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# Quantitative anatomy of the posterior cricoid region

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*The anatomy of the posterior cricoid cartilage region was examined to obtain a better quantitative understanding of this region. The mean height and width of the posterior cricoid cartilage in the midline measured 24.5 mm and 25 mm respectively. The mean distance between the fibres for the left and right posterior cricoarytenoid muscles was 5 mm at the midpoint of the posterior cricoid cartilage. The height of these muscles averaged 19 mm for left sides and 20 mm for right sides. The mean distances from the midpoint and superior midline of the posterior cricoid cartilage to the inferior laryngeal nerve were 14 mm and 15 mm respectively for left sides and 17 mm and 18 mm respectively for right sides. It is hoped that these data will be of use to clinicians performing invasive procedures in this area.*

**Key words: larynx, anatomy, landmarks, nerve**

## INTRODUCTION

Measurements of the posterior cricoid region are lacking in the literature. Important structures in this vicinity include the posterior cricoarytenoid muscle and the inferior laryngeal nerve. This area is not infrequently entered for the removal of foreign bodies and for the excision of tumours. Approaches to the posterior cricoid region have included entering the hypopharynx by an incision in the thyrohyoid membrane at the superior edge of the thyroid cartilage [1]. Other procedures that rely on adequate knowledge of the anatomy of this region include botulinum toxin injections for abductor laryngeal dystonia and attempts to restore the abductor function of paralysed laryngeal muscles by direct muscle reinnervation or electrical stimulation. Additional quantitation of the posterior cricoid may aid the clinician who performs invasive procedures in this.

## MATERIAL AND METHODS

Twenty-two adult cadavers were used for this study. These were made up of 11 males and 11 females (aged 55–89 years with a mean age of 67 years). No specimen was noted to have pathology or anomalies of the larynx following dissection. Following disassociation of the cranium from the vertebral column, the head, pharynx, and larynx were pulled anteriorly and the posterior pharynx was opened along the pharyngeal raphe and retracted laterally. Next, the mucosa of the larynx in the vicinity of the cricoid cartilage and piriform recess was carefully removed. Measurements were then made of the height and width of the posterior cricoid cartilage in the midline, the distance between the left and right posterior cricoarytenoid muscles and their maximal vertical height, and the distances from the midpoint and superior midline of the posterior cricoid cartilage to the inferior laryngeal nerve on the left and right sides

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(Fig. 1). All measurements were made with callipers. Statistics were considered significant when $p < 0.05$ (Student's t-tests).

## RESULTS

All the results are summarised in Table 1. The mean height and width of the posterior cricoid cartilage in the midline was 24.5 mm and 25 mm respectively. The mean distance between the fibres for the left and right posterior cricoarytenoid muscles was 5 mm. The height of these muscles averaged 19 mm for the left sides and 20 mm for the right sides. The mean distances from the midpoint and superior midline of the posterior cricoid cartilage to the inferior laryngeal nerve were 14 mm and 15 mm respectively for the left sides and 17 mm and 18 mm respectively for the right sides. A statistically significant difference between males and females was found when comparing the height of the posterior cricoarytenoid muscle, the width of the posterior cricoid cartilage and the height of the posterior cricoid cartilage, with this distance generally being greater in males. Table 2 lists the average measurements for this study when grouped by gender.

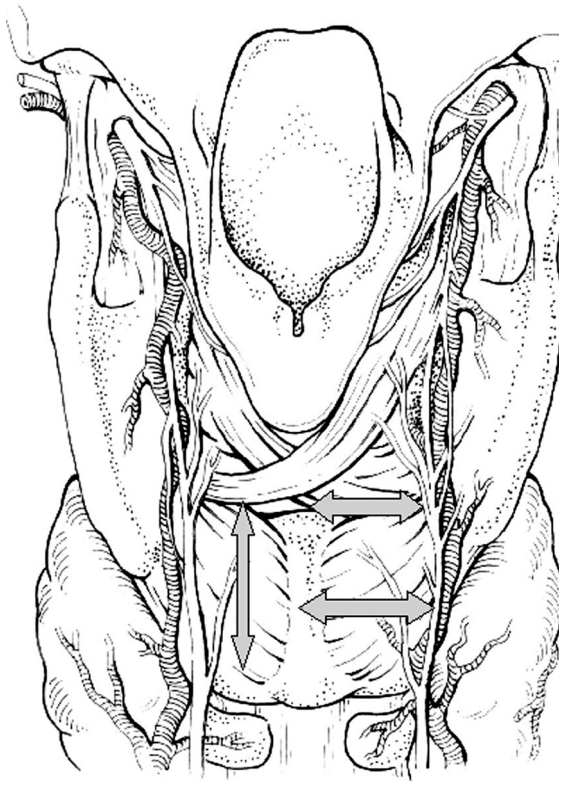

**Figure 1.** Posterior view of the larynx as seen in our study. The maximal height of the posterior cricoarytenoid muscle is shown by the vertically-oriented double arrows. The distance from the superior midpoint of the posterior cricoid cartilage to the inferior laryngeal nerve and the distance from the midpoint of the posterior cricoid cartilage to the inferior laryngeal nerve as measured in our study are shown by the superior and inferior horizontally-oriented double arrows respectively.

## DISCUSSION

Knowledge of the posterior cricoid region can be of use in procedures such as direct stimulation of the posterior cricoarytenoid muscle in cases of laryngeal paralysis [2, 7], resection of tumours of the piriform sinus [1], partial laryngectomies, treatment of subglottic stenosis with division of the posterior cricoid cartilage [10] and extraction of foreign bodies [9]. Moreover, knowledge of the distance from the inferior laryngeal nerve to the midline of the posterior cricoid cartilage is important, as injury to the motor branches of this nerve can lead to altered laryngeal function with disturbance of deglutition, respiration, and phonation, especially if it is bilateral [9].

Lang et al. [4] found that the average height of the posterior cricoid cartilage was 24.5 mm in males and 22 mm in females. We found a mean of 24.5 for males and females combined, 26 mm for males and 23 mm for females, the latter difference being statistically significant ($p < 0.05$). This difference in size of this muscle of the larynx may simply be due to the generally larger configuration of the male larynx, with the necessity for larger muscles to act upon the laryngeal cartilages. Goding and Bierbaum [2] found that all larynges in their study had approximately 4 mm of exposed cartilage along the inferior surface of the posterior cricoarytenoid muscle. These authors also found that the average inferolateral to superomedial diagonal width of the posterior cricoarytenoid muscle was 4 mm greater in the male than in the female larynx.

The recurrent laryngeal nerve becomes the inferior laryngeal nerve as it passes posterior to the cricothyroid joint [2]. We found that from the midpoint of the posterior cricoid cartilage laterally to the inferior laryngeal nerve there was an average distance of 14 mm and 15 mm for left and right sides respectively. Hartley et al. [3] have increased the size of the posterior cricoid cartilage in cases of laryngotracheal stenosis by splitting this cartilage and placing an interposed graft. Knowledge of the distance for this midline procedure to the laterally placed inferior laryngeal nerve as measured in our study would seem pertinent. Additionally, our findings concur with those of Reidenbach [8], who found in her specimens that roughly one half the inferior laryngeal nerve was covered by fibres of the posterior cricoarytenoid muscle lateral to the posterior cricoid cartilage. Additionally, the fact that vocal cord paralysis has been reported

**Table 1.** Measurements of the posterior cricoid cartilage region

| Sex | Height PCC | Width PCC | Distance L to R PCA | Height L PCA | Height R PCA | Midline to L ILN | Midline to R ILN | S/M CC to L ILN | S/M CC to R ILN |
|---|---|---|---|---|---|---|---|---|---|
| M | 23.5 | 28 | 5 | 20.5 | 20 | 13.5 | 14 | 16 | 16 |
| F | 22.5 | 22.5 | 4.3 | 19 | 19 | 11 | 12 | 13.5 | 15 |
| F | 26 | 24 | 4.5 | 17 | 17 | 12 | 12 | 16 | 16 |
| M | 27.5 | 29 | 4.5 | 19.5 | 20 | 14.5 | 14 | 18 | 18 |
| F | 22.5 | 26 | 6.7 | 19 | 19 | 14 | 13 | 17 | 18 |
| M | 25 | 28 | 5 | 19 | 19.5 | 14 | 12 | 19 | 18 |
| M | 26.5 | 27 | 4.5 | 22 | 22 | 16 | 16 | 20 | 20 |
| M | 28.5 | 26 | 5.5 | 20.5 | 20 | 16 | 18 | 18.5 | 19 |
| F | 23 | 23 | 4.5 | 14 | 15 | 12 | 12 | 19 | 19 |
| M | 30 | 30.5 | 5 | 23 | 24 | 11.5 | 13 | 17 | 17 |
| F | 24.5 | 25 | 4.5 | 23 | 23 | 17 | 17 | 18 | 19 |
| F | 24 | 24 | 2.5 | 19 | 19 | 13.5 | 15 | 15 | 16 |
| M | 24 | 25 | 5 | 24 | 24 | 15 | 15 | 18.5 | 17 |
| F | 22 | 28 | 4 | 17.5 | 18 | 14 | 15.5 | 16 | 17 |
| M | 23 | 26 | 4 | 16 | 16 | 13 | 17 | 15 | 15 |
| F | 22 | 21 | 4 | 16 | 16 | 13 | 14 | 15.5 | 16.5 |
| M | 26 | 28 | 6.5 | 21 | 21 | 16 | 18 | 15 | 15 |
| F | 21 | 18 | 5 | 14 | 14 | 14 | 14 | 18 | 18 |
| F | 27 | 20 | 6 | 20 | 20 | 15 | 17 | 17 | 17 |
| F | 21.5 | 20 | 4.5 | 17 | 17 | 13 | 14 | 15 | 16 |
| M | 26 | 27 | 5 | 22 | 22 | 15 | 15 | 16.5 | 17 |
| M | 23 | 28 | 5 | 21.5 | 22 | 17 | 17 | 20 | 20 |

All measurements in millimetres. M — male, F — female, PCC — posterior cricoid cartilage, CC — cricoid cortilage, L — left, R — right, PCA — posterior cricoarytenoid muscle, S — superior, M — middle, ILN — inferior laryngeal nerve

**Table 2.** Average distances measured in the present study grouped by gender

| | Height PCC | Width PCC | Distance L to R PCA | Height L PCA | Height R PCA | Midline to L ILN | Midline to R ILN | S/M CC to L ILN | S/M CC to R ILN |
|---|---|---|---|---|---|---|---|---|---|
| Male | 25.7 | 27.5 | 5 | 20.8 | 21 | 14.7 | 15.4 | 17.6 | 17.5 |
| Female | 23.3 | 22.9 | 4.6 | 17.8 | 17.9 | 13.5 | 14.1 | 16.4 | 17 |

All measurements in millimetres. PCC — posterior cricoid cartilage, CC — cricoid cortilage, L — left, R — right, PCA — posterior cricoarytenoid muscle, S — superior, M — middle, ILN — inferior laryngeal nerve

following laryngeal mask anaesthesia makes these relationships even more pertinent [5, 6].

We have made several measurements of the posterior cricoid cartilage region. We believe that understanding of this area, currently under-represented in the literature, will be improved with this knowledge.

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