ORIGINAL RESEARCH

Morphometric Study of the Larynx: A Cadaveric Study in Sri Lanka

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Abstract

Introduction: Morphometric data of the larynx are important for the diagnosis and treatment of laryngeal disorders, as they provide crucial information for various medical procedures and for surgeries. These measurements are fundamental in the development of biomechanical models of larynx.

Objectives: To describe the detailed morphometry of adult human larynx and its variations.

Methods: The study was performed on 11 larynges, from 6 male and 5 female cadavers older than 40 years, with no history of laryngeal pathology, neck trauma, or neck surgery. Specific external and internal measurements of the larynx were recorded using a digital vernier caliper with an accuracy of 0.1 mm. Data were analysed using Statistical Package for Social Sciences (SPSS) version 26.0.

Results: The mean values of external and internal dimensions of the larynx were higher in males than of females, except for the length from the lower border of thyroid cartilage to the upper border of cricoid cartilage (L6) and the length of the sinus. The difference was statistically significant only for the length from floor of thyroid notch to lower border of cricoid cartilage (L3), width of thyroid cartilage (L7), length from floor of thyroid notch to projection of anterior commissure (L8) and length of infraglottic cavity. Although, bilateral asymmetry was present in majority of specimens, there was no statistically significant difference between measurements on left and right sides of bilateral structures (vestibular, vocal, and aryepiglottic folds).

Conclusion: There was a wide individual variation in both external and internal dimensions of the larynx, with males having generally higher values compared to females. This knowledge can be integrated on laryngeal morphometry into clinical and surgical practices, as well as into the design of advanced biomechanical models to achieve better patient care and innovative treatment solutions.

Keywords: Morphometry, Adult human larynx, Sri Lanka

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Introduction

Larynx originally receives its name from the Greek word larynx, meaning “throat”. It is often referred to as the voice box owing to its function in voice production. The larynx is a hollow musculoligamentous structure with a cartilaginous framework that caps the lower respiratory tract. Its cavity is continuous inferiorly with the trachea and opens superiorly into the pharynx (1). Suspended from the hyoid bone above, the larynx is located in the midline of the anterior neck, spanning between the bodies of the third and sixth cervical vertebrae (C3-C6) at rest (1,2). It is somewhat higher in children and adult females. The size of the male and female larynges is similar in size until puberty, after which the male larynx enlarges considerably in comparison to that of female with all the cartilages being increased in both size and weight. The male thyroid cartilage continues to increase in size until 40 years of age, after which no further growth occurs (3).

The skeletal framework of the larynx is formed by a series of cartilages: three large unpaired cartilages – thyroid, cricoid, and epiglottic; three pairs of smaller cartilages – arytenoid, corniculate and cuneiform, which is held together by ligaments and fibrous membranes: extrinsic namely thyrohyoid membrane and cricotracheal, hyoepiglottic and thyroepiglottic ligaments; intrinsic namelyquadrangular membrane and cricothyroid ligament, and moved by a number of muscles; muscles that act on the inlet are aryepiglottic and oblique arytenoid muscles, assisted by the transverse arytenoid and thyroepiglottic muscles; muscles that affect the vocal ligaments are posterior and lateral cricoarytenoids, oblique and transverse arytenoids, thyroarytenoids and vocalis, and the cricothyroids (4).

From embryologic, anatomic, physiologic and surgical standpoints, the larynx is one of the most complex organs of human body (5). Known for its sophisticated design, the larynx serves multiple important functions in human body: protection of the lower respiratory tract during swallowing by preventing passage of solids and liquids into the airway and facilitating their entry into the oesophagus, aids in respiration by controlling flow of air to and from the lungs, phonation (voice production), and effort closure during activities that increase the intra-abdominal pressure (e.g. coughing, heavy-lifting, defecation) (1).

Morphometric data of the larynx provides essential information for endoscopic procedures, particularly those involving the upper respiratory tract to safely navigate the endoscope, avoiding damage to delicate structures and thereby to identify abnormalities that could indicate disease (2). Additionally, the knowledge of the laryngeal morphometry is crucial when performing the emergency life-saving procedure cricothyroidotomy (cricothyrotomy), for accurate identification of the cricothyroid membrane and optimising the incision size (6). Selecting the correct size of the endotracheal tube and its proper placement greatly relies on the measurements of the larynx, thus avoiding iatrogenic injuries to the trachea and larynx following endotracheal intubation (7). Furthermore, an extensive knowledge of the size and proportions of the human larynx and its cartilaginous components is required with the increasing application of sophisticated electrophysiological and radiological methods for the diagnosis and treatment of laryngeal disorders (8).

In otolaryngology, detailed knowledge of the laryngeal anatomy and its dimensions is essential for surgeries involving the larynx, such as laryngeal framework surgeries in cases of vocal cord paralysis, laryngeal microsurgery in cases of sub-glottic stenosis and post-intubation stenosis, and partial or total laryngectomies in cases of laryngeal cancer and severe trauma to the larynx (9). It minimises the risk of complications, improving surgical outcomes and preserving vocal function. Moreover, morphometric data of the larynx is useful for the construction and refinement of biomechanical models of the larynx (10). These models improve the diagnostic and therapeutic strategies by simulating how laryngeal structures function and interact.

After thorough literature review, no studies were found in Sri Lanka about the morphometry of human larynx. The objective of the present study is to describe the detailed morphometry of adult human larynx and its gender-based and side-based variations.

Methods

A descriptive cross-sectional study was performed on 11 cadavers which were donated and prepared for academic purposes. The cadavers were obtained from the Department of Anatomy at the Faculty of Medical Sciences of University of Sri Jayewardenepura, Sri Lanka. Demographic data including age, sex, and race, were acquired from the department cadaver registry. Informed written consent has been provided by all the donors for the use of their cadavers in medical teaching, training, and research activities.

The study sample consisted of a total of 11 larynges removed from 6 male and 5 female adult cadavers older than 40 years and Sri Lankan. Cadavers with no history of laryngeal pathology, neck trauma or neck surgery were included in the study. Larynges in which the structures appeared deformed, damaged, or mutilated were excluded.

Procedure

A midline neck incision was made from the mental tubercle to the sternal notch and deepened through the skin and subcutaneous tissue. Then, the platysma muscle was divided, and the investing layer of the deep cervical fascia was incised to expose the underlying structures. The sternocleidomastoid and strap muscles (sternohyoid, sternothyroid, and omohyoid) were sharply dissected to provide access to the larynx. Following excision of the surrounding soft tissue, the larynx extending from the base of the tongue to the upper part of the trachea was removed together with the attached hyoid bone and stored in 10% formalin. The specimens were cleaned to remove the extra laryngeal soft tissue so that all the laryngeal landmarks used in this study were easily seen. The projection of the anterior commissure (pAC) was marked at the outer surface of the thyroid cartilage with the help of a 24G needle by penetrating the cartilage at the level of pAC from inside to out.

The measurements were taken independently by two investigators using a digital vernier caliper with an accuracy of 0.1 mm. Any discrepancy of data was resolved by consensus. All the Measurements were taken thrice at different sittings and then averaged to minimize bias errors. The following measurements were taken:

External dimensions of the larynx

- from tip of the epiglottis to lower border of the cricoid cartilage (L1)
- from upper border of the hyoid bone to lower border of the cricoid cartilage (L2)
- from floor of the thyroid notch to lower border of the cricoid cartilage (L3)
- from lower border of the hyoid bone to floor of the thyroid notch (L4)
- from floor of the thyroid notch to lower border of the thyroid cartilage (L5)
- from lower border of the thyroid cartilage to upper border of the cricoid cartilage (L6)
- from projection of the anterior commissure to posterior border of the thyroid cartilage (L7)
- from floor of the thyroid notch to projection of the anterior commissure (L8)
- from projection of the anterior commissure to lower border of the thyroid cartilage (L9)
- from projection of the anterior commissure to the laryngeal prominence (L10)

Internal dimensions of the larynx

- length of the vestibule (a) – from tip of the epiglottis to upper border of the vestibular folds
- length of the sinus (b) – between vestibular and vocal folds
- length of the infraglottic cavity (c) – from vocal folds to lower border of the cricoid cartilage
- total length of laryngeal cavity (d) - from tip of the epiglottis to lower border of the cricoid cartilage
- length of vestibular folds (VeF) – bilaterally measured
- length of vocal folds (VoF) – bilaterally measured
- length of aryepiglottic fold (LAeF) – bilaterally measured
- maximum height of aryepiglottic fold (HAeF) - measured from midpoint of the length of the aryepiglottic fold up to lateral edge of the vestibular fold

Measurements that have been used in this study are shown in Figures 1-5.

Statistical Analysis

Data analysis was done using the Statistical Package for Social Sciences (SPSS) version 26.0. In this research, descriptive statistics; mean and standard deviation were used to analyse the data. Differences in the mean values of various external and internal measurements between the two sexes and between the two sides were analyzed using the Student's t-test and a $p < 0.05$ was considered as statistically significant.

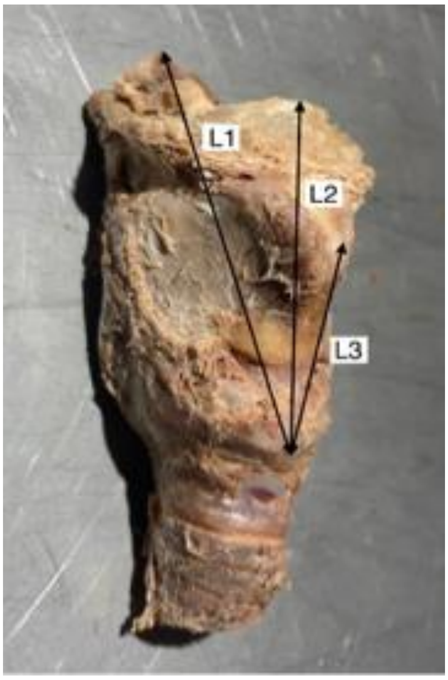

Figure 1: (L1) Distance from tip of the epiglottis to lower border of the cricoid cartilage; (L2). Distance from upper border of the hyoid bone to lower border of the cricoid cartilage; (L3). Distance from floor of the thyroid notch to lower border of the cricoid cartilage

Figure 2: (L4) Distance from lower border of the hyoid bone to floor of the thyroid notch; (L5). Distance from floor of the thyroid notch o lower border of the thyroid cartilage; (L6) Distance from lower border of the thyroid cartilage to upper border of the cricoid cartilage

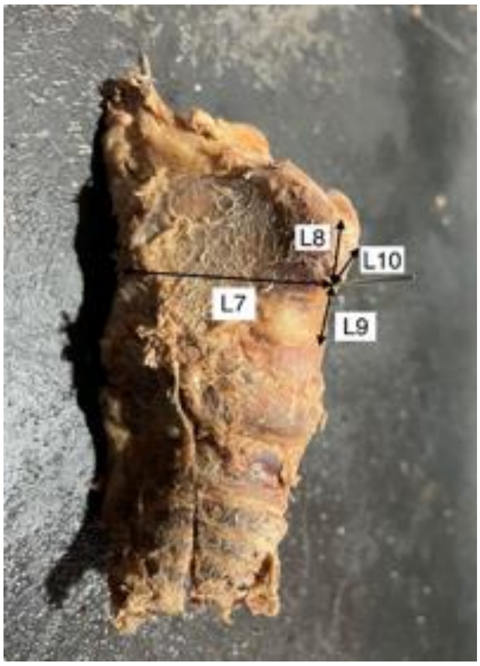

Figure 3: (L7) Distance from projection of the anterior commissure to posterior border of the thyroid cartilage; (L8) Distance from floor of the thyroid notch to projection of the anterior commissure; (L9) Distance from projection of anterior commissure to lower border of the thyroid cartilage; (L10) Distance from projection of anterior commissure to the laryngeal prominence

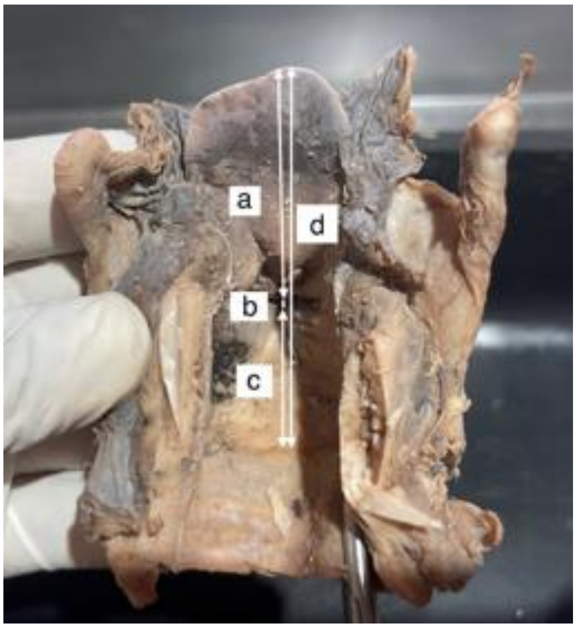

Figure 4: (a) Length of the vestibule; (b) Length of the sinus; (c) Length of the infraglottic cavity; (d) Total length of the laryngeal cavity

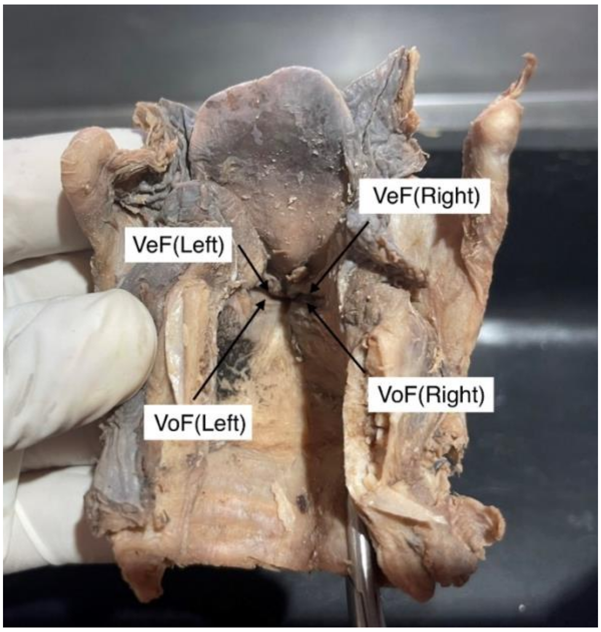

Figure 5: (VeF) Length of the vestibular fold; (VoF) Length of the vocal fold

Results

External dimensions of the larynx

The means, standard deviations, and ranges of the various external measurements are presented in Table 1. The mean distances with standard deviations in males and females respectively, from tip of the epiglottis to lower border of the cricoid cartilage (L1) were 65.8 ± 1.9 mm and 55.7 ± 2.1 mm, from upper border of the hyoid bone to lower border of the cricoid cartilage (L2) were 53.7 ± 3.6 mm and 44.9 ± 2.8 mm, from floor of the thyroid notch to lower border of the cricoid cartilage (L3) were 33.5 ± 3.1 mm and 28.5 ± 0.8 mm, from lower border of the hyoid bone to floor of the thyroid notch (L4) were 12.0 ± 2.8 mm and 8.6 ± 1.7 mm, from floor of the thyroid notch to lower border of the thyroid cartilage (L5) were 19.4 ± 1.3 mm and 14.0 ± 0.8 mm, from lower border of the thyroid cartilage to upper border of the cricoid cartilage (L6) were 7.7 ± 1.4 mm and 8.9 ± 1.5 mm, from projection of the anterior commissure to posterior border of the thyroid cartilage (L7) were 37.5 ± 1.2 mm and 33.1 ± 4.7 mm, from floor of the thyroid notch to projection of the anterior commissure (L8) were 7.5 ± 1.9 mm and 4.4 ± 0.8 mm, from projection of the anterior commissure to lower border of the thyroid cartilage (L9) were 12.1 ± 0.7 mm and 9.0 ± 0.4 mm, and from projection of the anterior commissure to the laryngeal prominence (L10) were 5.3 ± 1.1 mm and 3.0 ± 0.9 mm. The external dimensions in males were relatively higher than that in females, except for the L6 measurement. But the differences were statistically significant only for L3 ($p = 0.025$), L7 ($p = 0.000$), and L8 ($p = 0.035$).

Internal dimensions of the larynx

The means, standard deviations, and ranges of the various internal measurements are presented in Tables 2, 3 and 4. In males, the mean lengths with standard deviations of the vestibule (a), sinus (b), infraglottic cavity (c), and laryngeal cavity (d) were 35.7 ± 2.0 mm, 1.8 ± 0.4 mm, 21.5 ± 2.2 mm, and 58.5 ± 1.8 mm respectively. Correspondingly, the mean lengths in females were, 29.9 ± 2.4 mm, 1.9 ± 0.5 mm, 20.7 ± 0.7 mm, and 50.9 ± 2.6 mm.

The measurements of the laryngeal cavity in males were relatively higher compared to that in females, except for the b measurement where it was higher among females. But the differences were statistically significant only for c ($p = 0.018$). Respectively on left and right sides, the mean lengths with standard

Table 1: External measurements of the larynx (data are expressed in mm as mean ± standard deviation).

Measurements	Male		Female		Significance (p)
	Mean ± SD	Range	Mean ± SD	Range	
L1	65.8 ± 1.9	62.7 – 67.7	55.7 ± 2.1	53.2 – 57.8	0.563
L2	53.7 ± 3.6	49.1 – 59.5	44.9 ± 2.8	42.5 – 48.6	0.805
L3	33.5 ± 3.1	29.6 – 38.3	28.5 ± 0.8	27.2 – 29.1	0.025
L4	12.0 ± 2.8	9.4 – 16.9	8.6 ± 1.7	6.4 – 10.1	0.448
L5	19.4 ± 1.3	17.3 – 20.4	14.0 ± 0.8	13.0 – 14.9	0.222
L6	7.7 ± 1.4	6.1 – 9.9	8.9 ± 1.5	7.1 – 11.3	0.863
L7	37.5 ± 1.2	35.8 – 40.2	33.1 ± 4.7	26.8 – 37.4	0.000
L8	7.5 ± 1.9	5.8 – 10.6	4.4 ± 0.8	3.8 – 5.5	0.035
L9	12.1 ± 0.7	11.3 – 13.3	9.0 ± 0.4	8.7 – 9.7	0.422
L10	5.3 ± 1.1	3.8 – 6.6	3.0 ± 0.9	2.1 – 4.0	0.292

Table 2: Internal measurements of the larynx - Measurements of the laryngeal cavity (data are expressed in mm as mean ± standard deviation)

Measurement	Male		Female		Significance (p)
	Mean ± SD	Range	Mean ± SD	Range	
a	35.7 ± 2.0	33.4 – 38.6	29.9 ± 2.4	27.6 – 33.6	0.728
b	1.8 ± 0.4	1.2 – 2.2	1.9 ± 0.5	1.3 – 2.6	0.856
c	21.5 ± 2.2	18.1 – 23.3	20.7 ± 0.7	19.8 – 21.8	0.018
d	58.5 ± 1.8	55.8 – 61.1	50.9 ± 2.6	47.6 – 53.8	0.211

Table 3: Lengths of the folds (Data are expressed in mm as mean ± standard deviation).

Measure	Male					Female				
	Left		Right		Significance (p)	Left		Right		Significance (p)
	Mean ±SD	Range	Mean ± SD	Range		Mean ± SD	Range	Mean ± SD	Range	
VeF	15.5 ± 3.6	9.0 – 19.4	16.2 ± 4.2	9.4 – 21.9	0.732	12.0 ± 1.1	10.9 – 13.3	12.2 ± 1.0	11.0 – 13.1	0.672
VoF	15.9 ± 4.0	9.4 – 21.5	16.4 ± 4.2	9.5 – 22.3	0.874	12.3 ± 0.8	11.5 – 13.3	12.5 ± 1.2	11.1 – 14.0	0.188

Table 4: Length and height of aryepiglottic folds (data are expressed in mm as mean ± standard deviation).

Measure	Male					Female				
	Left		Right		Significance (p)	Left		Right		Significance (p)
	Mean ± SD	Range	Mean ± SD	Range		Mean ± SD	Range	Mean ± SD	Range	
LAEF	11.6 ± 2.1	8.6 – 14.1	12.4 ± 1.8	10.2 – 14.8	0.543	12.4 ± 2.6	8.7 – 15.2	12.8 ± 2.0	10.2 – 14.8	0.472
HAEF	17.8 ± 3.7	11.4 – 21.7	17.2 ± 4.3	11.9 – 21.7	0.441	15.0 ± 3.6	11.1 – 19.7	15.1 ± 3.7	11.8 – 21.1	0.851

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deviations of the vestibular folds (VeF) were 15.5 ± 3.6 mm and 16.2 ± 4.2 mm, vocal folds (VeF) were 15.9 ± 4.0 mm and 16.4 ± 4.2 mm, and aryepiglottic folds (LAeF) were 11.6 ± 2.1 mm and 12.4 ± 1.8 mm in males. Similarly, in females these measurements were 12.0 ± 1.1 mm and 12.2 ± 1.0 mm, 12.3 ± 0.8 mm and 12.5 ± 1.2 mm, and 12.4 ± 2.6 mm and 12.8 ± 2.0 mm on left and right sides respectively. In males, the mean heights of the aryepiglottic folds with standard deviations were 17.8 ± 3.7 mm on left side and 17.2 ± 4.3 mm on right side, whereas, in females were 15.0 ± 3.6 mm on left side and 15.1 ± 3.7 mm on right side. There was no statistically significant difference between the measurements on the left and right sides of the bilateral structures.

Discussion

Research on laryngeal morphometry remains relatively scarce, particularly studies involving adult human specimens. Much of the existing research concentrates on individual cartilages, and the measurements obtained are often limited, thus resulting in an incomplete understanding of laryngeal anatomy. In contrast, our study approached the laryngeal structure holistically, taking comprehensive measurements to provide an in-depth knowledge of its morphology.

External dimensions of the larynx

The distance from tip of the epiglottis to lower border of the cricoid cartilage (L1) in our study was 65.8 ± 1.9 mm in males and 55.7 ± 2.1 mm in females. This is comparable with the results of a cadaveric study done on Jharkhand population in India where this distance was 62.42 ± 7.54 mm in males and 46.09 ± 1.41 mm in females (9), and another cadaveric study done in India where this was reported to be 6.53 ± 0.38 cm and 5.72 ± 0.41 cm among males and females respectively (7). Regardless of sex, a cadaveric study done on Western Indian population demonstrated this measurement as 57.13 ± 7.32 mm (8), while an

Indian study on post-mortem specimens revealed a value of 60.17±8.12 mm (11).

In the current study, the distance from upper border of the hyoid bone to lower border of the cricoid cartilage (L2) was 53.7 ± 3.6 mm in males and 44.9 ± 2.8 mm in females, and from floor of the thyroid notch to lower border of the cricoid cartilage (L3) was 33.5 ± 3.1 mm in males and 28.5 ± 0.8 mm in females. Our results were relatively similar with the results of the Indian study on Jharkhand population, where L2 was reported as 52.00 ± 4.22 mm and 37.97 ± 3.83 mm, and L3 was reported as 34.03 ± 2.91 mm and 28.30 ± 1.36 mm in males and females respectively (9). The cadaveric study done on Western Indian population (8) and the Indian study on post-mortem specimens (11) demonstrated the L2 distance as 54.39 ± 6.04 mm and 50.43 ± 6.77 mm, and L3 distance as 32.42 ± 3.41 mm and 33.51 ± 3.6 mm respectively, without taking sex into account.

In the present study, we incorporated two new measurements which have not been utilised in the past literature: the distance from lower border of the hyoid bone to floor of the thyroid notch (L4), and the distance from lower border of the thyroid cartilage to upper border of the cricoid cartilage (L6). The measurement L4 closely resembles the thyrohyoid membrane which connects the hyoid bone to the thyroid cartilage, and L6 resembles the cricothyroid membrane which extends between the thyroid and cricoid cartilages. These measurements enhance the depth of our analysis and thereby offer a more detailed understanding of laryngeal morphometry.

Laryngeal framework surgery is a general term used for a group of phonosurgical procedures aimed at altering the structure of the larynx to improve or modify vocal function. As the largest and most accessible of the laryngeal cartilages, the thyroid cartilage serves as the primary site for surgical modifications, especially in thyroplasty. This specific type of laryngoplasty refers to laryngeal framework surgery which involves alteration or modification of the thyroid cartilage exclusively (medialisation thyroplasty, lateralisation thyroplasty, shortening thyroplasty, and elongation thyroplasty) (12). Therefore, our study includes multiple measurements of the thyroid cartilage, particularly targeting landmarks that are critical for these types of surgical procedures.

Our study found the distance from floor of the thyroid notch to lower border of the thyroid cartilage (L5) as 19.4±1.3 mm in males and 14.0± 0.8 mm in females. These measurements are similar to those reported by Enver et al. in two different Turkish studies, which were 18.8 ± 2.26 mm and 14.4 ± 2.92 mm (13), and 18.7 ± 3.2 mm and 14.6 ± 1.8 mm (14), in males and females respectively. The distance from projection of anterior commissure to posterior border of the thyroid cartilage (L7) in our study was 37.5 ± 1.2 mm in males and 33.1 ± 4.7 mm in females. These measurements are comparable with the results of two Turkish studies and a Brazilian study, which were documented as 40.2 ± 4 mm and 29.14 ± 4 mm (13), 38.8 ± 4.3 mm and 29.2 ± 2.5 mm (14), and 37.69 ± 3.39 mm and 27.51 ± 3.44 mm (15), in males and females respectively.

We observed a measurement of 7.5 ± 1.9 mm in males and 4.4 ± 0.8 mm in females, for the distance from floor of the thyroid notch to projection of the anterior commissure (L8). The studies conducted on Turkish and Brazilian populations demonstrated higher values compared to our findings, where this distance was 8.6 ± 2.13 mm and 7.14 ± 1.4 mm (13), 8.7 ± 1.9 mm and 7.0 ± 1.2 mm (14), and 9.94 ± 2.96 mm and 7.88 ± 2.28 mm (15), in males and females respectively. Our study revealed slightly higher values for the distance from projection of anterior commissure to lower border of the thyroid cartilage (L9), in contrast to previous studies. In two Turkish studies, Enver et al. reported this distance as 10.27 ± 2.96 mm and 7.86 ± 1 mm (13), and 10.0 ± 2.2 mm and 7.6 ± 1.5 mm (14), in males and females respectively. Similarly, Jotz et al. reported this distance as 10.83 ± 2.55 in males and 7.49 ± 2.57 mm in females (15).

Our study identified notably lower measurements for the distance from projection of the anterior commissure to the laryngeal prominence (L10), with values of 5.3 ± 1.1 mm in males and 3.0 ± 0.9 mm in females. In contrast, other studies reported significantly higher values: 11.55 ± 3.63 mm for males and 9.29 ± 2.63 mm for females in one study (13), and 7.73 ± 2.05 mm for males and 6.35 ± 2.44 mm for females in another (15). This marked discrepancy could be attributed to inconsistent techniques or definitions for marking the anterior commissure across different studies. This highlights the importance of standardised protocols for anatomical landmarks in laryngeal research to ensure consistency and comparability of results.

Int*ernal dimensions of the larynx*

The length of the vestibule (a) in our study was 35.7 ± 2.0 mm in males and 29.9 ± 2.4 mm in females. A study done on Jharkhand population in India demonstrated a similar length of 35.05 ± 3.61 mm for males, while in females this was recorded as 25.70 ± 2.35 mm which is slightly lower compared to that in our study (9). Irrespective of the sex, this measurement was reported as 32.11 ± 5.77 mm (8) and 33.45 ± 6.37 mm (11) in two other Indian studies.

In our study the length of the sinus (b) was measured as 1.8 ± 0.4 mm and 1.9 ± 0.5 mm in males and females respectively. As opposed to our findings, an Indian study done on Jharkhand population observed a value of 2.71 ± 0.60 mm in males and 1.04 ± 0.28 mm in females for this measurement, where the length of the sinus in male larynges was considerably higher than that in female larynges (9). Also, Poornima et al reported this measurement as 2.32 ± 1.01 mm regardless of the sex and it is consistent with the above ranges (11).

The present study observed the length of the infraglottic cavity (c) as 21.5 ± 2.2 mm in males and 20.7 ± 0.7 mm in females. Singhe et al., reported this distance as 26.06 ± 4.58 mm in males, which is significantly higher compared to that in our study, and 19.63 ± 0.55 mm in females, which is comparable with our study findings (9). Furthermore, the length of the infraglottic cavity was measured as 23.05 ± 3.13 mm and 24.21 ± 3.52 mm in the studies conducted by Joshi et al. (8) and Poornima et al., (11) respectively, regardless of the sex.

The total length of the laryngeal cavity (d) was measured as 58.5 ± 1.8 mm in males and 50.9 ± 2.6 mm in females in our study. In contrast to our findings, Singhe's study revealed a significantly higher measurement for males and a lower measurement for females, which were 66.16 ± 9.24 mm and 40.11 ± 7.66 mm respectively (9). Despite these differences, both studies agree on the relative comparison between sexes, with males having a greater total length of the laryngeal cavity compared to females. Without taking sex of the subjects into account, two Indian studies reported this distance as 61.52 ± 6.84 mm (8) and 62.31±11.18 mm (11). Those measurements align with the general trend observed in the literature.

We observed that the dimensions of the bilateral structures: length of the vestibular folds (VeF), length of the vocal folds (VoF), length of the aryepiglottic folds (LAeF), and maximum height of the aryepiglottic folds (HAeF) were very similar with minimal side-to-side variability. In terms of sex differences, males had relatively larger measurements for VeF, VoF, and HAeF compared to females. However, LAeF showed only minor variations between sexes, with females having slightly larger values. These observations are in alignment with existing literature, which similarly reports comparable bilateral dimensions (8,9,11) and consistently higher measurements in males across all four evaluated structures (9,13-15).

The relatively small sample size in our study limits the ability to generalise our findings to Sri Lankan population and may potentially compromise the reliability of the significance test results. Additionally, as this study utilises cadaveric specimens, post-mortem changes could affect the accuracy of the measurements, leading to deviations from the true anatomical dimensions. However, to the best of our knowledge, following an extensive review of existing literature, our study appears to be the only research on laryngeal morphometry conducted in Sri Lanka to date. Continued research with larger sample sizes and advanced methodologies will be essential for overcoming these limitations and advancing our understanding of laryngeal anatomy.

Conclusion

The present study offers a thorough and detailed analysis of the dimensions of the adult human larynx in Sri Lankan sample. There was a considerable variation in both external and internal dimensions, even among individuals of the same racial group. Significant differences were observed between the two sexes, with males having generally larger laryngeal dimensions compared to females. The bilateral structures though demonstrated asymmetry, the variations were slight and insignificant. Understanding laryngeal morphometry is crucial, as it provides valuable insights into anatomical differences that can influence clinical and surgical practices. Furthermore, we can integrate these findings into the design of advanced biomechanical models to achieve better patient care and innovative treatment solutions.

Limitations

Sample size is a limitation as most of the larynxes were excluded from analysis due to damages to its structure. However, some of the articles cited also have similar sample sizes.

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