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Anatomy

MORPHOMETRY OF ADULT HUMAN TRACHEA IN INDIAN POPULATION

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ABSTRACT **OBJECTIVE :**Accurate anatomical knowledge regarding the dimensions of the trachea has immense importance in anesthesiology, reconstructive surgery and other clinical fields. **MATERIAL AND METHOD :** The study was conducted on trachea of 30 adult human cadavers which were procured from Department of Anatomy of LHMC. The lumen of the trachea will be cut at 3 levels -upper ,middle ,lower. Tracheal diameter will be measured as external transverse diameter, internal transverse diameter and anteroposterior diameter at all 3 levels as mentioned above. **RESULTS:** The mean of tracheal length was 98.23±9.07mm. The mean of internal transverse diameter at level 1,2,3 was 17.71± 2.07mm, 16.95±1.81mm, 17.31±1.63mm.The mean of internal AP diameters at level 1,2,3 was 14.19± 1.62mm,13.51±1.58mm,13.84±1.58mm The external transverse diameter at level 1,2,3 was 21.87±3.48mm, 21.68±3.18mm,25.81±3.97mm. The external AP diameter at level 1,2,3 was 17.71± 2.07mm,16.95±1.81mm, 17.31±1.63 mm. **CONCLUSION :** Tracheobronchial morphometry data will be of use for optimizing surgical & anaesthesiological procedures.

KEYWORDS : Morphometry , trachea , tracheobronchial, reconstructive surgery

INTRODUCTION

Trachea is a centrally located membrano cartilaginous structure .

Unpaired hollow organ extending downwards as a continuation of the larynx

EXTENT : lower border of the cricoid cartilage opposite C6 vertebra up to the upper border of T5 vertebra where it divides into right and left principle bronchus .[1]

There is a wide variation in different dimensions viz. length, transverse and anteroposterior diameters and T-AP ratio of the lumen of trachea in a same age group as well as in different age groups in both sexes.[2]

Changes in tracheal dimensions occur in a variety of conditions. For ex, widening -tracheobronchomegaly and tracheomalacia;narrowing - tracheobronchopathia osteochondroplastica ,relapsing polychondritis. Pulmonologists are concerned with the relationship between the tracheal lumen and its significant role in production of allergic states, fibrosis of lungs and pulmonary tuberculosis.[3,4]

Accurate anatomical knowledge regarding the dimensions of the trachea has immense importance in reconstructive surgery and other clinical fields such as conduction of some maneuvers like endotracheal intubation and bronchoscopic procedures (diagnostic, therapeutic and combined) with skill and perfection.[5]

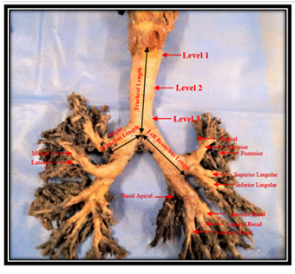
MATERIAL AND METHOD

The study was conducted on 30 trachea and 60 lungs of 30 adult human cadavers which was procured from Department of Anatomy and Forensic Medicine of Lady Hardinge Medical College. These lungs were retrieved from the donated and unclaimed bodies, registered to departments with known cause of death, unrelated to pulmonary diseases, from the age group of 18 years and above. All samples were collected after following the standard protocol for ethical Clearance .

An incision was given on either side of sternum, ribs and clavicle and cut with bone cutter. Trachea was incised at the lower end of the cricoid cartilage separating it from esophagus posteriorly. Lungs were removed en masse from the thoracic cavity and was fixed in 10% formalin solution. The lumen of the trachea was cut at three different levels (IMAGE 1) 1st-just below cricoid cartilage,2nd –in the middle of trachea,3rd –just above subcarinal, with the help of sharp scalpel to avoid laceration. Tracheal length will be measured from the lower end of cricoid cartilage to the vertex of carina where the trachea bifurcates.

Tracheal diameter will be measured as external transverse diameter, internal transverse diameter and anteroposterior diameter at all the levels as mentioned above.

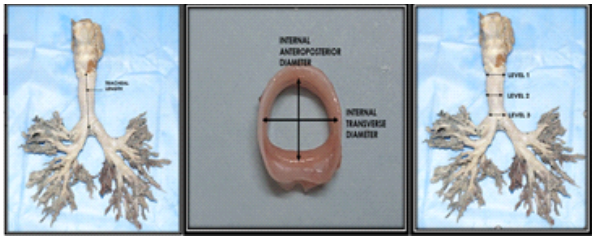
Image 1 :Tracheobrochial tree with levels of measurements and branches



OBSERVATION

The mean of tracheal length was 98.23±9.07mm (IMAGE 2). The mean of internal transverse diameter of trachea at level 1 was 17.71± 2.07mm, at level 2 was 16.95±1.81mm, at level 3 was 17.31±1.63mm.The mean of internal anteroposterior diameters of trachea at level 1 was 14.19± 1.62mm, at level 2 was 13.51±1.58mm, at level 3 was 13.84±1.58mm.The external transverse diameter of trachea(T) at level 1 was 21.87±3.48mm, at level 2 was 21.68±3.18mm,at level 3 was 25.81±3.97mm. The external anteroposterior diameter of trachea(AP) at level 1 was observed as 17.71± 2.07mm,at level 2 was observed as 16.95±1.81mm ,at level 3 was observed as 17.31±1.63 mm.

Image 2 : Showing levels of measurements



RESULTS

The mean of ratio of external transverse diameters (T) to external anteroposterior diameter (AP) : Level 1 was 1.25 which showed that transverse diameter was 1.25 times the anteroposterior diameter at level 1 and 1.28 times at level 2 and 1.5 times at level 3, which was increasing from level 1 to level 3 might be due to higher intrapulmonary pressure at lower level.

DISCUSSION

Changes in tracheal dimensions occur in a variety of conditions-generalized widening seen in tracheobronchomegaly and tracheomalacia and narrowing in tracheobronchopathia,

osteochondroplastica and may be one of the feature of relapsing polychondritis.

Table 1: Comparison Of Tracheal Length With Other Authors

GROSS	PRESENT STUDY (MEAN)	Chunder et al[16]	Standring et al[2]	Jit H &Jit I[1]
Tracheal Length	98.23mm	103mm	100mm	90.23mm in males 81.5mm in females

The present study corresponds with the study performed by Chunder et al due to the fact that both the studies were done in Indian population. This study also compared with values given by Standring et al.

It did not corroborates exactly with the study done by Jit H &Jit I might be due more number of subjects studied by them.

Table 2: Comparison Of External Transverse And Ap Diameter With Other Authors

GROSS	PRESENT STUDY	Chunder et al[16]	Standring et al[2]	Jit H & Jit I[1]
T at LEVEL1	**21.87mm**	**18.1mm**		**20.8mm in males 17.4mm in females**
T at LEVEL2	**21.68mm**	-	**17.5mm**	
T at LEVEL3	**25.81mm**	**18.5mm**		
AP at LEVEL1	**17.71mm**	**13.3mm**		**20.2mm in males 16.2mm in females**
AP at LEVEL2	**16.95mm**	-		
AP at LEVEL3	**17.31mm**	**15.0mm**		
T/AP at level 1	**1.25**	**1.48**		
T/AP at level 2	**1.28**	-		
T/AP at level 3	**1.5**	**1.3**		

The present study corresponds with study done by Jit H & Jit I might be due to fact that both the studies done in Indian population. It correlates less with Chunder et al and Standring et al might be due to the different positions used to record the diameters.

CONCLUSION

Tracheobronchial morphometry data of present study will be of used to clinicians for preparation of mathematical models and for optimizing surgical & anaesthesiological procedures like resection, reconstruction procedures, bronchoalveolar lavage, endobronchial biopsy and tracheal intubation.

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