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A Study on Anatomy and Histological Structure of Larynx in Adult Male and Female Turkeys

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Abstract: Considering that present a complete and comprehensive study on the structure hasn't been done in turkey's syrinx. In this study 10 adult male and female turkey's pieces were examined for macroscopic and then microscopic structure. The results showed that the male had exactly position on the base of the heart and between first and second intercostals space under the second cervical vertebrae. Syrinx also in female position was near the base of the heart, between first and second intercostals space under the second and third cervical vertebrae. In both sexes thin serous membrane connected to the esophagus ventral surface. Insurface. In microscopical examination results showed that the size of all parts of syrinx had increased in male than female and there was no difference in the epithelial layer between both sexes. Therefore there are some differences in position and structure between syrinx of adult male and female turkeys.

Key words: Syrinx · Gross · Microscopic · Turkeys

INTRODUCTION

In birds the voice producing apparatus is located in the thoracic cavity, so that the body cavity, filled with numerous air sacs, represents a giant resonant organ such as no other animals possess. The voice organ of the birds, the syrinx, is located at the bifurcation of the trachea [1].

Its detailed structure is exceedingly variable among the avian species. The classical subdivision into tracheobronchial, tracheal and bronchial types of syrinx in different groups of birds is supposed to reflect the derivation of the cartilages of the syrinx from either the trachea or primary bronchi [2, 3].

Syrinx is composed of a number of variably ossified cartilages, composing the cranial syringial cartilages, the pessulus and the caudal syringeal cartilages and vibrating soft structures consisting of a pair of medial tympaniform membrane and pad-like labia. These hard and soft structures are combined to form the median part of the syrinx cranially and its divided part caudally [3, 4].

Morphological structure of syrinx has been described in many birds' species such as Duck [5], Ostrich [6], Long Legged Buzzard [7], Japaneses Quail [8], Bursa Roller Pigeon [9] Male Mallard [10] and Jungle Crow [11].

There is no scientific study has been carried out to characterize the structure of the syrinx in turkey. In the present study we investigated the topography, anatomy and histology of the syrinx in this species.

MATERIALS AND METHODS

Ten (5 male and 5 female) one-year turkeys (*Meleagrisgallopavo*) weighing 2580.4±11.5 gram were obtained from slaughterhouse. After opening the body cavity the topographical position of syrinx was observed. Then sections were made 5 cm to the dorsal side of the trachea and 5 cm to the ventral side of syrinx. For histological investigation, the tissue was fixed in 10% buffer neutral formalin for 48-72 h. After routine histological process, paraffin blocks are prepared and 6-8 µm tissue sections were cut and stained with Orcein- Van Gisson's and Masson Tri Chrome [12].

RESULTS

In female and male turkey, the anatomical positions of the syrinx are different. The female turkey syringes were observed to lie ventrally of the esophagus and base

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Fig. 1A: Ventral view of the syrinx in the female turkey. Tr- trachea, H- heart, S- syrinx, E- esophagus, ST- sternotracheal muscle. Notice the syrinx is hidden at the dorsal surface of the heart

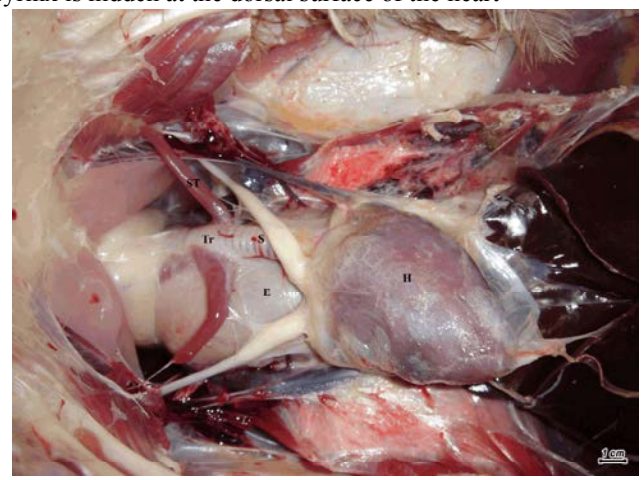

Fig. 1B: Ventral view of body cavity in the male turkey. Tr- trachea, H- heart, S- syrinx, E- esophagus, ST- sternotracheal muscle. Notice the syrinx is hidden at the dorsal surface of the heart

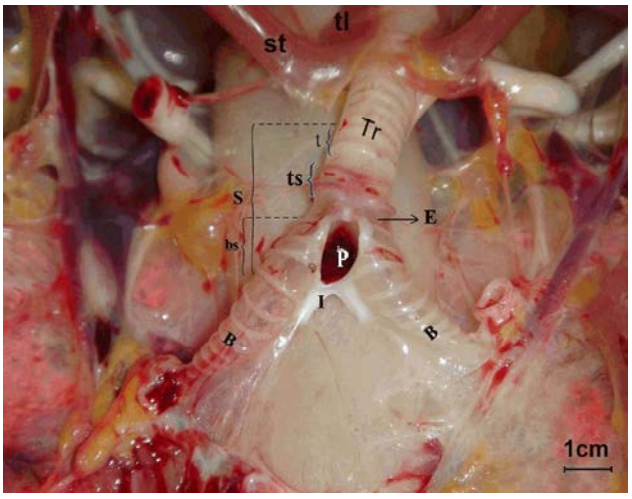

Fig. 2: Ventral view of the turkey syrinx.S-Syrinx,Tr- trachea, t- tympanum, ts- tracheosyringeal cartilage, bs- bronchosyringeal cartilage, B- bronchus, P- pessulus, I- interbronchial ligament, st- sternotracheal muscle, tl- tracheo-lateral muscle

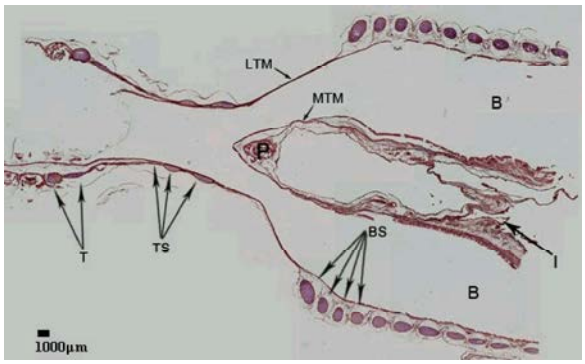

Fig. 3: Longitudinal section of the syrinx. T- tympanum, TS- tracheosyringeal cartilage, BS- bronchosyringeal cartilage, B- bronchus, P- pessulus, I- interbronchial ligament, LTM- lateral tympanic membrane, MTM- medial tympanic membrane, Orcein Van Gisson`s stain, Bar-1mm

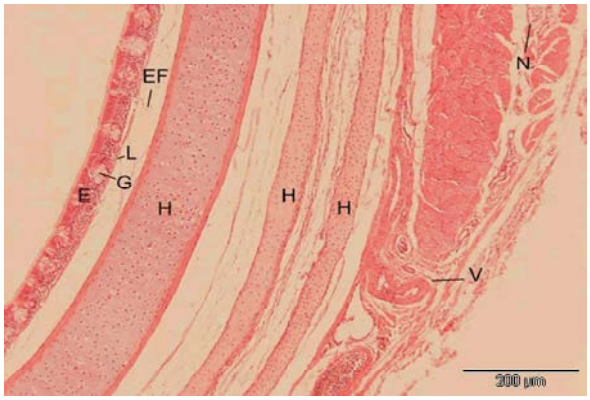

Fig. 4: Histological section of turkey syrinx.Histological section of turkey syrinx. E- psudostratified columnar epithelium, G- goblet cell, L- lamina propria, EF- elastic fibers, H- hyaline cartilage, N- nerve fiber, V- vessels, Masson`s Tri Chrome stain, Bar- 0/2mm

of the heart. It is attached to esophagus by thin serous membrane (Fig. 1A). In the male turkey, the syrinx is observed ventral to the esophagus exactly on the body of the heart, between the first and second intercostal space and like females it is attached to the esophagus, by thin serous membrane (Fig. 1B).

The skeleton of the syrinx in both sexes was composed of 3 different cartilage groups: tympanum (cranial cartilage), tracheo-syringeal cartilage (intermediate cartilage) and broncho-syringeal cartilage (caudal cartilage) (Fig. 2).

The tympanum was formed from 2-cartilage ring. The latero-lateral and dorso-ventral diameter decreases from cranial to caudal.

Tracheo-syringeal cartilages were composed of 2 cartilagous rings which latero-lateral length was longer than dorso-ventral length. Ventral and dorsal ends of intermediate cartilage were not joined to each other. Each is C-shaped attached to the pessulus at its ventral end and free at its dorsal end.

The broncho-syringeal cartilage are all C-shaped, they are four on each side. They are not attached to the pessulus. Both the latero-lateral and dorso-ventral diameter decreased caudally (Table 1).

The pessulus has a wedge-shaped structure, which divides the airways.

The vibrating structure or voice producing structure of the syrinx is composed of 2 medial (internal) tympaniform membrane and 2 lateral (external) tympaniform membranes.

The lateral tympanic membrane lies on the lateral aspect of the syrinx, which stretches between the caudal edges of last cartilage of tracheo-syringeal cartilage to the cranial edge of the first broncho-syringeal cartilage. They are attached to the pessulus from its dorsal and ventral side. Themedial tympanic membrane is well developed and forms the medial wall of the cranial end of bronchus. They stretch between caudo-lateral wall of pessulus and caudal end of interbronchial ligament (Fig. 3).

Table 1: Dorsoventral (DV) and craniocaudal (CC) length of syrinx rings (μm) as arithemic means and standard deviations in male and female turkey

		Tympanum		Tracheosyringeal cartilage		Broncheosyringeal cartilage			
		1st ring	2nd ring	1st ring	2nd ring	1st ring	2nd ring	3rd ring	4th ring
Male	DV	297.52±62.2	285.17±19.4	677.33±41.50	752.25±52.10	772.95±37.5	695.36±21.5	745.26±26.6	712.59±24.7
	CC	392.43±31.7	365.34±21.7	1030.44±22.7	1097.58±20.5	495.55±31.4	435.46±29.8	432.58±24.5	432.47±18.5
Female	DV	179.95±41.6	162.65±31.5	437.58±27.40	445.43±31.10	460.95±31.2	377.5823.60	345.98±19.7	375.42±26.8
	CC	190.22±31.8	220.61±28.7	610.62±51.40	760.68±33.80	309.61±27.8	292.58±31.6	300.99±27.8	277.54±33.5

There is no tympanic bulla in the turkey's syrinx. The intrinsic muscles are absent in turkey, but the extrinsic muscles were seen. The paired sterno-tracheal muscle is attached above the syrinx and tracheo-lateral muscles observed in both side of the lower part of trachea in the ventral surface.

In histological sections, the tunica mucosa of the syrinx was lined by ciliated psudostratified epithelium with goblet cells. The lamina propria and submucosa contained loose connective tissue with blood vessels and nerves. In the deep portion of lamina propria-submucosa, there are large amount of elastic fibers longitudinally oriented between the hyaline cartilage. The tunica adventitia, the outermost layer of the sections, consists of loose connective tissue with adipose cells small vessels and nerves (Fig. 4).

The microstructure of the internal and external tympanic membrane is the same. Internally the mucosa consists of a single layer of cuboidal or flattened cells with a few goblet cells scattered among them. Under this layer, there is a layer of coarse elastic fibers and then a layer of loose, fine collagen and elastic fibers with small blood vessels and smooth muscle fibers. The last layer is simple squamous epithelium.

DISCUSSION

The morphological structure of the syrinx has been described in many bird species [3, 5, 13-17]. This study presents some characteristics of this organ in turkey. Since both the trachea and primary bronchus participated in its formation, the syrinx in the turkey could be classified as of trachea bronchial type comparable to that of chickens, ostrich, pigeon, male mallard and long-legged buzzard [3, 6, 7, 9, 10, 18, 19]. This type of syrinx is the most common type in birds [18]. The topographical findings of the syrinx in the turkey were similar to those of the chicken, rooster, pigeon, ostrich, long-legged buzzard, new world turkey [3, 4, 6, 7, 9, 10, 13, 19, 20].

The *tympanum* was composed of 2 tracheal cartilage rings in male and female turkey that is different from those described in the chicken [7, 8, 16, 21, 22, 23], singing birds, rooster, ostrich, pigeon [6, 9, 13, 17, 24, 25, 26]. These cartilagous rings are fused to each other with circular ligaments.

The *tracheosyringeal cartilage*s in male and female turkey are composed of two complete rings. The chicken [7, 8, 16, 21, 22, 23], singing birds, rooster, ostrich, pigeon [6, 9, 13, 17, 24, 25, 26] have 4 cartilages C-shaped rings.

The *broncheosyringeal cartilages* were composed of 4 C-shaped half-rings which are different from those in other birds [3, 5, 9, 17, 1927]. In the pigeon this part has 5 incomplete rings and in the other birds there are only 3 incomplete rings.

The *pessulus*in turkeys were composed of connective tissue as described in new world turkeys [13] and ostrich [9]. This structure is cartilaginous in chickens [3, 19, 20, 27] and ossified in singing birds [16, 17]. The connective tissue structure of the *pessulus in* turkeys is probably due to the fact that the turkey is not a singing bird and thus neither osseous nor cartilaginous structure is needed to keep the *pessulus*tight.

Vibrating membranes are present in the walls of the bronchi. The *lateral tympanic membrane* in turkeys was in the same location as described for the chicken, gull, singing birds and ostrich [3, 4, 6, 17, 19, 28]. This membrane is defined as the sound organ in many avian species [3] but in turkey the level of the outer surface is supported by *tracheosyringeal cartilage* and therefore there is no ability to produce vibration and sound. The *medial tympanic membrane* covers the open ends of the *broncheo syringeal cartilage* as reported in some other species [3, 13, 14, 15, 16, 19, 20, 29, 30].

The external syringeal muscles are paired, lie to the right and left sides of tracheaand are divided into two groups, extrinsic and intrinsic. Extrinsic muscles are the sternotracheal and tracheolaryngeal in domestic fowl and pigeon. Intrinsic muscles are found in singing birds, passeriformes and parrots [24, 28, 30, 31]. In this study, extrinsic muscles were observed in turkey syrinx.

The histological structure of the syrinx has been investigated in only few bird species. Of those, the histological structure of the syrinx in the turkey was similar to that of the chicken [2], duck [5], pigeon [9, 17] and ostrich [6]. The mucosa lining, in particular, was the same as that of the chicken and duck [2, 5, 21, 32].

This study presents some of the characteristics of the sound organ in turkeys. Although the topographical and histological characteristics of the syrinx showed close resemblance to that of other bird species, some differences were observed regarding its anatomy.

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