RADIOLOGICAL AND IMAGING TECHNIQUES OF NORMAL LARYNX

THESIS

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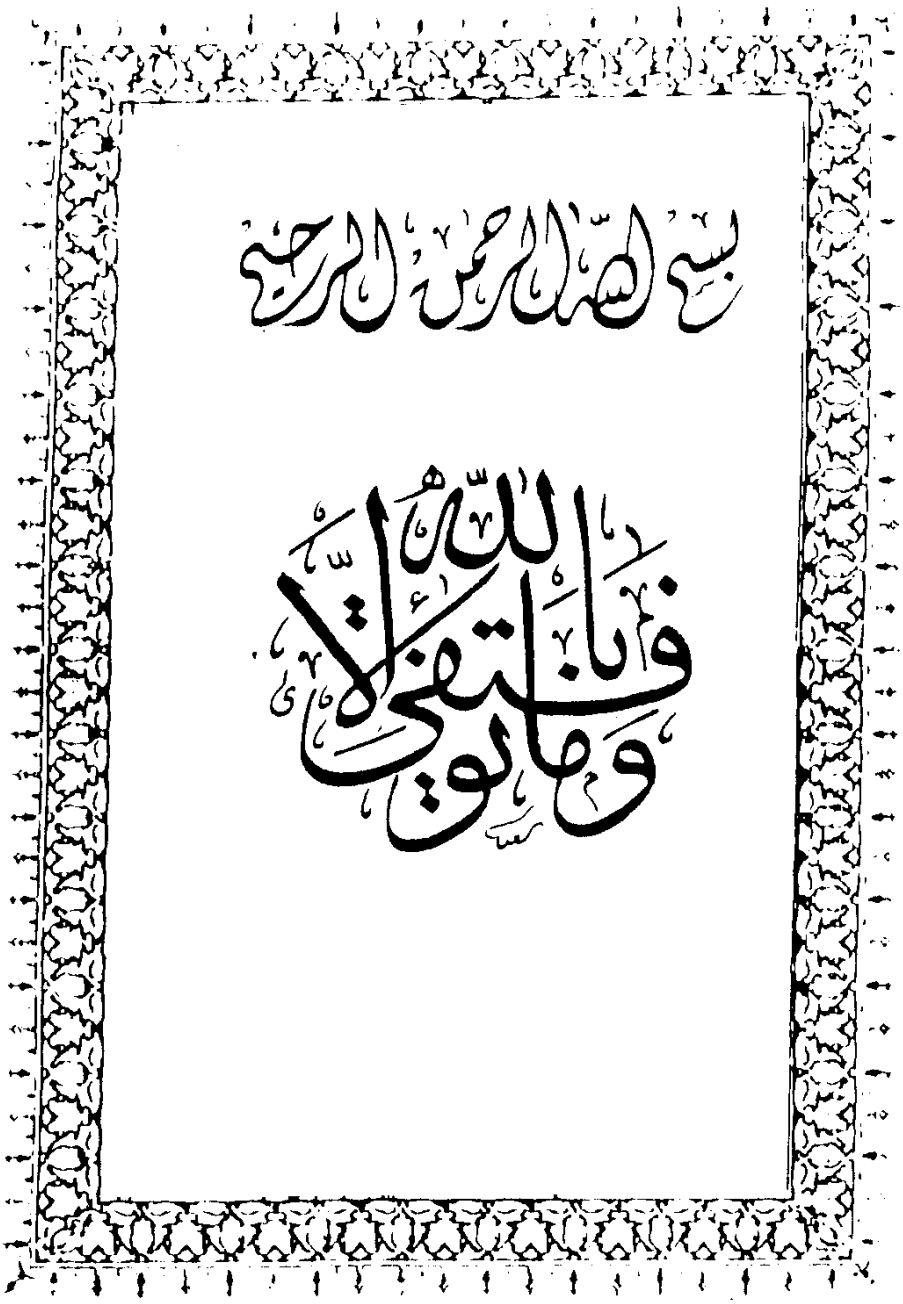

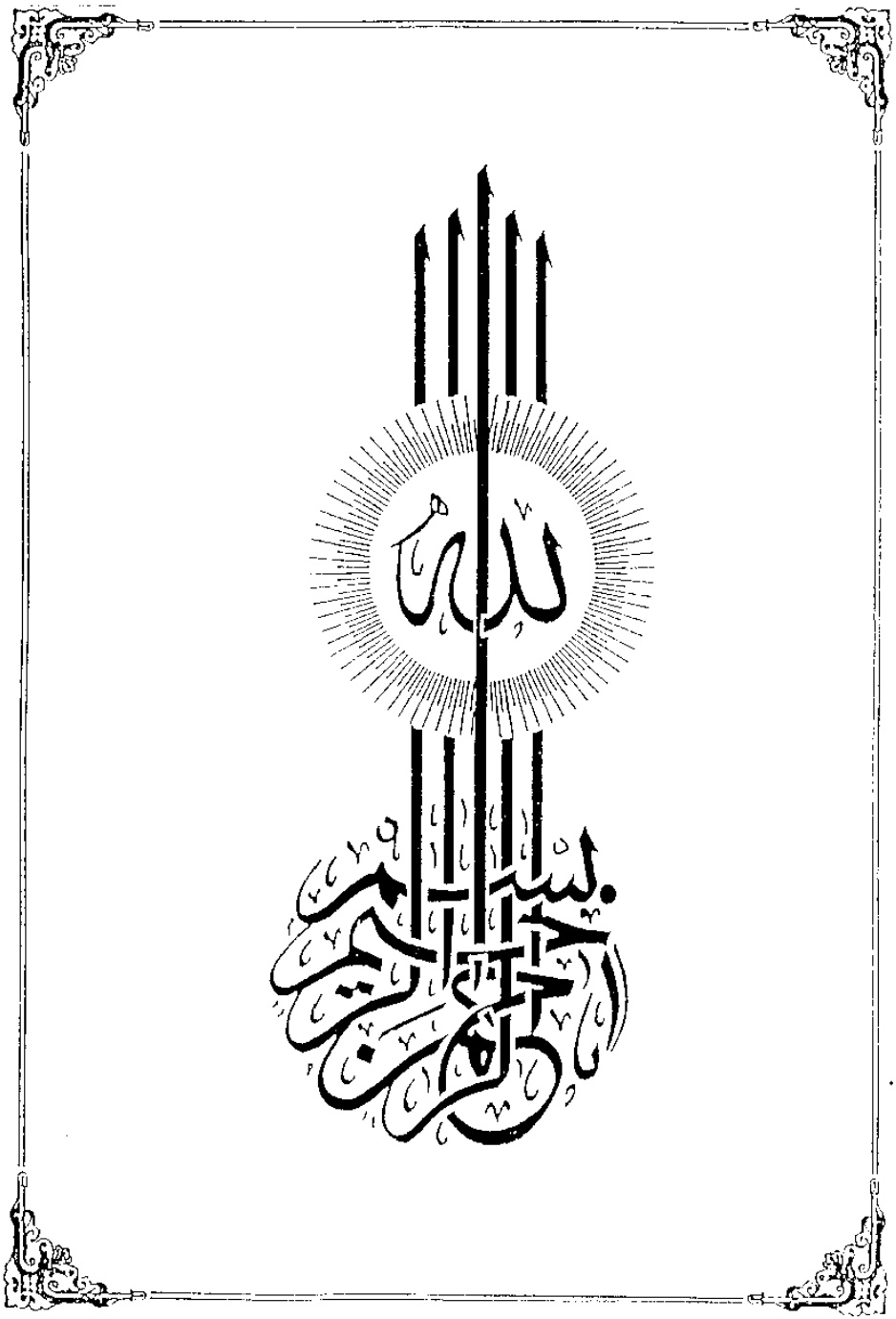

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INTRODUCTION AND AIM OF THE WORK.

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The larynx, being a remarkable mucosa-lined complex organ, comprising modified soft tissue sphincters supported by a unique cartilageneous framework, remains distant to the inspecting eye and the palpating hand. Mucous membranes can be examined directly by mirror and endoscopy, but areas such as the laryngeal ventricles and the subglottis often remain hidden from view; here, then, is the role of diagnostic radiological and iamging modalities.

The aim of this work is to demonstrate the different radiological and imaging modalities that can be used in the examination of the larynx and description of the normal appearance in each modality.

ANATOMY OF THE LARYNX.

ANATOMY OF THE LARYNX

The anatomy of the larynx will be described according to the following criteria :

1. Position with special notes about important levels.
2. Cartilages with special notes about their calcification.
3. Membranes & ligaments of the larynx.
4. Muscles with special notes about their action in phonation.
5. Joints of the larynx.
6. Cavity of the larynx & importance of surrounding spaces.
7. Laryngeal mucous lining.
8. Nerve supply of the larynx.
9. Blood supply & lymphatic drainage.
10. Functions of the larynx
    * Respiratory function.
    * Sphincteric function.
    * Phoantion & speech (Voice production).

1. Position of the larynx :

The larynx extends from the root of the tongue to the trachea. It projects ventrally between the great vessels of the neck & is covered anteriorly by the skin, the fasciae & the depressor muscles of the Hyoid bone. Above it opens into the laryngeal part of the pharynx by the laryngeal inlet & below it is continuous with the trachea. Thus, this specific postion of the larynx creates a flexible mobile chain in the respiratory system. So as that the hyoid bone is suspended by the suprahyoid muscles from the mandible and skull base; and the thyroid cartilage is suspended from the hyoid bone by the thyrohyoid membrane & also is in turn attached to the cricoid cartilage posteriorly by the cricothyroid joint. Anteriorly, the cricothyroid membrane closes the space between the undersurface of the thryroid cartilage and the downward sloping thin anterior cricoid arch. Finally the trachea is suspended from the undersurface of the cricoid cartilage. (Fig. 1).
(Ref. 1).

In the adult male it is situated opposite the 3rd, 4th, 5th & 6th cervical vertebrae, but it occupies a somewhat higher position in the child and in the adult famle.
(Ref.21).

In infants of between six and twelve months the tip of the epiglottis (the highest part of the larynx) is a little above the level of the cartilaginous disc between the dens and the body of the axis. On puberty in the male, the increase in size of the larynx is considerable on contorary to increase in size in female which is small.
(Ref.35).

2. Cartilages of the larynx :

[A] Single : Thyroid, cricoid & the epiglottis.

[B] Paired : Arytenoid, corniculate & the cuneiform.

(Figs. 2-7)

Thyroid cartilage : It is the largest one. It is formed of two laminae (Figs. 3-7) which are fused anteriorly but widely separated posteriorly.

Cricoid cartilage : It is signet - ring in shape - Its anterior narrow portion is called the arch of the cricoid cartilage & lies below the thyroid, while its posterior wide portion is called the lamina and lies between the posterior parts of the thyroid cartilage. The upper border of the arch is slopping and gives attachment to the crico-thyroid ligament and crico-vocal membrane. The arytenoid cartilages rest on the upper border of the lamina of the cricoid cartilage. The lower border of the cricoid cartilage is horizontal and gives attachment to the cricotracheal ligament. (Figs. 2, 3, 4)

Epiglottic cartilage : It is made of (yellow) fibro-elastic cartilage which never calcifies . It is broad leaf-like in shape lying behind the tongue. Its lower end is connected to the thyroid cartilage by the thyroepiglottic ligament.

(Fig. 4)

Arytenoid cartilages : They are in the form of a three sided pyramid with their bases resting on the upper border of the lamina of the cricoid cartilage. The anterior angle of the base projects to form the vocal process which gives attachment to the vocal ligament, and the posterior

lateral angle of the base projects to form the muscular process which gives insertion to the crico-arytenoid muscle. The small corniculate cartilage is composed of elastic cartilage & articulates with each apex of the arytenoid cartilages. While the other small elongated cuneiform cartilage is placed slightly in front of each corniculate cartilage. Both are enclosed within the m.m. of the aryepiglottic fold to form two swellings on each side of the post. part of the rima glottidis (Fig. 8 & 9)

(Ref. 1)

Calcification of the laryngeal cartilages :

The epiglottis, corniculate and cuneiform are made of yellow elastic fibrocartilage which rarely calcify , while other cartilages of the larynx calcify by aging because they are made of hyaline cartilage. Ossification in the thyroid cartilage begins in the inferior cornu in the late teens & later patchy ossification occurs in the lateral thyroid laminae. A central radiolucent window (sometimes divided by a vertical bar) persists in the thyroid cartilage. (Ref. 1)

(Fig. 7)

Calcification of the cricoid cartilage begins in the superior border of the lamina, in late teens, and proceeds anteriorly. Calcification of the posterior part of the lamina may be confused at radiography with a foreign body.

Calcification of the apex, body and muscular process of the arytenoid begins later, but the vocal process never ossifies. Calcification of thyroid & cricoid cartilages can partially obscure laryngeal radiographic detalis. The main problem in interpreting these cartilage findings

results from the inconstant and irregular calcification of those cricoid & thyroid cartilages. Thus differentiation between an area of irregular cartilage calcification and destruction due to a penetrating tumor is impossible on radiological basis alone. The cricoid cartilage tends to calcify more uniformly than the thyroid cartilage. Lastly the calcification of arytenoid cartilage should not be mistaken for a foreign body. (Ref. 26 & 1).

3.Ligaments & Membranes of the Larynx :

(Figs. 4, 8, 9).

They can be clacified into :-

A] Extrinsic ligaments : Which connect the larynx to the hyoid bone above & trachea below, they are :

* Thyrohyoid membrane : which is separated from the posterior surface of the body of hyoid bone by the hyoid bursa. (Fig. 2).
* Median thyrohyoid ligament.
* Lateral thyrohyoid ligament with the cartilago-triticia in it.
* Cricotracheal ligament.

B] Intrinsic ligaments :- Which connect the cartilages of the larynx themselves, they are :

* Quadriangular membrane & vestibular lig.
* Conus Elasticus:
  * Crico-vocal membrane (Cricothyroid lig.)
  * Vocal lig.
  * Median cricothyroid lig.
* Median thyro-epiglottic lig.
* Small ligaments of the synovial joints.

(Ref. 29 & 32).

4.Muscles of the larynx : Atlas 527.1

They may be divided into two groups :-

A] Extrinsic

B] Intrinsic

A] Extrinsic muscles of the larynx are of two opposing types : *Elevators *Depressors

*Elevators of the larynx :

The larynx moves up during swallowing & down following that act; & as the hyoid bone is attached to the thyroid cartilage by the thyrohyiod membrane, it follows that movements of the hyoid bone are accompainied by movements of the larynx. The elevators of the larynx include the (1) digastric, the (2) stylohyoid, the (3) mylohyiod and the (4) geno-hyoid muscles. Also, the three'badly named'pharyngeus muscles are elevators of the larynx,and better they are named (5) stylo-laryngeus, (6) salpingo-laryngeus, and (7) palatolaryngeus as their essential insertion is into the laryngx. Their attachments to the larynx are chiefly into the posterior border of the lamina and cornu of the thyroid cartilage (Ref. 15).

* Depressors of the larynx : (strap muscles)

They include the (1) sternothyroid, the (2) sternohyoid and the (3) omohyiod muscles. The action of these muscles is assisted by the elastic recoil of the trachea.

(Ref. 15)

B] Intrinsic muscles of the larynx which may be divided into two groups :

*Those controlling the inlet of the larynx.

*Those moving the vocal folds

(Ref.30).

* Muscles controllingthe inlet of the larynx :

i- Sphinctre of the Inlet (Ary-epiglottic Muscle) (Fig. 10). The free upper edge of the quadrate membrane,(the ary-epiglottic fold) contains muscle fibres which connect the side of the epiglottis to the muscular process and posterior surface of the (opposite) arytenoid cartilage. The two muscles thus cross each other behind the transversely running fibres of the interarytenoid muscle. In crossing the apex of the arytenoid cartilage many of the fibres of this muscle are attached to the corniculate cartilage, thus giving rise to the erroneous description of the lower part of this muscle as an oblique interarytenoid muscle. It is more accurate to conceive this muscle as a complete sphinctre of the inlet Its contraction opposes the arytenoids to each other and draws the epiglottis down to bring its lower half into contact with the arytenoids. It should be noted that the free edge of the ary-epiglottic fold sometimes contains no muscle fibres and that in these cases the oblique interarytenoid fibres are always well developed. In such cases the epiglottis is approximated to the arytenoids by the following muscle.

ii- The thyro-epiglottic muscle (Fig.8,9). Arises from the upper border of the lamina of the thyroid cartilage. Its fibres lie outside the quadrate membrane, on which they run to be inserted into the side of the epiglottis.