

Morphometric Study of Cricoid Cartilages in Adults by Dissection Method

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Abstract

Background: Out of different cartilages of larynx, cricoid is the strongest cartilage. It is the only cartilage which extends completely around the air passage. Renewed interest in subglottic stenosis recently has underscored the importance of detailed knowledge of cricoid cartilage. **Aim:** To study morphometric features of cricoid cartilage in adult human cadavers and also to compare the measurements of the cricoid cartilage between male and female. **Materials & Methods:** Larynx specimens of South Indian population, were collected from 62 cadavers (Male: 31, Female: 31) from postmortem bodies from the department of Forensic medicine, MMC and RI, Mysore for a period of 18 months from Nov 2013 to April 2015. Following four parameters like height of arch and lamina, outer Antero-Posterior and Transverse diameters were measured using digital vernier caliper in mm on each cricoid cartilage and the observations were tabulated. **Results:** Mean value of height arch of cricoid cartilage was 5.97 ± 0.94 in male and 4.94 ± 1.01 in female. Mean value of height of lamina was 21.3 ± 1.9 in male, 17.91 ± 2.29 in female. Mean value of outer antero-posterior (AP) diameter was 23.84 ± 2.43 in males and 19.18 ± 2.34 in female. The mean value of outer transverse diameter was 25.53 ± 2.23 in male and 19.29 ± 2.52 in female. **Conclusion:** The mean values of all parameters of cricoid cartilage were more in males compared to females. The mean value of outer AP diameter was equal to the mean transverse diameters in females. Where as in males and the mean transverse diameter was more than AP diameter.

Keywords: larynx, cricoid cartilage, morphometry, sex differentiation.**Copyright @ 2020:** This is an open-access article distributed under the terms of the Creative Commons Attribution license which permits unrestricted use, distribution, and reproduction in any medium for non-commercial use (NonCommercial, or CC-BY-NC) provided the original author and source are credited.

INTRODUCTION

From embryologic, anatomic, physiologic and surgical standpoints, the larynx is one of the most complex organs of human body [1]. Morphometric data of the larynx is useful in otorhinolaryngology during procedures like intubation, endoscopy, laryngeal micro-surgeries, phonosurgery, stenting, cricothyroidotomy and transplantation [2].

A basic knowledge of anatomy of larynx is necessary for those who are involved in fields of surgical treatment of larynx such as speech therapists, anesthetists, oncologists, pulmonologists, radiologists, general practitioners, ENT surgeons and phoneticians [3].

Skeletal framework of larynx is formed by series of cartilages like unpaired thyroid, cricoid and epiglottis and paired arytenoids, cuneiform and corniculate [4]. Further, the growing utilization of advanced electrophysiological and surgical methods in

management of some of the laryngeal disorders like subglottic stenosis and post intubation stenosis of lower respiratory tract, require an intense comprehension of size and proportion of human larynx and its cartilaginous components, especially the cricoid cartilage [5, 6].

A signet shaped ring, cricoid is the only complete cartilaginous ring of larynx. The cartilage consists of a posterior quadrangle lamina and a narrow anterior arch. The cricoid is composed of hyaline cartilage, which undergoes variable ossification with advancing age which is especially pronounced in lamina [7, 8]. The diameters of the cricoid cartilage vary a lot and studies have found that it is oval in shape, with males having a larger cricoid cartilage compared to females [9].

Many studies have been done on thyroid cartilage but only a very few have been done on the cricoid cartilage. So this study was intended to provide

information about this significant but relatively neglected laryngeal cartilage. Therefore, the aim of this study was to assimilate precise and reliable morphometric data of human cadaveric cricoid cartilages.

MATERIALS AND METHODS

The 62 (31 Male, 31 Female) postmortem larynx specimens of South Indian population were collected from the department of Forensic medicine, MMC and RI, Mysore. Study was done for a period of 1 ½ years from Nov 2013 to April 2015. A written consent was taken from the relatives of the subject. The study includes post-mortem larynx specimens of both the sexes of adult age group (18 to 70 years). Postmortem larynx specimens of hanging,

strangulation, lacerated wound over the neck, with history of any previous laryngeal surgery and larynx specimens of below 18 years, above 70 years age group were excluded.

Soon after postmortem, larynx specimens extending from Hyoid bone to trachea were collected prospectively and fixed in 10% formalin solution. Careful dissection was done after fixation, to isolate Cricoid cartilages by removing muscles, ligaments, small cartilages and mucous membrane. Height of arch and lamina were measured as shown in figure 01, AP and transverse diameters were measured from inferior aspect of cricoids cartilage as shown in figure 02. Measurements were taken with the help of digital vernier caliper and tabulated.

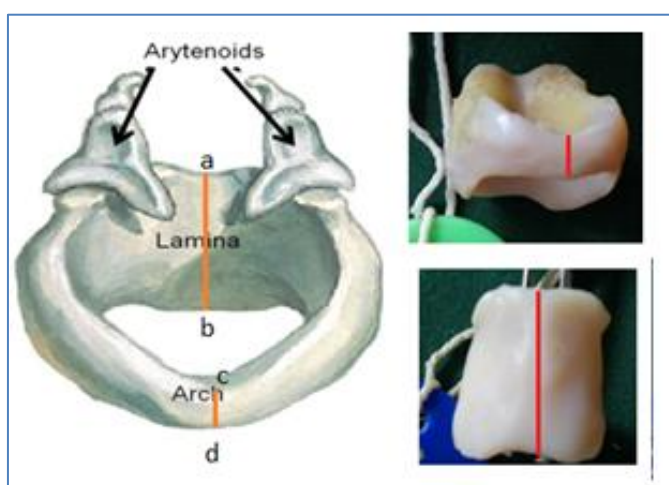


Fig-1: Superior aspect of cricoid cartilage: ab – height of lamina, cd – height of arch

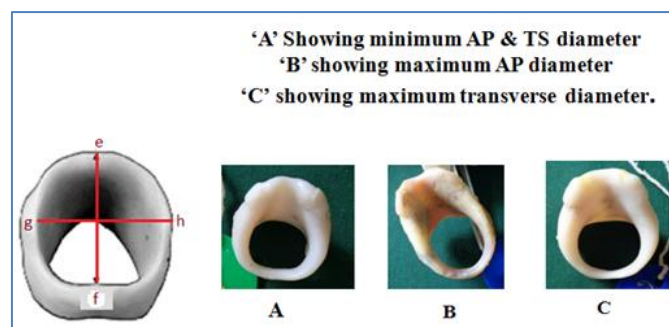


Fig-2: Inferior aspect of cricoid cartilage: ef –antero-posterior diameter, gh – transverse diameter

OBSERVATIONS

The mean values of all parameters of cricoid cartilage were more in males compared to females. The mean value of outer AP diameter was equal to the mean

transverse diameters in females. Where as in males and the mean transverse diameter was more than AP diameter (Table 01).

Table-1: Comparision of Parameters of Cricoid cartilage between male and female

Parameters	Male (31)	Female (31)
Height of Arch	5.97±0.94	4.94±1.01
Height of Lamina	21.3±1.90	17.91±2.29
Antero-posterior diameter	23.84±2.43	19.18±2.34
Transverse diameter	25.53±2.23	19.29±2.52

DISCUSSION

Cricoid cartilage has important clinical implications in placements of stents, transplantation, endotracheal tubes and for surgical procedures. Shibin Mathews reports in his article under physiologic variants of cricoid cartilage as "In a Swedish study by Randestad *et al.*, laryngeal dimensions were taken from 34 men and 27 women, demonstrating the dimensional differences of the inner cricoid ring. In women, the

mean diameter was 11.6 mm (range: 8.9 to 17.0 mm), and in men, the mean diameter was 15.0 mm (range: 11.0 to 21.5 mm) [10].

The mean values of height of the cricoid arch and lamina in males and females in the present study are less than the mean values of all other studies [1, 5, 9, 11] as shown in table 02.

Table-2: Comparison of Parameters of present study with other studies

Authors	Sample size	Ht of arch	Ht of lamina	AP outer diameter	Transverse outer dia.
Monica Jain <i>et al.</i> [5]	M (20)	6.0±0.8	22.0±1.9	28.6±4.9	25.7±3.2
	Fe (20)	5.6±1.0	19.9±2.3	23.2±4.1	21.3±4.7
Mohini Joshi <i>et al.</i> [1]	50	6.54 ±1.23	21.45±1.97	19.29±2.47	18.33±2.26
Rajan Kumar Singla <i>et al.</i> [9]	M (25)	7.56±1.15	21.81±2.98	20.01±3.8	24.77±3.43
	Fe (5)	7±0.53	18.55±0.65	19.89±1.41	21.94±0.52
Ik Sung Kim <i>et al.</i> [11]	M (33)	7.10±0.23	22.33±0.44	18.78±0.47	17.19±0.40
	Fe (15)	5.72±0.29	20.10±0.59	15.97±0.54	13.36±0.50
Present study (2019)	M (31)	5.97±0.94	21.3±1.9	23.84±2.43	25.53±2.23
	Fe (31)	4.94±1	17.91±2.29	19.18±2.34	19.29±2.52

In the present study the mean values of Antero-posterior diameter and transverse diameters in both sexes are less than the mean values quoted by other authors [1, 9,11].

In the present study the mean value of transverse diameter is equal to mean value of AP diameter in females where as in males the mean value of transverse diameter is more than antero posterior diameter.

A study done by Singla R K [9] reports that transverse diameter of cricoid cartilage is more than Antero-posterior diameter of cricoid cartilage in both sexes. Whereas majority of authors have shown the converse that is antero-posterior diameter being greater than the transverse diameter.

Comparison of these outcomes to other works reveals that the morphology of the cricoid cartilage varies amongst populations in most of the parameters. This may well be due to diversity in body shape and race. The big variation in almost all sizes and shapes of the cricoid cartilage renders it hard to standardize the rigid stents utilized in these organs. Consequently appropriate sized endo-tracheal tubes should be used for intubation, taking into consideration the sex and race of the individual, apart from other factors. Understanding of such measurements and differences is of paramount importance for clinical practice in order to prevent needless damage to the larynx [3].

CONCLUSION

Mean values of all parameters of cricoid cartilage were found to be more in male than female.

Significant difference was noted in values of cricoid arch and lamina in male and female laryngeal specimens ($p < 0.05$). AP & transverse diameters in male were more than female laryngeal specimens. Transverse diameter was more than AP in males and equal in females. Morphometrical data of the cricoid cartilage may be very useful in endotracheal intubation, laryngeal microsurgery and laryngeal framework surgery. These parameters can be helpful in evaluation of subglottic stenosis and its surgical repair.

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