tissue, and it is kept from collapsing during inspiration by hyaline cartilages. The cartilages, from sixteen to twenty in number, are C-shaped, open posteriorly, the posterior free ends are connected by unstriped muscle "trachealis" fig. 1. (J. Joseph 1963 ; Rogerwarwick & Peter L. Williams & P. Chir 1973).

The trachea extends from the lower end of the cricoid cartilage, at the level of the 6th cervical vertebra, to its termination at the bronchial bifurcation "the carina". In the preserved dissecting room cadaver this is at the level of the 4th thoracic vertebra and the manubriosternal junction "the angle of L-ouis", but in the living subject in the erect position, the lower end of the trachea can be seen in oblique radiographes of the chest to extend to the level of the 5th, or, in full inspiration, to the 6th thoracic vertebra. In children, carina is on a level with 3rd costal cartilage. (Harold Ellis & Stanley Feldman 1977 ; R.S. Atkinson G. B. Rush man & J. Alfred Lee 1977).

In the adult the trachea is about 15 cm long,of which 5 cm lie above the suprasternal notch. It moves with respiration and with alteration in the position of the head, e.g. on deep inspiration the carina can descend as



Grays anatomy 1973, Rogerwarwick & Peter L. William & P. Chir 1973

Fig.1: The cartilages of the larynx; trachea and bronchi (anterior aspect).
1. thyroid cartilage 2. conus elasticus 3. caricoid cartilage 4. Lt. main bronchus 5. apical bronchus of upper lobe 6. posterior bronchus 7. anterior bronchus 8. lingular bronchus 9. superior ling. bronchus 10 inferior lingular bronchus 11. anterior basal bronchus 12. lateral basal bronchus 13. apical bronchus of inferior lobe 14. medial basal bronchus 15. posterior basal bronchus 16. upper lobe bronchus 17. apical bronchus of upper 18. posterior bronchus 19. RT. main bronchus 20. anterior bronchus 21. RT. bronchus 22. middle bronchus 23. anterior basal bronchus 24. lateral basal bronchus.

much as 2.5 cm, and extension of the head and neck can increase the length of the trachea by as much as 23-30 per cent compaired to the trachea when the head is flexed. Clinically, if a patient is intubated with the head in a flexed position at the atlanto-occipital joint, and the endotracheal tube is so short that it just reach beyond the vocal cords, the subsequant hyperextension of the head may withdrow the tube into the pharynx. table 1. (Harold Ellis & Stanley Feldman 1977 ; Wylie & Churchill-Davidson 1978).

The external diameter of the trachea from side to side is about 2 cm in adult male and 1.5 cm in adult female, much smaller in the child, and thereafter the diameter in mm corresponds to the age in years. The diameter of the trachea is correlated with the size of the subject, a good working rule is that it has the same diameter as patient's index finger. Abnormal narrowing of the trachea in its middle third, making it difficult to introduce a tube of adequate size, has been reported. Abnormal dilatation of the trachea has been described in a patient with chronic bronchial infection, treated by tracheostomy and insertion of a cuffed tube. High tracheal bifurcation and deformity may cause problems during intubation. (Harold Ellis & Stanley Feldman 1977) ; R.S. Atkinson & J. Alfred Lee 1977.

Age	Length in cm.	diameter in mm.
at birth	4	6
3 month	4	6.8
6 month	4.2	7.2
12 month	4.3	7.8
18 month	4.5	8.8
2 year	5	9.5
4 year	5.4	11
5 year	5.6	11.5
6 year	5.7	12
7 year	5.8	12.5

Ropert M. Smith 1980

Table 1. Tracheal length and diameter with the age.

The trachea is lined with ciliated columnar epithelium with goblet cells, which secrete mucus. The mucus humidify inspired air, entrap particulate mater such as dust or microorganisms, and has a bactericidal property. The mucus consists of two layers, an outer layer of thick viscous mucus which is designed to entrap particulate mater, and inner layer of thin serous fluid designed to lubricate the action of the ciliary mechanism. The ciliated mucosa is responsible for moving secretions towards the glottis at rate of 0.25- 1 cm per minute. Ciliary activity is the most important single factor in the prevention of the accumulation of secretions. (J.Josef 1963 ; Wylie & Churchill Davidson 1978; John V. Farman 1981).

FACTORS INFLUENCING CILIARY ACTIVITY:

1) MUCUS: Cilia cannot work without a blanket of mucus. The volatile general anaesthetics not only slow the propelling mechanism but also limit the production of suitable secretions. If a patient has an inadequate secretion of mucus after the use of atropine, or breathes dry gas for a long period, then evaporation will result in drying of the mucosa and ciliary activity will cease. (Wylie & Churchill-Davidson 1978).

2) TEMPERATURE: It affect the amount of mucus sercretion. Optimum temp. is (28°-33°). (Wylie & Churchill-Davidson 1978).

3) DRUGS: As shown in the table 2.

Drugs	Low Concent.	High Concent.
nitrous oxide	No effect	no effect
ether	+	-
chloroform	+	-
cyclopropane	+	-
morphia	-	---
atropine	-	---
cocain 10/100	----	
cocain 5/100	--	
cocain 2.5/100	+	
ephedrine 1/2:100	+	
adrenalin 1/10000	----	

Wylie & Churchill-Davidson 1978

table 2. Effect of drugs on ciliary activity.

4) P H CHANGES: Alkalinity stimulate and acidity inhebite the ciliary activity. (Wylie & Churchill-Dav. 1978).

The cough reflex is active throughout the length of the trachea, particularly at the carina. (John V. Farman 1981).

BLOOD SUPPLY:

Upper two-thirds, are supplied by the inferior thyriod artery, lower one-third by the bronchial arteries. The arteries run circumferentially and there are few anastomosis in the long axis of the trachea.
(R.S. Atkinson & J. Alfred Lee 1977).

The inferior thyroid artery carries sympathetic dilator fibres from middle cervical ganglion. Parasympathetic constrictor and secretory fibers is from both recurrent laryngeal nerves and right vagus.
(J. Joseph 1963).

RELATIONS:

The trachea lies exactly in the mid-line in the cervical part of its course but within the thorax it is slightly deviated to the right by the aortic arch.

I. IN THE NECK: The relations are symmetrical.

It is covered anteriorly by the skin and by the superficial and deep fascia, through which the rings are easily felt. The 2nd, 3rd and 4th rings are covered by the isthmus of the thyroid, along whose upper border branches of the superior thyroid artery join from either

side. In the lower part of the neck the edges of the sternohyoid and the sternothyroid muscles overlap the trachea, which is here also covered by the inferior thyroid veins (as they go downwards to the innominate); by the crosscommunication between the anterior jagular veins and, when present, by the thyroidea ima artery, which ascends from the arch of the aorta or from the innominate artery. It is because of this close relationship with the innominate arterly that erosion of the tracheal wall by a tracheostomy tube may cause sudden profuse haemorrhage. It is less common for the carotid artery to be involved in this way. On either sides are the lateral lobes of the thyroid gland, which intervene between the trachea and the carotid sheath and its contents (the common carotid artery, the internal jugular vein and the vagus nerve). Posteriorly, the trachea rests on the œsophagus, with the recurrent laryngeal nerves lying in a groove between the two.

The close relationship of the unsupported posterior tracheal wall and the œsphagus is revealed during œsphagoscopy. When an endotracheal tube with an inflated cuff is in the trachea, the anterior wall of the œsophagus is compressed. For this reason patient with inflated tracheostomy tube (especially high pressure cuffs) may have difficulty in swallowing. During oesophagoscopy with a rigid oesophagoscope, an overinflated endotracheal cuff may be mistaken for an œsophageal obstruction. (Harold Ellis & Stanley Feldman 1977).

2) IN THE THORAX: The relations are asymmetrical.

The thoracic part of the trachea descends through the superior mediastinum.

Anteriorly, from above downwards, lie the inferior thyroid veins; the origin of the sternothyroid muscles from the back of the manubrium; the remains of the thymus; the innominate artery and the left common carotid artery, which separate the trachea from the left innominate vein; and lastly the arch of the aorta.

Posteriorly, as in its cervical course, the trachea lies throughout on the oesophagus, with the left recurrent laryngeal nerve placed in a groove between the left border of these two structures.

On the left, the left common carotid and left subclavian arteries; the aortic arch and the left vagus intervene between the trachea and the pleura, the altering relationships between the major arteries and the trachea are due to the diverging, somewhat spiral, course of the arteries from their aortic origins to the root of the neck.

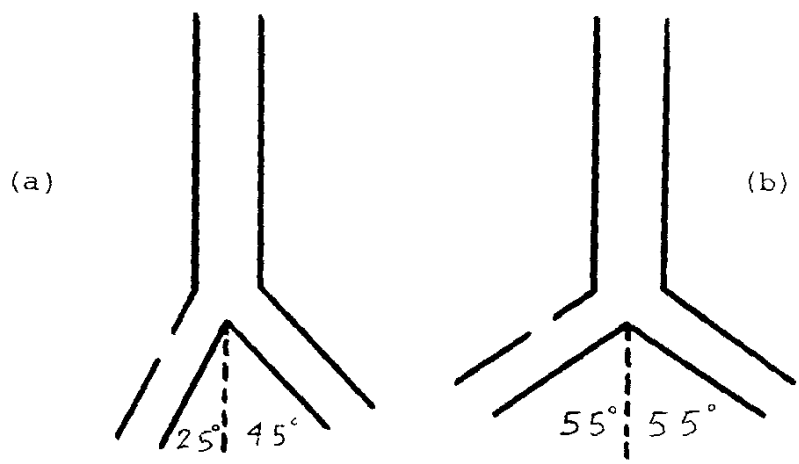
The large tracheobronchial lymph nodes lie at the sides of the trachea and in the angle between the two bronchi.

In infants these relationships are somewhat modified, the innominate artery is higher and crosses the trachea just as it descends behind the suprasternal notch. The left innominate vein may project upwards into the neck to form an anterior relation of the cervical trachea.

In children up to the age of two, the thymus is large and lies in front of the lower part of the cervical trachea. (Harold Ellis & Stanley Feldman 1977).

RIGHT BRONCHIAL TREE

RIGHT MAIN BRONCHUS: It is 2.5 cm long. It leaves the trachea at an angle of 25° from the vertical and enter the right lung opposit the 5th thoracic vertebra. As it is more nearly vertical, wider and shorter than the left main bronchus there is a much greater tendency for foreign bodies, endotracheal tubes or suction catheter to enter this lumen. (R.S. Atkinson & J. Alfred Lee 1977; Wylie & Churchill-Davidson 1978).



Wylie & Churchill-Davidson 1978

fig. 2. Angle of the main bronchi (a) in adult (b) in childern

In the event of an endotracheal tube being inserted too far a further complication is that the bevelled end of the tube may become blocked off by its lying against the mucosa on the medial wall of the main bronchus.