

A CADAVERIC STUDY OF LENGTH OF TRACHEA IN NEPALESE POPULATION OF VARIOUS AGE GROUPS

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ABSTRACT

INTRODUCTION

The trachea is centrally located membranocartilaginous unpaired hollow organ extending downwards as a continuation of the larynx. The study of the semorphometric variations is of profound clinical importance as it may help the clinicians to understand the etiology of several pulmonary diseases and the surgeons to deal with resection and reconstruction of the tracheobronchial tree. This knowledge is also helpful for smooth conduction of some maneuvers like endotracheal intubation and bronchoscopic procedures.

MATERIALS & METHODS:

A study of length of human trachea was undertaken in the Department of Anatomy, College of Medical Science Teaching Hospital, Bharatpur, Nepal from april 2012 to December 2013. Twenty nine specimens were collected out of which, sixteen were male and thirteen were female. The specimens were grouped into five age groups for both sexes. The length of trachea, was measured and, standard error (SE), standard deviation(SD) and test of significance were calculated using independent sample 't' test and multiple comparison test.

RESULTS:

The length of trachea, there was a rapid increase in length from 0-15 years group to 16-25 years group in both the sexes. Thereafter it exhibited very insignificant variations from 26-40 and 41-55 years group in both sexes. From 41-55 years age group to >55 years age group there was a slight increase in tracheal length in both sexes.

CONCLUSION:

The length of trachea varies with age and the results observed are comparatively less than written in standard books from foreign authors ,hence racial difference plays a key role in the length of trachea. Furthermore, we suggest more research is required in this field from our regional area.

KEYWORDS: Morphometry, trachea, principal bronchi, cadaveric study

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INTRODUCTION :

The trachea is centrally located membranocartilaginous unpaired hollow organ extending downwards as a continuation of the larynx¹. Its length is 10-12 cm long. Trachea extends from the lower border of the cricoid cartilage opposite C6 vertebra up to the upper border of T5 vertebra where it ends by dividing into right and left principal bronchi supplying the right and left lungs respectively².

The length of trachea varies with age³. Beside pure anthropometry, Anatomical knowledge about the length of trachea is essential for anaesthetists for selecting anatomically designed cuff for endotracheal intubation and bronchoscopic procedure⁴. Apart from that the study of these morphometric variations and relationship with age is of profound clinical importance as it may help the clinicians to understand the etiology and prognosis of several pulmonary diseases⁵. With the above factors in limelight, the present study was taken up to measure the length, as no literature is available regarding these data amongst Nepalese population

MATERIALS AND METHODS:

The present study was conducted in the dissection hall of Department of Anatomy, College of Medical Sciences - Teaching Hospital, Bharatpur, Nepal from april 2012 to December 2013.

a) Procurement of specimens (study materials):-

1. Fourteen specimens of healthy human trachea and right and left principal bronchi of different age groups of both sexes were dissected out from relatively fresh and properly embalmed unclaimed cadavers.
2. Fifteen specimens of healthy human trachea and right and left principal bronchi of different age groups of both sexes were procured from the mortuary of Bharatpur Hospital with due consent from concerned authority.

b) Sample size:-

Twenty nine specimens were studied in the present study. Fourteen specimens were dissected out from cadavers, out of which nine were from male and five from female. Fifteen specimens were collected from mortuary of Bharatpur hospital which included seven male and eight female specimens.

c) Study design:-

The present study was conducted in five different age groups in both sexes. 0-15 years, 16-25 years, 26-40 years, 41-55 years and > 55 years.

d) Morphometric study:-

1. The length of trachea from (lower border of cricoid cartilage to the point of the tracheal bifurcation) and the length of the right and left principal bronchi (from the angle of tracheal bifurcation to the point of its dividing into secondary bronchi) were recorded in centimeter scale.

e) Documentation:-

1. Photographic documentation of composite specimens were taken.
2. All the measurements were recorded in a tabulated manner age wise (the different age groups in the present study will be: 0-15 years, 16-25 years, 26-40 years, 41-55 years and 55 years and above) in both sexes.

f) Statistical analysis:-

For the measurements, the standard error, standard deviation statistical analysis and test of significance was calculated using independent sample 't' test with the help of 'SPSS' software version 15.0 and recorded in a tabular form.

OBSERVATION AND RESULTS:

The numbers of specimens studied in the five age groups were as follows:-

Table No.1. Number of specimens studied in different age groups.

Age groups (in years)	Total No. of specimens	No. of specimens dissected from cadavers	No. of specimens procured from autopsy cases
0-15	4	1	3
16-25	6	2	4
26-40	7	4	3
41-55	8	5	3
>55	4	2	2

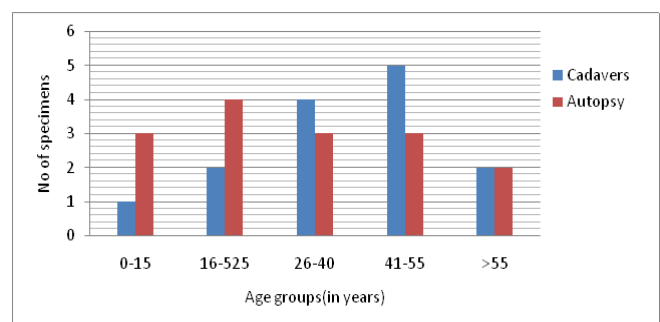


Fig1: Bar diagram showing number of specimens procured from cadavers and autopsy in different age groups.

Table No.2. Showing sex distribution in each age group

Age groups (in years)	Total number of specimens	Male Specimens	Female Specimens
0-15	4	2	2
16-25	6	3	3
26-40	7	4	3
41-55	8	5	3
>55	4	2	2

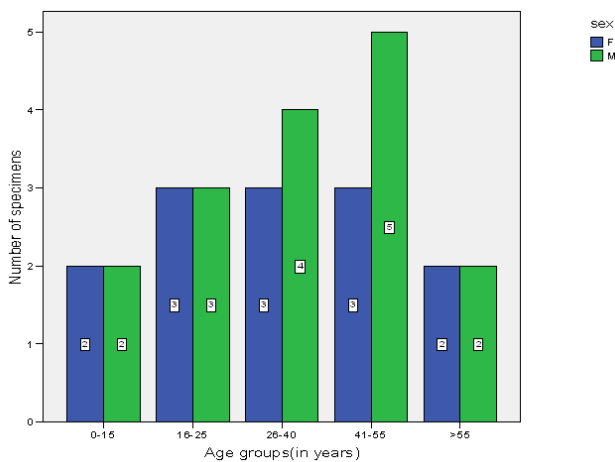


Figure 2 Bar diagram showing sex distribution in each age group.

Table No.3. Measurement of length of trachea in different age groups in male and female.

Age Groups (in years)	Age (in years)	Specimen No. (Sp.No.)	Sex	Length (cm)
0-15	13	1	M	10.0
	15	2	M	9.7
	9	3	F	7.0
	12	4	F	7.5
16-25	22	5	M	11.0
	18	6	M	10.9
	24	7	M	10.8
	20	8	F	9.9
	22	9	F	10.0
	19	10	F	9.8
	27	11	M	10.5
26-40	38	12	M	10.8
	35	13	M	10.4
	28	14	M	10.5
	39	15	F	10.0
	29	16	F	10.1
	33	17	F	10.1
41-55	50	18	M	9.9
	48	19	M	10.1
	55	20	M	10.0
	54	21	M	10.1
	53	22	M	9.8
	43	23	F	10.1
	45	24	F	10.0
>55	52	25	F	9.9
	65	26	M	11.2
	58	27	M	11.1
	65	28	F	11.0
	60	29	F	10.1

Table No.4. Average length of trachea in male and female.

Sex	Average length of trachea
Male	10.4cm
Female	9.6 cm

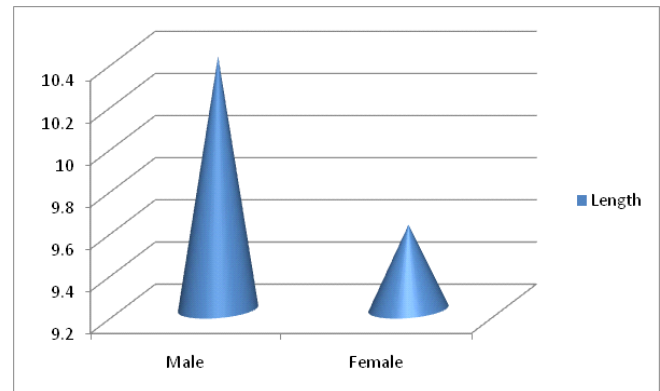


Fig 3: Cone diagram showing average length of trachea in male and female.

Table No.5. Measurement of mean length of trachea in different age groups in male and female

Sex	Age groups (in years)	Mean length (cm)
M	0-15	9.85
	16-25	10.90
	26-40	10.55
	41-55	9.98
	>55	11.15
F	0-15	7.25
	16-25	9.90
	26-40	10.07
	41-55	10.66
	>55	10.55

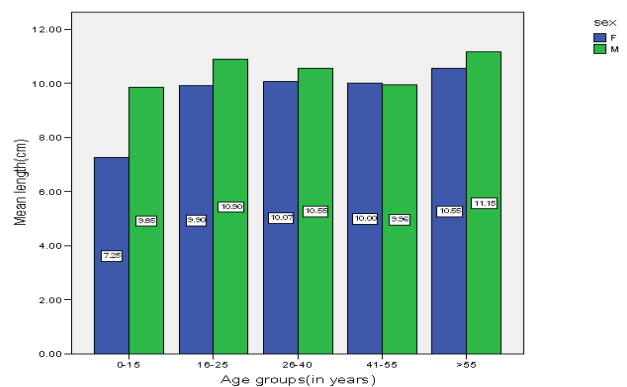


Figure 4. Diagram showing mean length of trachea in different age groups in male and female.

Table No.6. Statistical constants of mean length of trachea in different age groups in male and female including test of significance using independent sample test.

Sex	Age groups (in years)	Mean length (cm)	Standard Deviation (SD)	Standard Error (SE)	p value	Significance (sig)
M A L E	0-15	9.85	0.21	0.15	0.012	isg
	16-25	10.90	0.10	0.05	0.000	hsg
	26-40	10.55	0.17	0.86	0.006	isg
	41-55	9.98	0.13	0.05	0.829	isg
	>55	11.15	0.63	0.05	0.316	isg
F E M A L E	0-15	7.25	0.35	0.25	0.012	isg
	16-25	9.90	0.10	0.05	0.000	hsg
	26-40	10.07	0.57	0.03	0.006	isg
	41-55	10.00	0.10	0.05	0.702	isg
	>55	10.55	0.63	0.45	0.316	isg

Abbreviations used:
isg-insignificant
hsg-highly significant

DISCUSSION:

The average length of trachea found in this study was 10.4cm in male and 9.6 cm in female respectively (Fig:3 ,Table No.4) .The mean tracheal length found in this study were 9.85 cm, 10.90cm, 10.55cm, 9.98 cm. and 11.15cm in males and 7.25 cm, 9.90 cm,10.06cm, 10cm and 10.55cm in females in the 0-15 years,16-25 years,26-40 years,41-55 years and > 55 years age groups respectively (Fig: 4 ,Table No.5)

The p value was highly significant for tracheal length in16-25 age groups and insignificant in rest age group in both sexes(Table:6).

Proctor, D.F (1997)⁶ stated that the distance between cricoids and the bifurcation of trachea is 12 cm, while according to Engel (1962)⁷, the average length of the trachea in adults was 9.15cm. According to Standring et al (2005)¹ it is 10-11cm long.According to Cunningham's textbook of Anatomy⁸ the length of the trachea, is 7cm between fourteenth and sixteenth year and 9-15 cm in adult.In the present study, the length did not exceed 11.2cm in adults.

Guha et al (2010)⁴ conducted a study involving 87 specimens of human trachea and principal bronchi (51 male and 36 female) and noted the average length of trachea as 10.45 cm and 9.14 cm in male and female respectively. They also observed that the length of the trachea increased from 0-15 years age group to 15- 25 years age group in both the sexes. Similar observation was made in the present study which is also in accordance with Croteau and Cook (1961)⁸ who stated that the tracheal length showed greater relative change in

younger subjects this might be due to the fact that this period is the growing period of life.

They also stated that increase in height of the person has no correlation with the increase in tracheal length.

In the other group, that is from 26-40 years to 41-55 years the increase or decrease of tracheal length was minimum. From 41-55 years to 55 years and > 55 years there was a slight increase in tracheal length in both male and female, which might be due to the relaxation by more fibrous tissue present in this age group.

However, in a study carried out on 47 trachea of autopsied Bangladeshi adult male by Begum T et al (2009)⁹, the length of trachea increased with advancing age. In their study the average length of trachea in adult male was 9.42 cm.

The results we observed were lower than those described by different western authors Shah (2005)¹, Snell(2004)¹⁰, Allen (2003)¹¹, Thibodean & Patton (2003)¹², Sinnatamby (1999)¹³ and Ellis & Feldman (1993)¹⁴. The geographical variation and racial differences may play a key role in results which may help our anesthesiologist, intensivist and clinician.

CONCLUSION:

The length of trachea, there was a rapid increase in length from 0-15 years group to 16-25 years group in both the sexes. Thereafter it exhibited very insignificant variations from 26-40 and 41-55 years group in both sexes. From 41-55 years age group to >55 years age group there was a slight increase in tracheal length in both sexes.

To conclude, there is a wide variation in different components of human tracheo-bronchial tree in different age group in both sexes. Further more, an accurate anatomical knowledge of the same is of immense importance in problems of resection and reconstruction of the tracheobronchial tree as also in selecting proper size and gauge of endotracheal tubes and bronchoscopes respectively.

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