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Chapter

Esophagus

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Abstract

The manuscript aims to include gross anatomical and histological structure of the esophagus. The esophagus is one of the important portions of the digestive system. Definition of the esophagus is, a muscular tube which is extended from the pharynx floor until the stomach. Its function is to transport the food particles from the oropharynx by swallowing operation on way esophageal opening during pharynx to the stomach. Morphology, the esophagus is a long cylindrical structure, which is divided into three segments, the upper portion is called cervical, either intermediate is the thoracic part, and the lower segment is named abdominal, which is attached with the stomach. Muscles of the esophagus are skeletal or striated muscles in the upper segment toward the pharynx, striated and smooth in the middle, either latest segment of the esophagus consists of smooth muscles only. The esophageal structure is different from other types of animals. These differences depend on the nature of food consumption. Histology, the esophagus contains four layers called tunics. First tunics is called the mucosa (epithelia have stratified squamous non-keratin, lamina properia, and muscularis), the next tunics is sub mucosa (connective tissue) with spread to find esophageal glands, either the other two layers are tunica muscularis (outer layer included longitudinal orientation and inner muscles is circular orientations), circular muscle orientation is not clearly circular in each part of the esophagus, but these fibers become more actually at lower parts of the esophagus. Either the muscularis and adventitia (loose connective tissue) without being covered by mesothelium.

Keywords: esophagus, anatomy, histology

1. Introduction

The digestive system is one of important systems, that sustains digest and absorbs nutritional materials and expels as feces the remaining waste. The digestive system includes the mouth cavity, pharynx, esophagus, stomach, small, and large intestine until anus [1, 2].

The esophagus in gray mongoose is a narrow musculo–membranous folded tube extending from the oropharynx to the stomach. The esophagus is ventrally bordered by the trachea, dorsally by the vertebral column, and laterally by the carotid artery; a similar location is also observed in canine [3].

As in domestic animals [4, 5], the esophagus of gray mongoose is divided into three parts, cervical, thoracic, and abdominal.

The cervical region of the esophagus passed dorsally to the trachea but turns to the left side of the trachea before entering the thoracic cavity. The course of the esophagus is akin
to that of a canine [6]. Meanwhile, it appeared to deviate slightly to the left in the cervical region only and runs along the dorsal aspect of the trachea in the laboratory rat [7].

So, the abdominal portion of the esophagus in gray mongoose is short, 1 cm in length, and expanded to the stomach till the end, while in cat, the length of the caudal part of the esophagus is 3 cm. However, these variations may be due to individual’s factors such as height, body weight, and gender [8].

The internal wall of the mongoose esophagus showed longitudinal folds all over its length, this may be given more capacity for a large mass of food to pass through, taking into consideration that the gray mongoose is voracious and eat food quickly. Whereas in cats, the presence of transverse folds is only restricted in distal thirds of the thoracic esophagus [8]. And this phenomenon in humans has been termed a feline esophagus (Figure 1) [9].

1.1 Cranial gastrointestinal tract

The cranial gastrointestinal tract involves the mouth cavity, pharynx, esophagus, stomach, and duodenum. This outlines the embryonic boundaries between foregut and midgut and is also the division that clinicians commonly used to describe gastrointestinal bleeding as either cranial or caudal in origin. The duodenum may seem to be a unified organ when dissected, but it is divided into four segments based on role, position, and interior anatomy, descending, horizontal, and ascending [1].

1.2 Gross Anatomy of the esophagus

Anatomical differences in the esophagus between species reflect modification to different foods consumed by different species and behavioral adaptations [10]. The esophagus’ gross anatomy has been described previously, have three regions; cervical, thoracic, and abdominal [5] in the dog.

Figure 1.
Parts of the digestive system in rabbit.
The esophagus is a cylinder structure that often prolongs from the pharynx to the cardiac opening of the stomach, the length of the esophagus as measured in 8–13 cm adult cats varied between 17.5–21 cm. The esophagus would have been about 30 cm long in dogs and about 2 cm in diameter [11].

The esophagus of the goat was 45–50 cm long; the esophagus of the cervical part was 13–15 cm long. On the other hand, in bovine, the esophagus length was 90–105 cm long [12]. The length of the esophagus in sheep is 45 cm long and the diameter in the pharynx was 1.8 and 2.5 cm in the cardia. The length of the esophagus in the horse is 125–150 cm [12]. The cervical part is 75 cm [13, 14]. The camel esophagus is an elongated tube structure of large capacity; it can be 1–2 m long [14].

The bovine esophagus length is 90–105 cm, the cervical region is 42–49 cm. Measurements of the esophagus diameter are unreliable due to its dilatability in the living animal. The esophagus in sheep is 45 cm in length, 12 increases in diameter from 1.8 cm in the pharynx to 2.5 cm in the stomach junction [8]. In canine, the cervical portion of the esophagus dorsally to the trachea but turns in the middle of the neck to the left and continues through the thoracic inlet to this direction. The esophagus collapses in its latent state and can distend to accommodate fluid and solid material. The esophagus begins at the inferior margin of the cricopharyngeus muscle and extends to the lower esophageal sphincter [15].

Topographically, in cats, the esophagus starts from the pharynx and extends through the length of the cervical area on the dorsal side of the trachea; it remains completely straight on the dorsal surface of the trachea between the 1st and 7th cervical vertebrae. Cervical esophagus length is about 4 cm; it is about 30 percent of the length of the body [16, 17]. However, the first part of the esophagus in canine and other domestic animals is located dorsally to trachea but turned left in the middle of the neck, retaining this position through the thoracic outline [17].

In guinea pig, the cervical part of the esophagus deviates slightly to the left only in the cervical region, the dorsal aspect of the trachea follows mostly mid sagittal. Its length is approximately 30 mm, the diameter is approximately 2 mm (Langer, 2002). In the rat, only in the cervical region, the esophagus slightly deviates to the left and passes mid sagittally along the trachea's dorsal aspect with a total length of 7.5 cm [6].

The esophagus in rabbits is accompanied laterally by vagosympathetic trunk and carotid artery along the cervical course. It lies dorsally to the trachea and ventrally to the cervical muscles, prolonging from the pharynx to the thoracic outline, approximately 7 cm long [18].

The gross investigation of the llama esophagus shows the cervical part placed dorsally and on the left side of the trachea. The total length is about 121 cm, the cervical portion is about 80 cm long [19].

The cat's thoracic esophagus is located adjacent to essential structures, such as the trachea, vertebrae, lungs, heart, blood vessels, and lymphatics. The cranial third of the thoracic esophagus seems to have an intimate relationship with the trachea; the caudal third has quite an intimate relationship with the aorta [7].

Topographic morphology of thoracic esophagus in dogs made an appearance within the mediastinum left to the trachea, continuously differentiating dorsal to trachea between both the left sub clavian artery and the left lung in the peri-cardiac mediastinum. At the level of the 2nd thoracic vertebra between both the left aortic arch and the right azygous vein, the esophagus reaches the base of the heart dorsal to the trachea and the left bronchus. It passes at the level of the 5th rib above the tracheal bifurcation and passes between the caudal lung lobes toward the esophageal hiatus at the level of the 10th thoracic vertebra [20].
The thoracic segment in the feline extends from the thoracic inlet, where it is located to the left of the trachea, passes through the bifurcation of the trachea, and reaches caudally to the esophageal hiatus of the diaphragm [21].

In laboratory animals, the thoracic portion course began as shown at the level of the 1st rib, at the thoracic inlet; its dorsal situation to the trachea has still been maintained. It is positioned between the lung lobes at both the tracheal bifurcation and passes over the base of the heart. After its origin, the thoracic aorta passes obliquely to its left over the esophagus. The thoracic part was approximately 20 mm long [22].

In the rabbits, the esophagus at the thoracic outline has remained dorsal to the trachea and continues as the thoracic esophagus until the bifurcation between the lung lobes of the trachea [23].

The esophagus is enacted through the dorsal thoracic inlet to the trachea. Throughout the mediastinum, in adult lamas, the thoracic esophagus reached to the right of the aortic arch dorsal to the heart base [19].

The abdominal esophagus stretches from those in the diaphragm hiatus to that of the sphincter of the stomach's cardia, about 1 cm long, the base of the esophagus progressions smoothly into the stomach's cardiac orifice. The abdominal portion of either the esophagus is situated on the dorsal border to that of the left liver lobe in the esophageal impression. Lower esophageal sphincter muscles at either the ends of the esophagus, but there is no clear anatomical demarcation of the limits of the sphincters [24].

In the cat, the abdominal esophagus is short, expanded, enters its abdomen from the esophageal hiatus with either the vagus trunk, commonly 3 cm or less in length, and binds to either the gastroesophageal junction [17].

In the dog, the abdominal section of either the esophagus is wedge-shaped. Dorsally, the esophagus joins the stomach and sits ventrally on the notches at both the thin dorsal border of the liver's caudate lobe [11, 21].

Figure 2.
Ventral view of squirrel shows cervical, thoracic, and abdominal esophagus (blue arrow), stomach (S), duodenum(d) [30].
The abdominal part, that same esophagus in the laboratory mouse is short (several mm length) easily noticed [25].

As the esophagus passed through a slit-like esophageal hiatus in the cat, the surrounding muscle of the right diaphragmatic crus, as in man and dog, supports it [26].

In cattle, the caudal end of the esophagus is usually slit-like about 2–3 cm, [27, 28].

In rabbits, the esophagus passes in the abdominal cavity through esophageal hiatus ventral to the thoracic aorta and continues as a short abdominal course of about 1 cm connected with the stomach at lesser curvature [29].

The abdominal portion of the esophagus in llama was very short, approximately 2 cm in length. Esophageal outer diameter began gradually enlarged [29].

Internally, in feline the transverse folds is only present, whilst another study found longitudinal folds in the cranial and middle parts of the cervical esophageal walls and transverse folds in the caudal part [29].

In the cat, internal appearance shows that the caudal portion of the esophagus has transverse folds [30].

In squirrels, the esophagus is featured muscular tubular like, it’s located at beginning of oropharynx to stomach. It is divided into three parts, 1st cervical and 2nd segments are thoracic and abdominal segments. In this paragraph, the study shows esophagus of squirrels is extended from and endpoints corresponded between the 6th cervical vertebra and 11th thoracic ribs (Figure 2) [30].

1.3 Histological structure of esophagus

The histological findings of the esophagus consist of muscular tubes, which is star-like lumen, filled with or without desquamating cells. The structure of the esophagus includes the 4th tunicus (mucosa, submucosa, muscularis, and adventitia). We observed the epithelia, stratified squamous non-keratin. The first tuncus is called tunica mucosa has epithelia, lamina properia which includes loose connective tissue and muscular layer beneath them. The second layer is named submucosa includes connective tissue. Another consists of tunica muscularis orientation, it consists of internal layer which is called circular muscular fibers while the outer layer is longitudinal orientation. The adventitia is the last tunica which includes loose connective tissue [30].

1.3.1 Mucosa

The tunica mucosa is divided into three portions, the first portion is called epithelium (Non-keratinized stratified squamous), which rested on the basal lamina. The second layer is lamina propria, and third layer is muscularis mucosa. Lamina propria is formed mostly of loose connective tissue in some states from collagen fibers and elastic fibers and lamina muscularis mucosa consists of some smooth muscle fibers [30].

1.3.2 Submucosa

This tunica includes dense connective tissue represented elastic and collagen fibers, irregular connective tissue. This layer consists of large blood vessels and meissner plexus, which is a group of ganglia that connects central nervous system.

1.3.3 Muscularis

Group of muscles include longitudinal and circular orientation bundles muscles form tube-like esophagus: longitudinal muscle fibers are located to inner either
circular muscle fibers are located externally. The muscle fibers in this portion from tunica are situated laterally within the roof of the esophagus, but these fibers extended and surround all surfaces at lower sides, and it is strongest in the lower third layer of the esophagus. Either circular muscle fibers are located under the longitudinal muscle, and the circular muscle, which is thinner to compare with longitudinal muscle. Circular muscles does not actually circular in each part of esophagus; these fibers remain most elliptic in the upper third part and become more circular at the lower third part of the esophagus. Also, these fibers do not form a regular formation but run in an irregular pattern making a shutter-like system. Spontaneous perforation of the esophagus usually occurs in the last 2 cm, and this perforation consists of the entire esophageal wall, causing mediastinitis because of gastric acid leakage. The upper part of the esophagus consists of striated muscle and the lower part consists of smooth muscle fibers [30].

1.3.4 Adventitia

This is the last layer of tunics boundary of the esophagus and is composed of loose connective tissue. Because no serosa is found on the esophagus (Figure 3) [30].
2. Conclusions

The esophagus is different in different kinds of animals, depending on the nature of food consumption, such as large animals can be contrasted with small animals e.g., squirrels, mice, rats... etc. The sphincter muscle may be missing in upper and lower parts of the esophagus in some animals, also the nature of epithelium may vary in all animals, that is, keratinize or non-keratinize, depending on the food that animals have. Other differences are, glands of the esophagus may be present or not in submucosa, so the distribution of desquamating cells inside the lumen. The myentric nerve plexus is very prominent in some animals and located between the outer layer of tunica muscularis and adventitia.
References


[10] Furth EE, Rubesin SE and Rose D. Radiologic-Pathologic Conferences of the Hospital of the University of Pennsylvania, Feline Esophagus. 2017


[18] Deprem T, Taşçi SK, Bingöl SA, Sari EK, Aslan Ş, Ilhan S. Histological and histochemical studies on the structure of pancreatic Histological and
Esophagus

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